IMPORTANT NOTICE

Buell motorcycles conform to all applicable U.S.A. Federal Motor Vehicle Safety Standards and U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.

To maintain the safety, dependability, and emission and noise control performance, it is essential that the procedures, specifications and service instructions in this manual are followed.

Any substitution, alteration or adjustment of emission system and noise control components outside of factory specifications may be prohibited by law.

Buell Motorcycle Company
The Buell Motorcycle Company maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively, we need user feedback - your critical evaluation of this manual.

Please comment on the completeness, accuracy, organization, usability, and readability of this manual.

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Please list the page, item, and part number(s) of any errors you find in this manual.

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Please tell us how we can improve this manual.

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2009 Buell 1125 Electrical Diagnostics Manual (99949-09Y)

Please clip out and mail to: Service Communications Department
Buell Motorcycle Company
P.O. Box 653
Milwaukee, WI USA 53201
ABOUT THIS MANUAL

GENERAL
This electrical diagnostic service manual has been prepared with two purposes in mind. First, it will acquaint the user with the construction of the Buell product and assist in the performance of repair. Secondly, it will introduce to the professional Buell Technician the latest field-tested and factory-approved diagnostic methods. We sincerely believe that this manual will make your association with Buell products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL
Refer to the table below for the content layout of this manual.

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Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. Sections and topics in this manual are sequentially numbered for easy navigation.

For example, a cross-reference shown as 2.1 SPECIFICATIONS refers to chapter 2 CHASSIS, heading 2.1 SPECIFICATIONS.

For quick and easy reference, all pages contain a section number followed by a page number. For example, page 3-5 refers to page 5 in section 3.

A number of acronyms and abbreviations are used in this document. See the D.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

WARNING
Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Good preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and will reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover sources of trouble. Tools, instruments and any parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a distraction and causes needless delay.
Always wear proper eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Flying parts could result in death or serious injury. (00496b)

Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended. It is important to note that some warnings against the use of specific service methods, which could damage the motorcycle or render it unsafe, are stated in this manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Buell Motorcycle Company could not possibly know, evaluate or advise the service trade of all possible ways in which service might be performed, or of the possible hazardous consequences of each method, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Buell Motorcycle Company must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized as a result. Failure to do so could result in death or serious injury.

PRODUCT REFERENCES

Read and follow warnings and directions on all products. Failure to follow warnings and directions can result in death or serious injury. (00470b)

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.

Kent-Moore Products

All tools mentioned in this manual with an "HD", "J" or "B" preface must be ordered through SPX Kent-Moore. For ordering information or product returns, warranty or otherwise, visit www.spx.com.

Loctite Sealing and Threadlocking Products

Some procedures in this manual call for the use of Loctite products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please contact Loctite Corp. at www.loctite.com.

PRODUCT REGISTERED MARKS


H-D MICHIGAN, INC. TRADEMARK INFORMATION

1125CR, 1125R, Blast, Buell, Firebolt, Glaze, Gloss, Harley, Harley-Davidson, HD, H-D, Lightning, Sunwash, Tender, Triple Tail, Thunderstorm, Ulysses, Uniplanar, ZTL and ZTL-2 are among the trademarks of H-D Michigan, Inc.

CONTENTS

All photographs, illustrations and procedures in this manual may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Since product improvement is our continual goal, Buell Motorcycle Company reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.
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<th>FUEL SYSTEM</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td>Dual 61 mm down draft throttle bodies</td>
</tr>
<tr>
<td>Fuel delivery</td>
<td>DDF13 Fuel Injection</td>
</tr>
<tr>
<td>Recommended fuel</td>
<td>91 Octane</td>
</tr>
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</table>

### Table 1-2. Idle Speed Specifications

<table>
<thead>
<tr>
<th>ADJUSTMENT</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal idle speed</td>
<td>1250 Nominal, non-adjustable</td>
</tr>
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### Table 1-3. Battery Specifications

<table>
<thead>
<tr>
<th>BATTERY</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>12 VDC/12 AH/200CCA</td>
</tr>
<tr>
<td>Type</td>
<td>Sealed, AGM</td>
</tr>
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</table>

### Table 1-4. Spark Plug Specifications

<table>
<thead>
<tr>
<th>SPARK PLUG</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>10 mm</td>
</tr>
<tr>
<td>Type</td>
<td>NGK CR9EKB</td>
</tr>
<tr>
<td>Gap</td>
<td>0.032 in. 0.81 mm</td>
</tr>
<tr>
<td>Torque</td>
<td>7-9 ft-lbs 10-12 Nm</td>
</tr>
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</table>

### Table 1-5. Starter Specifications

<table>
<thead>
<tr>
<th>STARTER</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>900 W electric with one-way clutch</td>
</tr>
</tbody>
</table>

### Table 1-6. Fuel Pump Pressure Specifications

<table>
<thead>
<tr>
<th>RANGE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>58 psi (400 kPA)</td>
</tr>
<tr>
<td>Key ON/OFF (20 minutes after key OFF)</td>
<td>75 psi (517 kPA)</td>
</tr>
<tr>
<td>100% duty cycle</td>
<td>80 psi (551 kPA)</td>
</tr>
</tbody>
</table>

### Table 1-7. Relay Specifications

<table>
<thead>
<tr>
<th>RELAY</th>
<th>PART NO.</th>
</tr>
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<tbody>
<tr>
<td>Auxiliary</td>
<td>31522-00C</td>
</tr>
<tr>
<td>Ignition</td>
<td>31522-00C</td>
</tr>
<tr>
<td>Key Switch</td>
<td>31522-00C</td>
</tr>
<tr>
<td>Start</td>
<td>Y0175.1AM</td>
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</tbody>
</table>

### Table 1-8. Alternator Specifications

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC voltage output</td>
<td>38 Amp three phase</td>
</tr>
<tr>
<td>Stator coil resistance</td>
<td>0.1-0.3 Ohms</td>
</tr>
</tbody>
</table>

### Table 1-9. Regulator Specifications

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage @ 3600 RPM</td>
<td>14.3-14.7 VDC @ 75 °F (24 °C)</td>
</tr>
<tr>
<td>Amperes @ 3600 RPM</td>
<td>45 Amps, three phase shunt</td>
</tr>
</tbody>
</table>

### Table 1-10. Electrical System Specifications

<table>
<thead>
<tr>
<th>ELECTRICAL SYSTEM</th>
<th>AMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main fuse/battery fuse</td>
<td>30</td>
</tr>
<tr>
<td>Ignition fuse</td>
<td>15</td>
</tr>
<tr>
<td>Light fuse</td>
<td>15</td>
</tr>
<tr>
<td>Accessory fuse</td>
<td>10</td>
</tr>
<tr>
<td>Brake/horn</td>
<td>10</td>
</tr>
<tr>
<td>ECM fuse</td>
<td>10</td>
</tr>
<tr>
<td>Key switch fuse</td>
<td>15</td>
</tr>
<tr>
<td>Cooling fan fuse</td>
<td>15</td>
</tr>
<tr>
<td>Auxiliary power</td>
<td>10</td>
</tr>
<tr>
<td>Fuel pump</td>
<td>15</td>
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</table>

**Note:** Spare fuses are located in the tool kit.

### Table 1-11. Ignition Coil Specifications

<table>
<thead>
<tr>
<th>WINDING</th>
<th>RESISTANCE</th>
</tr>
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<tbody>
<tr>
<td>Primary winding</td>
<td>0.5-1.0 Ohms</td>
</tr>
<tr>
<td>Secondary winding</td>
<td>Internal diode not accurately measurable with DVOM</td>
</tr>
</tbody>
</table>
Table 1-12. Temperature Specifications

<table>
<thead>
<tr>
<th>RANGE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal operating</td>
<td>140-220 °F (60-104 °C)</td>
</tr>
<tr>
<td>Over-temperature threshold</td>
<td>230 °F (110 °C)</td>
</tr>
<tr>
<td>(lamp lit)</td>
<td></td>
</tr>
<tr>
<td>Fans on @</td>
<td>194 °F (90 °C)</td>
</tr>
<tr>
<td>Fans off @</td>
<td>140 °F (60 °C)</td>
</tr>
</tbody>
</table>

COMPONENT LOCATIONS

Some components and connectors are not easily located on the motorcycle. The following graphics show locations for these components and connectors. The graphics are generally ordered from front to back around the motorcycle.

Figure 1-1. Behind Fairing Connectors (1125R)

Figure 1-2. Behind Fairing Connectors (1125CR)

Figure 1-3. Clutch Switch Connector [95]
Figure 1-4. Horn
1. Horn connector [122]
2. Horn
3. Oil cooler

Figure 1-5. O2 and IAT Connectors
1. O2 sensor, front [138]
2. IAT sensor [89]
3. IAT sensor

Figure 1-6. Cooling Fan, Right Connector
1. Coolant reservoir
2. Cooling fan, right connector [97] (located between radiator and inside shroud)

Figure 1-7. Rear Brake Switch Connector [121]

Figure 1-8. Front Brake Switch Connectors [170]
1. Oil pressure switch [120]
2. Hydraulic clutch pressure hose

Figure 1-13. Oil Pressure Switch Location

Figure 1-14. ECM Ground

Figure 1-15. Ground 1

Figure 1-16. ECM
Figure 1-17. Chassis Top View

1. Active intake solenoid
2. Baro sensor [228]
3. Fuel pump connector [86]
4. Voltage regulator connector [77]
5. Relay block
6. Battery ground
7. Battery positive
8. Battery
9. Fuse block
10. Starter solenoid
11. Starter solenoid connector [128]
12. Voltage regulator
13. VSS connector [65]
14. Stator/regulator connector [46]
15. Active intake solenoid [178]
16. Rear ignition coil [83R]
17. Fuel pressure sensor connector [227]
18. Rear fuel injector connector [85]
DIAGNOSTIC TOOLS

HOW TO USE DIAGNOSTIC TOOLS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
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<tbody>
<tr>
<td>B-48115</td>
<td>BREAKOUT BOX</td>
</tr>
<tr>
<td>HD-26792</td>
<td>SPARK TESTER</td>
</tr>
<tr>
<td>HD-34730-2D</td>
<td>FUEL INJECTOR TEST LIGHT</td>
</tr>
<tr>
<td>HD-39978</td>
<td>DIGITAL MULTIMETER (FLUKE 78)</td>
</tr>
<tr>
<td>HD-41354</td>
<td>SPEEDOMETER TESTER</td>
</tr>
<tr>
<td>HD-41354-1</td>
<td>INPUT/OUTPUT CABLE</td>
</tr>
<tr>
<td>HD-41404-B</td>
<td>HARNESS TEST KIT</td>
</tr>
<tr>
<td>HD-48053</td>
<td>ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER</td>
</tr>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

HD-48650 Digital Technician II

DIGITAL TECHNICIAN II (Part No. HD-48650) is a computer based diagnostic device used to communicate/diagnose and program systems/modules.

Diagnostics in this manual are developed under the assumption that DIII is not available.

HD-41404 Harness Test Kit

The HARNESS TEST KIT (Part No. HD-41404-B) contains pin and socket terminals, and stackable banana jack patch cords used to test circuits. The pin and socket terminals are used to connect to various connectors used on the vehicle. See the tool instruction sheet for specific terminal usage.

NOTE

To prevent terminal damage while using the probe tips, insert the probe tip straight into the cavity and keep it stable during the test. Do not wiggle or move the probe tip once it has been inserted into the terminal. Do not use more than one probe per terminal or cavity at any one time.

B-48115 Breakout Box

The BREAKOUT BOX (Part No. B-48115) is spliced into the main harness. Used with a DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978), the Breakout Box allows circuit diagnosis of the wiring harness and connections without having to probe with sharp objects.

To install the Breakout Box, perform the following steps:
1. Disconnect the ECM connectors [10] (black) and [11] (gray) from the ECM.
2. See Figure 1-18. Attach the Breakout Box to the ECM connectors as follows:
   a. Attach black connector from Breakout Box to the [10] (black) ECM connector.
   b. Attach black connector from the wiring harness to the black connector on the Breakout Box.
   c. Attach gray connector from Breakout Box to the [11] (gray) ECM connector.
   d. Attach gray connector from the wiring harness to the gray connector on the Breakout Box.

Figure 1-18. ECM and Breakout Box with Connections

To remove the Breakout Box, perform the following steps:
2. Disconnect Breakout Box connectors from ECM connectors.
3. Disconnect Breakout Box connectors from wiring harness.
4. Reconnect harness to ECM.

HD-26792 Spark Tester

1. See Figure 1-19. The SPARK TESTER (Part No. HD-26792) is used to verify adequate spark at the spark plug. Attach the tester to the coil top plug and to ground, while cranking the engine a spark should jump across the gap on the tester leads.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.
HD-39978 Digital Multimeter (Fluke 78)
The DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) is used for various tests throughout this manual.

HD-48053 Advanced Battery Conductance and Electrical System Analyzer
Follow the instructions in the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053) instruction manual to perform a battery test. The test results include a decision on the battery condition and the measured state of charge.

Fuel Injector Test Lamp
The FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2D) is used to test the fuel injector drivers as well as the ignition coil drivers in the ECM.
1. Connect the BREAKOUT BOX (Part No. B-48115).
2. Disconnect the fuel injector connectors.
3. See Figure 1-22 for typical setup. Connect one side of the fuel injector test lamp to power and the other to the terminal on the ECM for the circuit you are testing.
4. Crank the engine.
5. If the test lamp flashes, the circuit is working properly.
HD-41354 Speedometer Tester

See Figure 1-23. Connect SPEEDOMETER TESTER (Part No. HD-41354) with the INPUT/OUTPUT CABLE (Part No. HD-41354-1) supplied, or connect point-to-point leads to VSS connector [85B] terminals 2 (signal) and 3 (ground). Turn Speedometer Tester power on and allow the tester to self-test.

On the tester, perform the following:

1. Press the CLEAR button.
2. Press "1".
3. Press ENTER.
4. Enter 144 Hz by pressing "144" and then press ENTER.

The speedometer should read approximately 60 mph (97 km/h).
VOLTAGE DROP

The amount of voltage dropped over any part of a circuit is directly related to the amount of resistance in that part of the circuit.

1. Entire circuit voltage drop through the starter.
2. Circuit voltage drop through the solenoid.
3. Circuit voltage drop through the relay.

Figure 1-24. Simplified Starter Circuit

Voltage Drop Test

The Voltage Drop test:

- Helps locate poor connections or components with excessive voltage drops.
- Measures the difference in potential or the actual voltage dropped between the source and destination.
- Checks the integrity of the wiring, switches, fuses, connectors, and contacts between the source and destination.

See Figure 1-24 for a simplified circuit diagram of how voltage drops can vary in a circuit. The voltages represent what might be seen if the meter leads were connected at those points on the circuit.

Most of the voltage on a good working circuit drops across the components the circuit is powering. Typically, a good circuit drops less than 1.0 Volt. If the voltage drop is greater, backtrack the connections until the source of the potential difference is found. Always start at the destination, then move upstream if there is an issue. The benefits of doing it this way are:

- Readings are not as sensitive to real battery voltage.
- Readings show the actual voltage dropped not just the presence of voltage.
- The system is tested as it is actually being used.
- Testing is more accurate and displays hard-to-find poor connections.
- Starting circuits, lighting circuits or ignition circuits can be tested with this approach. (Start from the most positive and go to the most negative destination or component).

When testing a starter circuit, measure the voltage drop across the following sections of the circuit. If the voltage drop increases over 1.0 Volt on any of the tests then the wire or connection tested contains the high resistance and should be repaired.

1. Disconnect the fuel pump connector [86] to prevent the engine from starting. Connect the red meter lead to the positive battery post. Connect the black meter lead to the battery power starter post on the starter and observe the meter reading. Crank the starter and observe the meter reading. The difference in the voltage is the voltage drop.

2. Move the black meter lead to the starter side post of the starter solenoid. Crank the starter.

3. Move the black meter lead to the battery side post on the starter solenoid. Crank the starter.

4. Finally move the black meter lead to the negative battery post and the red meter lead to the starter case. Crank the starter.

When testing a typical ground circuit, place the black meter lead on the negative battery post. Place the red meter lead at the negative side of the connector in question. Move the red meter lead through the circuit until the high voltage drop is found.

WIGGLE TEST

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-48115</td>
<td>BREAKOUT BOX</td>
</tr>
<tr>
<td>HD-39978</td>
<td>DIGITAL MULTIMETER (FLUKE 78)</td>
</tr>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

The Wiggle Test checks for the presence of intermittents in a wiring harness. The DIGITAL TECHNICIAN II (Part No. HD-48650) can be used to perform the Wiggle Test.

1. See Figure 1-25. Connect DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) to wiring harness between the suspect connections. When diagnosing ECM connections, use BREAKOUT BOX (Part No. B-48115) to simplify the procedure. See 1.2 DIAGNOSTIC TOOLS.

2. Set the DVOM to read voltage changes.

3. Start the motorcycle engine and run at idle.

4. Shake or wiggle the harness to detect intermittents. If intermittents are present, radical voltage changes register on the DVOM.
**Relay Test (5 Pin)**

A relay can be tested using the motorcycle's 12-Volt battery and a multimeter.

1. Unplug the relay from relay block.

2. See Figure 1-27 to energize the relay. Connect relay terminal 85 to the negative battery terminal and relay terminal 86 to the positive battery terminal.

   **NOTE**
   Some relays contain internal diodes. If the applied voltage is not the correct polarity, the diode could be damaged.

3. Check for continuity between terminals 30 and 87. A good relay shows continuity (continuity tester lamp on or a zero ohm reading on the ohmmeter). A malfunctioning relay will not show continuity and must be replaced.

**RELAY DIAGNOSTICS**

**Relay Variation**

See Figure 1-26. Relays used on this vehicle have five terminals. Schematically the relays are very similar with the exception being normally closed contact being eliminated in the four terminal relay. Some relays have five terminals at the base, even though internally 4 or 87A are not connected. See this topic whenever a relay terminal is referenced in this manual to make sure the proper terminal is being accessed.

**JOB/TIME CODES VALUES**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

Dealership technicians filing warranty claims should use the job/time code values printed in bold text underneath the appropriate repair. When using DIGITAL TECHNICIAN II (Part No. HD-48650), dealership technicians filling out warranty claims should use the job/time code given by the computer.
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 INITIAL DIAGNOSTICS</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2 SERIAL DATA COMMUNICATION</td>
<td>2-12</td>
</tr>
</tbody>
</table>
DESCRIPTION AND OPERATION

Initial diagnostics are a starting point to navigate through the EDM in a manner to efficiently troubleshoot any concerns. A basic understanding of electronics and a general knowledge of the motorcycle are necessary to effectively use this manual.

Before diagnosing a concern, perform a general functional test of the motorcycle to verify the concern and to make sure there is nothing else that could cause problems with accurately diagnosing the motorcycle. Use the flowcharts in this chapter for initial diagnostics.

CHECKING FOR DIAGNOSTIC TROUBLE CODES (DTC)

Part of this initial test is checking for DTCs. Some concerns only exhibit a symptom, while others cause a DTC to set along with the symptom. When a DTC is stored, the ECM sends a signal to the Instrument Cluster (IC). The IC illuminates the check engine lamp. If more than one DTC exists, diagnose them in the order of priority, starting with the lowest number. Refer to Table 2-1 for a complete list of DTCs and the order of priority.

RETRIEVING DIAGNOSTIC TROUBLE CODES (DTC)

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

There are two ways to retrieve DTCs:

• DIGITAL TECHNICIAN II (Part No. HD-48650), a computer-based diagnostics package.

• See Figure 2-1. The Instrument Cluster (IC) to view the DTCs.

In order to view the DTCs on the IC, perform the following procedure.

1. Hold down the MODE and TOGGLE switches at the same time as the ignition is turned on.
2. The IC displays DIAG MODE. Press the TOGGLE switch again to display the first DTC.

3. Continue pressing and releasing the TOGGLE switch to move to the next stored DTC.
4. When all DTCs have been scrolled through, the IC displays the message LIVE DATA.

NOTE

If the security system is armed when entering DIAG MODE, the message ENTER PIN displays when the ignition is turned on. Once the correct pin is entered, the display changes to DIAG MODE. The TOGGLE switch then cycles through the DTCs normally.

Figure 2-1. Instrument Cluster

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1004</td>
<td>70</td>
<td>Fuel Level Sender Low</td>
<td>4.2 FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005</td>
</tr>
<tr>
<td>B1005</td>
<td>69</td>
<td>Fuel Level Sender High/Open</td>
<td>4.2 FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005</td>
</tr>
<tr>
<td>P0087</td>
<td>29</td>
<td>Fuel Rail/System Pressure Too Low</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0107</td>
<td>63</td>
<td>Map Sensor Low/Open</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
<tr>
<td>P0108</td>
<td>62</td>
<td>Map Sensor High</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
</tbody>
</table>

Table 2-1. Diagnostic Trouble Codes (DTC) Priority Table
<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0112</td>
<td>22</td>
<td>Intake Air Temperature</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor Voltage Low</td>
<td></td>
</tr>
<tr>
<td>P0113</td>
<td>21</td>
<td>Intake Air Temperature</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor High/Open</td>
<td></td>
</tr>
<tr>
<td>P0117</td>
<td>20</td>
<td>Engine Coolant Temperature</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor Circuit Low</td>
<td></td>
</tr>
<tr>
<td>P0118</td>
<td>19</td>
<td>Engine Coolant Temperature</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor Circuit High</td>
<td></td>
</tr>
<tr>
<td>P0122</td>
<td>11</td>
<td>Throttle Position Sensor</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circuit Low</td>
<td></td>
</tr>
<tr>
<td>P0123</td>
<td>10</td>
<td>Throttle Position Sensor</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circuit High</td>
<td></td>
</tr>
<tr>
<td>P0131</td>
<td>50</td>
<td>Front Oxygen Sensor Circuit</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low/Engine Lean</td>
<td></td>
</tr>
<tr>
<td>P0132</td>
<td>48</td>
<td>Front Oxygen Sensor Circuit</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High/Engine Rich</td>
<td></td>
</tr>
<tr>
<td>P0134</td>
<td>48</td>
<td>Front Oxygen Sensor</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open/Inactive</td>
<td></td>
</tr>
<tr>
<td>P0151</td>
<td>51</td>
<td>Rear Oxygen Sensor Circuit</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low/Engine Lean</td>
<td></td>
</tr>
<tr>
<td>P0152</td>
<td>47</td>
<td>Rear Oxygen Sensor Circuit</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High/Engine Rich</td>
<td></td>
</tr>
<tr>
<td>P0154</td>
<td>49</td>
<td>Rear Oxygen Sensor Circuit</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open/Inactive</td>
<td></td>
</tr>
<tr>
<td>P0192</td>
<td>26</td>
<td>Fuel Pressure Sensor Circuit</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>P0193</td>
<td>25</td>
<td>Fuel Pressure Sensor Circuit</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>P0261</td>
<td>35</td>
<td>Front Fuel Injector Circuit</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>P0262</td>
<td>34</td>
<td>Front Fuel Injector Circuit</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>P0264</td>
<td>37</td>
<td>Rear Fuel Injector Circuit</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>P0265</td>
<td>36</td>
<td>Rear Fuel Injector Circuit</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>P0337</td>
<td>7</td>
<td>Crank Position Sensor Circuit</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>P0338</td>
<td>8</td>
<td>Crank Position Sensor Circuit</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>P0339</td>
<td>9</td>
<td>Crank Position Sensor Circuit</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent</td>
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<tr>
<td>P0502</td>
<td>40</td>
<td>Vehicle Speed Sensor Circuit</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>P0503</td>
<td>41</td>
<td>Vehicle Speed Sensor Circuit</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent/Erratic High</td>
<td></td>
</tr>
<tr>
<td>P0506</td>
<td>54</td>
<td>Idle Air Control System</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPM Higher Than Expected</td>
<td></td>
</tr>
<tr>
<td>DTC</td>
<td>PRIORITY ORDER</td>
<td>FAULT CONDITION</td>
<td>DIAGNOSTIC PROCEDURE</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>P0507</td>
<td>55</td>
<td>Idle Air Control System RPM Lower Than</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0511</td>
<td>53</td>
<td>Idle Air Control Circuit Fault</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0562</td>
<td>39</td>
<td>Battery Voltage Low</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0563</td>
<td>38</td>
<td>Battery Voltage High</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0603</td>
<td>3</td>
<td>ECM EEPROM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0604</td>
<td>1</td>
<td>ECM RAM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0605</td>
<td>2</td>
<td>ECM ROM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0607</td>
<td>4</td>
<td>ECM Microprocessor Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0616</td>
<td>61</td>
<td>Starter Relay Circuit Low</td>
<td>6.14 START RELAY: DTC P0617</td>
</tr>
<tr>
<td>P0617</td>
<td>60</td>
<td>Starter Relay Circuit High</td>
<td>6.14 START RELAY: DTC P0617</td>
</tr>
<tr>
<td>P0628</td>
<td>28</td>
<td>Fuel Pump Circuit Low</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0629</td>
<td>27</td>
<td>Fuel Pump Circuit High</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0691</td>
<td>58</td>
<td>Right Fan Control Circuit Low</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0692</td>
<td>56</td>
<td>Right Fan Control Circuit High</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0693</td>
<td>59</td>
<td>Left Fan Control Circuit Low</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0694</td>
<td>57</td>
<td>Left Fan Control Circuit High</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P1009</td>
<td>6</td>
<td>Security System Fault</td>
<td>5.4 SECURITY SYSTEM</td>
</tr>
<tr>
<td>P1047</td>
<td>52</td>
<td>Feedback Fuel Cylinder Difference too Great</td>
<td>6.22 OXYGEN (02) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P1110</td>
<td>66</td>
<td>Active Intake Control Circuit Short Low/Open</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1111</td>
<td>65</td>
<td>Active Intake Control Circuit Short High</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1112</td>
<td>64</td>
<td>Active Intake Control Throttle Position Sensor Feedback Failure</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1151</td>
<td>16</td>
<td>Bank Angle Sensor Shorted Low</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1152</td>
<td>15</td>
<td>Bank Angle Sensor Shorted High</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1154</td>
<td>17</td>
<td>Clutch Position Sensor Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1155</td>
<td>18</td>
<td>Neutral Switch Input Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1501</td>
<td>13</td>
<td>Sidestand Sensor Low</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1502</td>
<td>12</td>
<td>Sidestand Sensor High/Open</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1503</td>
<td>14</td>
<td>Sidestand Down at Vehicle Speed</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1601</td>
<td>67</td>
<td>Auxiliary Relay Driver Circuit Fault</td>
<td>5.1 ACCESSORIES</td>
</tr>
</tbody>
</table>

2009 Buell 1125: Initial Diagnostics and Serial Data 2-3
Table 2-1. Diagnostic Trouble Codes (DTC) Priority Table

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2228</td>
<td>24</td>
<td>BARO Pressure Sensor Circuit Low</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2229</td>
<td>23</td>
<td>BARO Pressure Sensor Circuit High</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2300</td>
<td>31</td>
<td>Front Ignition Coil Control Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2301</td>
<td>30</td>
<td>Front Ignition Coil Control High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2303</td>
<td>33</td>
<td>Rear Ignition Coil Control Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2304</td>
<td>32</td>
<td>Rear Ignition Coil Control High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>U0001</td>
<td>5</td>
<td>High Speed CAN Bus Error</td>
<td>2.2 SERIAL DATA COMMUNICATION</td>
</tr>
</tbody>
</table>

**CODE TYPES**

DTCs are categorized as current and historic. Both types are stored in the ECM and the IC.

**Current**

Current DTCs failed the last time the module ran the parameters to set them. Therefore, the fault that caused them is normally present.

**Historic**

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC.

Historic DTCs are stored for 50 run cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC clears itself.

Diagnostic charts are designed for use with current DTCs. As a result, they frequently suggest part replacement. When diagnosing a historic DTC, the charts can be helpful but should not lead to part replacement without verification the part is faulty.

**MULTIPLE DTCS**

There are conditions where one fault may set several DTCs. This is why it is important to follow the DTC priority table. By following the order in the table it reduces the likelihood of performing unnecessary diagnostics and possibly faulting the wrong component. Refer to Table 2-1.

**CLEARING DTCS**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

The only way to clear DTCs is to use DIGITAL TECHNICIAN II (Part No. HD-48650).

**CHECK ENGINE LAMP**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

See Figure 2-2 for check engine lamp location. When the ignition switch is turned on, the check engine lamp illuminates for four seconds. This is a bulb check to verify the lamp is working.

- After the bulb check, the lamp goes out and stays out if there are no DTCs.
- If only historic DTCs are set, then the lamp illuminates for an additional eight seconds.
- If a current DTC is set, the lamp goes through the four second bulb check and then stays on continuously.
- See Figure 2-3. If multiple DTCs are present, use DIGITAL TECHNICIAN II (Part No. HD-48650) to determine which DTCs are current or historic.

**Diagnostic Procedure**

The IC illuminates the check engine lamp when the ignition is turned on for a bulb check. The ECM sends a message to the IC to turn off the lamp. If the IC does not receive this message it continues to illuminate the lamp.

If the check engine lamp does not illuminate even during the bulb check, then see 4.5 INSTRUMENT CLUSTER INOPERATIVE.

**NOTE**

When the IC is replaced, there is a 30 minute timer that counts down before the information is written to the IC. This is done so the technician has time to test a new cluster to determine whether the fault is within the cluster or not before the cluster matches to the ECM. Once the VIN is written to the IC it cannot be cleared.
If the check engine lamp is always on with the ignition on and no DTCs are present, replace the IC. If the check engine lamp is still on, install original IC and replace the ECM.

1. Low fuel lamp
2. Check engine lamp
3. Engine over temperature lamp
4. Oil pressure lamp
5. Low battery voltage lamp

Figure 2-2. Warning Lamps

**Symptoms**

If no DTCs are present but there is a symptom or concern indicating a malfunction, address and repair the symptom if it is not a normal characteristic of the system. Refer to Table 2-2 for a list of symptoms.
### Table 2-2. Symptom Table

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary power inoperative</td>
<td>5.1 ACCESSORIES</td>
</tr>
<tr>
<td>Charging system inoperative</td>
<td>3.3 CHARGING SYSTEM DIAGNOSTICS</td>
</tr>
<tr>
<td>COMM ERROR displayed</td>
<td>2.2 SERIAL DATA COMMUNICATION</td>
</tr>
<tr>
<td>Engine cranks, but will not start</td>
<td>6.28 ENGINE CRANKS, BUT WILL NOT START</td>
</tr>
<tr>
<td>Headlamp inoperative</td>
<td>5.3 LIGHTS</td>
</tr>
<tr>
<td>Horn always on</td>
<td>5.2 HORN</td>
</tr>
<tr>
<td>Horn inoperative</td>
<td>5.2 HORN</td>
</tr>
<tr>
<td>Instrument Cluster (IC) inoperative</td>
<td>4.5 INSTRUMENT CLUSTER INOPERATIVE</td>
</tr>
<tr>
<td>Low fuel lamp always on</td>
<td>4.6 LOW FUEL LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Low fuel lamp inoperative</td>
<td>4.6 LOW FUEL LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Marker lamps inoperative</td>
<td>5.3 LIGHTS</td>
</tr>
<tr>
<td>Misfire at idle or under load</td>
<td>6.30 MISFIRE AT IDLE OR UNDER LOAD</td>
</tr>
<tr>
<td>Oil pressure lamp always on</td>
<td>4.3 OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Oil pressure lamp inoperative</td>
<td>4.3 OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Starter does not spin</td>
<td>3.1 STARTING SYSTEM DIAGNOSTICS</td>
</tr>
<tr>
<td>Starter stalls or spins too slowly</td>
<td>3.1 STARTING SYSTEM DIAGNOSTICS</td>
</tr>
<tr>
<td>Starts, then stalls</td>
<td>6.29 STARTS, THEN STALLS</td>
</tr>
<tr>
<td>Stop lamp inoperative</td>
<td>5.3 LIGHTS</td>
</tr>
<tr>
<td>Tail lamp inoperative</td>
<td>5.3 LIGHTS</td>
</tr>
<tr>
<td>THEFT ERROR displayed</td>
<td>5.4 SECURITY SYSTEM</td>
</tr>
<tr>
<td>Turn signal indicator inoperative</td>
<td>4.4 TURN SIGNAL INDICATOR INOPERATIVE</td>
</tr>
<tr>
<td>Turn signal inoperative</td>
<td>5.3 LIGHTS</td>
</tr>
</tbody>
</table>

### Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 2-5. Ignition/Accessory Power
Figure 2-6. Chassis Grounds
Initial Diagnostics (Part 1 of 2)

Turn the ignition ON with the engine stop switch in the RUN position.
Do the headlamps and the IC illuminate?

YES
Press the start button.
Does the engine start?

YES
Using the Onboard Diagnostic Information System (ODIS), check for DTCs.
Are any DTCs present?

YES
Refer to Diagnostic Trouble Codes (DTC) Priority Table in 2.1 INITIAL Diagnostics.

NO
Operate the motorcycle under the conditions to duplicate the concern.
Is the symptom present?

YES
See 2.1 INITIAL Diagnostics.

NO
Could not duplicate the concern. Perform a wiggle test. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING.

NO
Does the engine crank normally but not start?

YES
See 5.3 LIGHTS.

NO
Go to Initial Diagnostics (Part 2 of 2).

YES
See 6.1 DDFI-3 OPERATION.

NO
Is the security lamp flashing or is there any indication the security system is active or locked?

YES
See 3.1 STARTING SYSTEM DIAGNOSTICS.

NO
See 5.4 SECURITY SYSTEM.
Continued from Initial Diagnostics (Part 1 of 2),
Verify the battery is fully charged. See 3.4
BATTERY TESTING.
Is the battery charged?

YES
Check the battery fuse.
Is the fuse good?

NO
Charge battery and
retest.

YES
Test the ground circuits to the battery
for an open or high resistance.
Is an open or high resistance
present?

NO
Test for a short to ground in the power
circuits protected by the battery fuse.
Review the Battery Power Distribution
Wiring Diagram in Appendix B.
Is a short to ground present?

YES
Locate and repair the open
or high resistance in the
ground circuit.

NO
See 4.1
INSTRUMENT
CLUSTER AND
GAUGES.

YES
Locate and repair the
short to ground in the
power circuit. Replace the
battery fuse.

NO
Replace the battery fuse. See
3.3 CHARGING SYSTEM
DIAGNOSTICS for additional
information.
DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

Serial data communication circuits are used by modules and diagnostic tools to share information.

Electronic Control Module (ECM)

See Figure 2-7. The ECM is located inside the left radiator outer shroud. The ECM monitors the sensors from the engine and fuel systems in order to manage the fuel and spark delivery to the motorcycle which enhances performance and driveability.

Instrument Cluster (IC)

The IC uses the CAN communication to display information to the operator and to communicate to the ECM.

Controller Area Network (CAN) connector

See Figure 2-7. The CAN connector [243] is located inside the left radiator outer shroud next to the ECM. This connector is mainly used for initial programming of the modules when the motorcycle is built. Check that this plug is present to verify proper CAN operation. The CAN connector plug should have a resistance of approximately 120 Ohms.

Data Link Connector (DLC)

See Figure 2-7. The DLC is located under the left radiator shroud. The DLC is used to connect the DIGITAL TECHNICIAN II to the motorcycle.

COMM ERROR OR DTC U0001

The ECM sets U0001 if it loses communication to the IC. When the IC recognizes a loss of communication with the ECM, it displays either a THEFT ERROR message or a COMM ERROR message, depending if there was any communication during that ignition cycle or not.

Diagnostic Tips

The IC sets a THEFT ERROR message if the fault happened when the ignition is off. It sets a COMM ERROR message if the ignition is on and the IC and ECM are communicating when the fault occurs. Once the ignition is cycled off and back on, the COMM ERROR message clears and THEFT ERROR displays.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 2-8. Serial Data Communication
COMM ERROR or DTC U0001

Disconnect the terminating resistor from connector [245]. Turn the ignition on. Is the THEFT ERROR or COMM ERROR message cleared from the ECM?

YES

Replace the terminating resistor.

NO

Turn the ignition off. Disconnect the ECM connector [11]. Measure the resistance from terminal 1 to terminal 2 of the CAN connector [243B]. Is the resistance less than 100 Ohms?

NOTE

Use Harness Test Kit (Part No. HD-41404). See 1.2 DIAGNOSTIC TOOLS.

YES

Disconnect the IC. Test for continuity between terminals 1 and 2 of connector [243B]. Is continuity present?

NO

Is the resistance greater than 150 Ohms?

YES

Disconnect the IC. Test terminals 1 and 2 of connector [243B] for a short to ground. Is a short to ground present?

NO

CAN lines are shorted together. Locate and repair the short.

Discontinue the IC. Test for continuity between terminal 1 of connector [243B] and terminal 9 of connector [36B]. Is continuity present?

YES

Locate and repair the open in (PK/4V) wire.

NO

Replace the instrument cluster.

Discontinue the IC. Test terminals 1 and 2 of connector [243B] for a short to voltage. Is a short to voltage present?

YES

Test for continuity between terminal 2 of connector [243B] and terminal 10 of connector [36B]. Is continuity present?

NO

Locate and repair short to ground in (PK/4V) or (PK/4Y) wire.

YES

Locate and repair short to voltage in (PK/4V) or (PK/4Y) wire.

NO

Locate and repair open in (PK/4V) wire.

NO

Replace and program the ECM.
STARTING SYSTEM DIAGNOSTICS

DESCRIPTION AND OPERATION

When the ignition switch is turned on, power is supplied to the coil side of the key relay and energizes the relay. This allows battery power to flow through the relay, to the lights fuse, and to the switch side of the start relay.

When the engine stop switch is in the RUN position with the ignition switch turned on, power is supplied to the ignition relay causing the relay to energize. This supplies power to the start switch. When the start switch is pressed, power flows to the coil side of the start relay. The ECM grounds the coil side of the start relay. The ECM monitors the clutch switch, neutral switch, and the state of the security system. If the security system is not locked and either the clutch lever is pulled in or the motorcycle is in neutral, the ECM supplies ground to the coil side of the start relay allowing power to flow to the solenoid. This energizes the solenoid and full battery power is sent to the starter.

Once the engine is running, the alternator starts supplying the power to charge the battery and run all of the electrical components on the motorcycle. The voltage regulator regulates the power coming from the alternator and charges the battery using the circuitry through the battery fuse.

COMPONENTS

Starter

See Figure 3-1. The electric starter is located on the front of the engine.

- The starter drive gear transfers rotation to the limiter assembly.
- The limiter assembly gear transfers rotation to the starter ring gear.
- The starter ring gear drives the alternator rotor on the end of the crankshaft.

When the engine starts, a sprag clutch on the backside of the alternator rotor disengages the starter ring gear and the rotor disengages allowing the starter ring gear and the rotor to rotate independently of each other.

Figure 3-1. Starter Terminal

Starter Solenoid

See Figure 3-2. The starter solenoid is located under the seat and is a switch to open and close the high current circuit to the electric starter motor.

Figure 3-2. Starter Solenoid Terminals (typical)

1. Solenoid stud (to battery)
2. Solenoid stud (to starter)
3. Starter solenoid connector [128]

Engine Stop Switch (Right Hand Controls)

The engine stop switch is located on the right hand controls. When the engine stop switch is in the RUN position, voltage is supplied to the coil side of the ignition relay.

Start Switch (Right Hand Controls)

The start switch is a pushbutton switch located in the right hand controls. When the start switch is pressed, voltage is supplied to the coil of the ignition relay.

Key Relay

See Figure 3-3. The key relay is located in the relay box under the seat. When the ignition switch is turned on, power is supplied to the key relay. The key relay energizes and provides power to the lights fuse.

Figure 3-3. Key Relay

2009 Buell 1125: Starting/Charging 3-1
Ignition Relay
See Figure 3-4. The ignition relay is located in the relay box under the seat. When the ignition switch is turned on, and the engine stop switch is in the RUN position, the ignition relay is activated.

Start Relay
See Figure 3-5. The start relay is located in the relay box under the seat. When the ignition switch is turned on, and the engine stop switch is in the RUN position, the ignition relay is activated. With the start switch pressed, the ECM verifies the clutch is engaged or the transmission is in neutral. The ECM then supplies the ground circuit, activating the start relay, to transfer power to the starter solenoid. Simultaneously, power is removed from the headlamps for the duration of the start switch activation.

Ignition Switch
The ignition switch is located on the handlebars, below the Instrument Cluster (C). The ignition switch locks the handlebars and turns the electrical power to the motorcycle on and/or off.

Battery

**WARNING**

Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)

**WARNING**

Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)

**WARNING**

Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)

**WARNING**

If battery becomes hot, gassing or spewing of electrolyte can occur, which could cause death or serious injury. Unplug or turn OFF the charger until battery cools. (00412b)

**WARNING**

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling. (00019e)

**CAUTION**

If battery releases an excessive amount of gas during charging, decrease the charging rate. Overheating can result in plate distortion, internal shorting, drying out or damage. (00413b)

See Figure 3-6. The Absorbed Glass Mat (AGM) battery stores energy in chemical form to provide electrical power for the vehicle. The AGM batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries.

The battery is recharged by the alternator and kept from overcharging by the regulator during use.

See 3.4 BATTERY TESTING. Battery condition can be determined by a voltage test, a conductance test, or a load test.

A battery may be tested, whether fully charged or not, using the conductance test. However, the battery must be fully charged to perform a load test.
The rotor of the alternator is bolted to the crankshaft. The stator is bolted to the inside of the alternator cover and delivers voltage to a voltage regulator through a wire harness that passes through a boss in the side of the alternator cover.

**Voltage Regulator**

See Figure 3-7. The voltage regulator is located under the seat on the left side frame rail. The voltage regulator is a shunt regulator. The circuit combines the functions of rectifying the AC voltage from the alternator stator and regulating the charge voltage to the battery and other vehicle systems. The voltage regulator cannot be repaired, only replaced.

![Voltage Regulator](image)

**Battery Fuse**

See Figure 3-6. The 30 Amp battery fuse is located in the fuse box under the seat and is used to protect the circuits to most of the other fuses.

**SYMPTOMS**

The troubleshooting tables contain detailed procedures to solve and correct problems. Follow 3.1 STARTING SYSTEM DIAGNOSTICS to diagnose starting system problems. The 1.3 DIAGNOSTICS/TROUBLESHOOTING, Voltage Drop procedure helps locate poor connections or circuits with excessive resistance.

<table>
<thead>
<tr>
<th>SOURCE OF PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>Voltage drop due to discharged battery.</td>
<td>Charge battery.</td>
</tr>
<tr>
<td></td>
<td>Short-circuited or open between electrodes.</td>
<td>Replace battery.</td>
</tr>
<tr>
<td></td>
<td>Poor contact condition of battery terminal(s).</td>
<td>Clean and retighten.</td>
</tr>
<tr>
<td>Wiring</td>
<td>Poor or no connection at either end of the battery positive or negative cable.</td>
<td>Repair or replace cable(s).</td>
</tr>
<tr>
<td></td>
<td>Cracked or corroded battery cable ends.</td>
<td>Clean, tighten or replace cable(s) as needed.</td>
</tr>
<tr>
<td></td>
<td>Open wire(s) or poor connection at handlebar switch or start relay, especially relay ground wire (grounds through ECM).</td>
<td>Tighten connections or repair or replace wire(s).</td>
</tr>
</tbody>
</table>
### Table 3-1. Starter Does Not Run or Runs at Very Low Speeds

<table>
<thead>
<tr>
<th>Source of Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start switch, clutch switch, engine stop switch or neutral switch</td>
<td>Poor switch contacts or open switch.</td>
<td>Replace switch.</td>
</tr>
<tr>
<td>Start relay</td>
<td>Open coil winding.</td>
<td>Replace relay.</td>
</tr>
<tr>
<td></td>
<td>Poor or no continuity at relay points.</td>
<td>Replace relay.</td>
</tr>
<tr>
<td></td>
<td>ECM has disabled start relay.</td>
<td>Disarm security system.</td>
</tr>
<tr>
<td>Solenoid</td>
<td>Poor contact condition caused by burned contacts.</td>
<td>Replace solenoid assembly.</td>
</tr>
<tr>
<td></td>
<td>Windings open or short-circuited.</td>
<td>Replace solenoid assembly.</td>
</tr>
<tr>
<td>Starter motor</td>
<td>Brushes worn below specification.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Commutator burnt.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Commutator high mica.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Field winding grounded.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Armature winding grounded or short-circuited.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Free running current draw out of range.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Insufficient brush spring tension.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td>Limiter assembly</td>
<td>Limiter assembly failure.</td>
<td>Replace limiter assembly.</td>
</tr>
<tr>
<td>Sprag clutch</td>
<td>Sprag clutch failure.</td>
<td>Replace rotor/sprag clutch assembly.</td>
</tr>
</tbody>
</table>

### Table 3-2. Engine Cannot Be Cranked

<table>
<thead>
<tr>
<th>Source of Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>Voltage drop due to discharged battery.</td>
<td>Charge battery.</td>
</tr>
<tr>
<td></td>
<td>Short-circuited or open between electrodes.</td>
<td>Replace battery.</td>
</tr>
<tr>
<td></td>
<td>Poor contact condition of battery terminal(s).</td>
<td>Clean and retighten.</td>
</tr>
<tr>
<td>Starter motor</td>
<td>Starter gear teeth worn out.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td>Limiter assembly</td>
<td>Limiter assembly malfunction.</td>
<td>Replace limiter assembly.</td>
</tr>
<tr>
<td></td>
<td>Limiter assembly gears damaged.</td>
<td>Replace limiter assembly.</td>
</tr>
<tr>
<td>Gear teeth on freewheel gear</td>
<td>Excessively worn teeth.</td>
<td>Replace freewheel gear.</td>
</tr>
<tr>
<td>Sprag clutch</td>
<td>Sprag clutch failure.</td>
<td>Replace rotor/sprag clutch assembly.</td>
</tr>
</tbody>
</table>

### Table 3-3. Starter Does Not Stop Running

<table>
<thead>
<tr>
<th>Source of Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start switch or start relay</td>
<td>Unopened contacts.</td>
<td>Replace start switch or start relay.</td>
</tr>
<tr>
<td></td>
<td>Poor return caused by sticky switch or relay contacts.</td>
<td>Replace start switch or start relay.</td>
</tr>
<tr>
<td>Solenoid</td>
<td>Coil shorted.</td>
<td>Replace solenoid.</td>
</tr>
<tr>
<td></td>
<td>Contact plate melted and stuck.</td>
<td>Replace solenoid.</td>
</tr>
<tr>
<td>Sprag clutch</td>
<td>Sprag clutch seizure.</td>
<td>Replace rotor/sprag clutch assembly.</td>
</tr>
</tbody>
</table>
Figure 3-8. Starting Circuit
Starter Stalls or Spins Too Slowly

- Perform voltage drop tests from battery positive to starter motor terminal. See 1.3 DIAGNOSTICS/TROUBLESHOOTING. Crank the engine. Is voltage drop greater than 1.0 Volt?
  - YES
  - Perform voltage drop tests between battery positive to starter solenoid terminal 2. Crank the engine. Is voltage drop greater than 1.0 Volt?
    - YES
      - Perform voltage drop tests between battery positive and solenoid battery terminal 1. Is voltage drop greater than 1.0 Volt?
        - YES
          - Repair the connection between battery and solenoid.
        - NO
          - Replace the starter solenoid.
    - NO
      - Locate and repair the connection between the solenoid and the starter.
      - See 3.2 TESTING STARTER ON MOTORCYCLE. Perform starter current draw test on motorcycle. Perform Starter Motor Free Running Current Draw Test (on bench). Are test results within range?
        - YES
          - Clean the ground connections.
        - NO
          - Replace the starter.

With the spark plugs removed and the transmission in 6th gear, rotate rear wheel. Check for engine and/or crankshaft bind. Use appropriate code.
Continued from Starter Does Not Spin (Part 1 of 3).
Did the IC swap?

YES
Do the brake lamps or horn work?

NO
See 2.1 INITIAL DIAGNOSTICS.

YES
Remove the key relay. Test for battery voltage at terminal 85 (R/BK) wire with ignition ON. Is battery voltage present?

NOTE
See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

NO
See 5.3 LIGHTS.

YES
Check for continuity to ground on socket terminal 85 (BK) wire of the key relay. Is continuity present?

NOTE
See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

NO
Disconnect connector [33]. Check for continuity on terminal 3 connector [33B] (R/BK) wire to socket terminal 85 on the key relay.

NOTE
See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

YES
Check for voltage on socket terminal 30 (R) wire of the key relay. Is battery voltage present?

NOTE
See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

NO
Locate and repair the open to ground.

5828

YES
Replace the ignition relay.

5832

NO
Locate and repair the open in the (R) wire.

5827
STARTER CURRENT DRAW TEST

1. See Figure 3-9. Disconnect fuel pump connector [66] located under the seat.
2. Verify the transmission is in neutral.
3. Clamp induction ammeter over positive cable from the starter to the solenoid.

NOTE
Engine could start and run until the fuel in the lines is purged.

4. Turn the ignition switch on. While reading the ammeter, push the starter button. Disregard initial high current reading; that is normal when engine is first turned over.
   a. Typical starter current draw ranges between 140-180 amps.
   b. If starter current draw exceeds 180 amps, the problem may be in the starter or the starter drive. Remove the starter for further tests. See 3.2 TESTING STARTER ON MOTORCYCLE, Free Running Current Draw Test.

2. See Figure 3-10, attach one heavy jumper cable (6 gauge minimum) as follows:
   a. Connect one end to the starter mounting flange.
   b. Connect the other end to the negative (-) terminal of a fully charged battery.
   c. Connect a second heavy jumper cable (6 gauge minimum) to one end to the positive (+) terminal of the battery.
   d. Connect the other end of the second jumper cable to the battery terminal on the starter. Place an induction ammeter over cable.

3. Check ammeter reading.
   a. Ammeter should show 25-40 amps.
   b. If reading exceeds 40 amps, replace the starter motor.
   c. If starter current draw on the vehicle was over 180 amps and this test was within specification, there may be a problem with the engine or primary drive.

Figure 3-9. Fuel Pump Connector [66]

FREE RUNNING CURRENT DRAW TEST

1. Place the starter in a vise. Use a clean shop towel to prevent scratches or other damage.

Figure 3-10. Free Running Current Draw Test
DESCRIPTION AND OPERATION
See Figure 3-12. The charging system consists of the alternator and regulator.

COMPONENTS

Alternator
The alternator consists of 2 main components:
- The rotor which mounts to the left side of the crankshaft.
- The stator which bolts to the alternator cover.

Voltage Regulator
See Figure 3-11. The voltage regulator is a shunt regulator. The circuit combines the functions of rectifying the AC voltage from the alternator stator and regulating the charge voltage to the battery and other vehicle systems.

Figure 3-11. Voltage Regulator Location

TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48053</td>
<td>ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER</td>
</tr>
</tbody>
</table>

When the charging system fails to charge or does not charge at the normal rate, check the battery, wiring, and voltage regulator.

Battery
Check for a weak or dead battery. See 3.4 BATTERY TESTING for battery testing procedures. Battery must be fully charged in order to perform a load test, and starting or charging tests. However, a partially discharged battery may be tested using the BATTERY TEST function of the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053).

Wiring
The stator's plug and socket connections must be clean and tight.

Check for corroded or loose connections in the charging circuit.

Voltage Regulator Inspection
The voltage regulator ground must have a clean, tight connection for proper grounding. Check by using an ohmmeter with one lead on a known good ground, such as battery ground cable, and the other on the regulator body.

Job/Time Code Values
Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 3-12. Charging System Circuit
Charging System Test (Part 1 of 2)

1. Test the battery. Charge or replace as required.

2. Inspect the voltage regulator. See 3.3 CHARGING SYSTEM DIAGNOSIS.

   - **PASS**
     - Perform Milliampere Draw Test.

   - **FAIL**
     - Correct as required.

3. **PASS**
   - Perform Total Current Draw Test. Record measurement.

4. **FAIL**
   - Disconnect the voltage regulator. Does milliampere draw drop?

   - **YES**
     - Replace the grounded stator.

   - **NO**
     - Isolate damaged component or wiring.

5. Go to Charging System Test (Part 2 of 2).

6. **FAIL**
   - Isolate damaged wiring or excessive accessories.
Charging System Test (Part 2 of 2)

Continued from Charging System Test (Part 1 of 2).
Perform Current and Voltage Output Test. Record measurement and compare with Total Current Draw Test before proceeding.

PASS

Perform Voltage Output Test.

FAIL

Perform Stator Check.

PASS

System tests good up to this point. Suspect:

- Accessories on for long periods when motorcycle is parked and not running.
- Accessories on when motorcycle is ridden very slowly for long periods.
- Battery self-discharge and/or accessory draw because motorcycle was not operated for a long period.

FAIL

Replace the voltage regulator.

Perform AC Output Test.

Replace the stator.

PASS

5316

Replace the voltage regulator.
Perform Current Output Test.

FAIL

Inspect the rotor.

System OK.

FAIL

5319

5315

5319

5314

Replace the stator.

Replace the rotor.
Milliampere Draw Test

NOTE
Be sure accessories are not wired so they stay on at all times. This condition could drain the battery completely if the vehicle is parked for a long time. Check for this by connecting an ammeter between negative battery terminal and battery.

1. Remove the 30 Amp battery fuse.

2. See Figure 3-13. Using HARNESS TEST KIT (Part No. HD-41404-B) purple male socket probes and patch cords, connect ammeter to battery fuse socket terminals. With this arrangement, any regulator drain is picked up.

3. With the ignition switch turned off and all lights and accessories off, observe current reading.
   a. Add regulator draw to appropriate value for ECM. If observed ammeter reading is less than listed in table, draw is within limits. Refer to Table 3-4.
   b. A higher reading indicates excessive current draw. Check accessories for excessive drain.

NOTE
A battery with a surface discharge condition could suffer a static drain. Correct by cleaning battery case.

Table 3-4. Milliampere Draw Test

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAXIMUM DRAW IN MILLIAMPERES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator</td>
<td>1.0</td>
</tr>
<tr>
<td>ECM</td>
<td>1.0</td>
</tr>
<tr>
<td>Instrument Cluster (IC)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
1. Ammeter
2. Battery fuse socket
3. Voltage regulator

Figure 3-13. Milliamper Draw Test (Ignition Turned to OFF)

Total Current Draw Test
If the battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

NOTE
if a load tester is unavailable, use an ammeter with current probe.

WARNING
Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

1. See Figure 3-14 to check for this condition, and place load tester induction pickup or current probe pickup over battery negative cable.
2. Disconnect the stator plug from the voltage regulator. Start the motorcycle and run the engine at 3000 RPM.

3. With the ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw.

4. Compare this reading to the reading obtained after performing a Current and Voltage Output Test.
   a. The current output should exceed current draw by a minimum of 3.5 amps.
   b. If output does not meet specifications, there may be too many accessories for the charging system to handle.

5. Reconnect voltage regulator after testing.

Current and Voltage Output Test: Using Load Tester

1. Connect the load tester as follows:
   a. Connect the negative and positive leads to the battery terminals.
   b. Place the load tester induction pickup over the positive regulator cable.

2. Run the engine at 3000 RPM. Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible. Increase the load as required to obtain a constant 13.0 VDC.

3. The current output should be 28-34 Amps. Make a note of the measurement for use in the Total Current Draw Test.

NOTE
Rider’s habits may require output test at lower RPM.

Current and Voltage Output Test: Using HD-48053

1. Connect the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053) leads to the vehicle battery.

2. Perform a charging system test following the instructions in the analyzer instruction manual.

See Figure 3-15 for an example of the analyzer’s printout. The test results include a decision on the charging system’s condition and the measured voltage at idle and at 3000 RPM. The analyzer provides a printout stating either CHARGING SYSTEM NORMAL (no problem found) or CHARGING TEST PROBLEM.

If the analyzer states CHARGING TEST PROBLEM, one of the following results will be displayed:

- LOW CHARGING VOLTS - The alternator is not supplying sufficient current for the system electrical loads.
- HIGH CHARGING VOLTS - The voltage output from the alternator exceeds the normal regulator limits.
- INVESTIGATE VOLT OUTPUT - The rev voltage is lower than the idle voltage.

Stator Check

1. Turn ignition switch OFF:

2. See Figure 3-16 and connect an ohmmeter as follows:
   b. Insert one ohmmeter lead into a stator connector socket.
   c. Attach the other lead to a suitable ground.

3. Test for continuity with the ohmmeter set to the ohms scale.
   a. A good stator shows no continuity (open circuit) between any stator sockets and ground.
   b. Any other reading indicates a grounded stator which must be replaced.

4. See Figure 3-17. To check the stator for resistance, disconnect voltage regulator connector [46].
5. Test stator sockets 1-2, 2-3, and 3-1 for resistance with the ohmmeter set on the ohms scale.
   a. Resistance across all the stator sockets should be 0.1-0.3 Ohms.
   b. If the resistance is higher, the stator is damaged and must be replaced.
   c. If resistance is lower, the stator may have a turn-to-turn short and should be replaced.

NOTE
When measuring resistance (Ohms), compensate for test lead resistance before performing the measurement. Select the Ohms position and touch the test leads together. Refer to the multimeter user's manual to either zero the display or manually subtract the test lead resistance from the measured circuit's value.

AC Output Check

1. Test AC output as follows:
   b. See Figure 3-18. Connect an AC voltmeter across stator connector terminals 1-2.
   c. Run the engine at 3000 RPM. The AC output should be 45-55 Volts AC.
   d. Repeat the test across terminals 2-3 and 1-3.

2. Compare the test results to specifications.
   a. If the output is below specifications, charging problem could be a faulty rotor or stator. Perform Stator Check.
   b. If output is within specifications, charging problem might be faulty regulator. Replace as required.

3. Repeat the Current and Voltage Output Test.

Figure 3-16. Test for Grounded Stator (typical)

Figure 3-17. Check for Stator Resistance (typical)

Figure 3-18. Check Stator AC Voltage Output (typical)
DESCRIPTION AND OPERATION

Battery condition can be determined by a voltage test, a conductance test, or a load test.

A battery may be tested, whether fully charged or not, using the conductance test. However, the battery must be fully charged to perform a load test.

VOLTmeter TEST

The voltmeter test provides a general indication of battery state of charge or condition. Check the voltage of the battery to make sure it is in a 100% fully charged condition. Refer to Table 3-5.

If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform the 3.4 BATTERY TESTING, Load Test.

Table 3-5. Voltmeter Test For Battery Charge Conditions

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>STATE OF CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.7</td>
<td>100%</td>
</tr>
<tr>
<td>12.6</td>
<td>75%</td>
</tr>
<tr>
<td>12.3</td>
<td>50%</td>
</tr>
<tr>
<td>12.0</td>
<td>25%</td>
</tr>
<tr>
<td>11.8</td>
<td>0%</td>
</tr>
</tbody>
</table>

CONDUCTANCE TEST

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48053</td>
<td>ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER</td>
</tr>
</tbody>
</table>

Use the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053) and perform a battery test as follows:

1. Connect the HD-48053 analyzer directly to the lead terminals of the battery, not to the bolt or wire terminal.
2. Follow the instructions in the analyzer instruction manual to perform a battery test.

The test results include a decision on the battery condition and the measured state of charge.

See Figure 3-19. The analyzer printer provides a printout including one of the following test results:

- GOOD BATTERY - Return the battery to service.
- GOOD-RECHARGE - Fully charge the battery and return to service.
- CHARGE & RETEST - Fully charge the battery and retest.
- REPLACE BATTERY - Replace the battery.
- BAD CELL-REPLACE - Replace the battery and retest.
- BATTERY NOISE - Remove surface charge from battery and retest.

LOAD TEST

To load test the battery, proceed as follows:

⚠️ WARNING

Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

1. Remove the battery from the motorcycle.
2. Always fully charge the battery before testing or test readings will be incorrect. Load testing a discharged battery can result in permanent battery damage.
3. After charging, allow the battery to stand for at least one hour before testing.

⚠️ WARNING

Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

4. See Figure 3-20. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

NOTE

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.
5. Load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6 V or more at 70°F (21°C). Refer to Table 3-6.

**WARNING**

Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)

**WARNING**

Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

**CAUTION**

Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)

6. Install the battery in the motorcycle.

---

![Diagram of battery setup](image)

Figure 3-20. Load Test Battery

**Table 3-6. Battery Load Test**

<table>
<thead>
<tr>
<th>COLD CRANKING AMPERAGE (CCA)</th>
<th>100%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1125 models</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

2009 Buell 1125: Starting/Charging 3-21
SUBJECT
4.1 INSTRUMENT CLUSTER AND GAUGES.......................................................... 4-1
4.2 FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005.......................... 4-6
4.3 OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE............................... 4-11
4.4 TURN SIGNAL INDICATOR INOPERATIVE.................................................. 4-15
4.5 INSTRUMENT CLUSTER INOPERATIVE...................................................... 4-16
4.6 LOW FUEL LAMP ALWAYS ON OR INOPERATIVE...................................... 4-20
DESCRIPTION AND OPERATION

The Instrument Cluster (IC) uses direct inputs along with communication from the ECM to display information. The IC receives battery power through terminals 2 and 12. Ground is supplied through terminals 3 and 13. Ignition power comes from the ignition switch to terminal 14. There are two Controller Area Network (CAN) lines going to the ECM from terminals 9 and 10 of the IC.

See Figure 4-1. The TOGGLE and MODE switches are located on the IC along with the tachometer, the theft mode LED, and the indicator and warning lamps. The LCD screen on the IC displays a digital speedometer, odometer, clock, and information messages.

1. LCD screen
2. Tachometer
3. TOGGLE switch
4. MODE switch
5. Indicator lamps
6. Warning lamps
7. Theft mode LED

Figure 4-1. Instrument Cluster

COMPONENTS

Speedometer

The speedometer digitally displays the forward speed of the motorcycle in mph or km/h depending on the configuration. The configuration can be changed by using the TOGGLE and MODE switches on the IC. The speedometer receives the vehicle speed data over the CAN lines from the ECM.

Tachometer

The tachometer displays engine RPM. The numbers on the tachometer multiplied by 1000 equals engine RPM. As the tachometer approaches approximately 10,000 RPM the needle illuminates. The IC receives the RPM data over the CAN lines from the ECM.

Odometer

The odometer displays the distance traveled by the motorcycle. There are five different odometer settings that can be displayed by clicking the MODE switch. These include the main odometer (ODO), trip odometer 1 (TRIP 1), trip odometer 2 (TRIP 2), service odometer (SERVICE), and the low fuel odometer (F-trip). The trip odometers record mileage until they are reset and then start over. The fuel odometer is only available when the low fuel light is on and tracks the mileage traveled since the low fuel light came on. The service odometer tracks the number of miles (kilometers) left until the next regular maintenance is due.

Clock

The clock displays the current time and can be set for either a 12 or 24 hour format.

Indicator Lamps

See Figure 4-2. The indicator lamps are located at the top edge of the IC and inform the operator of turn signal, headlamp, and neutral positions.

1. Left turn signal indicator
2. Neutral indicator
3. Headlamp high beam indicator
4. Right turn signal indicator

Figure 4-2. Indicator Lamp

Left Turn Signal Indicator: The IC uses a direct input on terminal 4 from the left turn switch to determine when to flash the left turn signal indicator. The IC then supplies the voltage to the left turn signals.

Neutral Indicator: The IC receives a message from the ECM over the CAN lines letting the IC know when the transmission is in neutral and the indicator should be illuminated.

Headlamp High Beam Indicator: The IC uses a direct input on terminal 6 from the headlamp high/low switch to determine when to illuminate the high beam indicator.
Right Turn Signal Indicator: The IC uses a direct input on terminal 5 from the right turn switch to determine when to flash the right turn signal indicator. The IC then supplies the voltage to the right turn signals.

Warning Lamps

See Figure 4-3. The warning lamps are located at the right upper side of the IC. These lamps illuminate to inform the operator of a concern within the different systems of the motorcycle.

1. Low fuel lamp
2. Check engine lamp
3. Engine over temperature lamp
4. Oil pressure lamp
5. Low battery voltage lamp

**Figure 4-3. Warning Lamps**

Low Fuel Lamp: The IC uses a direct input on terminal 15 from the fuel level sender to determine when to illuminate the low fuel warning indicator. The IC also activates the (F-trip) odometer when the low fuel indicator is illuminated. This tracks the number of miles driven since the low fuel warning indicator was illuminated.

Check Engine Lamp: The IC illuminates the check engine lamp when the ignition is turned on or when there is a malfunction with the engine management system. The ECM sends a signal to the IC over the CAN lines to let it know when to illuminate the check engine lamp. See 6.1 DDFI-3 OPERATION for diagnosing the Check Engine Lamp.

Engine Over Temperature Lamp: The ECM sends a communication over the CAN lines to the IC when the engine temperature reaches 230 °F (110 °C). The IC then illuminates the engine over temperature lamp and flashes the coolant temperature on the LCD screen. See 6.1 DDFI-3 OPERATION for diagnosing the engine over temperature lamp.

Oil Pressure Lamp: The IC receives a direct input on terminal 8 from the oil pressure switch. When oil pressure drops, the switch closes and the IC illuminates the oil pressure lamp. The oil pressure lamp comes on when the ignition is turned on.

Low Battery Voltage Lamp: The IC illuminates the low battery voltage lamp when the battery voltage drops below 12V. The IC also displays the message SYSTEM VOLTAGE on the LCD screen. The IC receives the battery voltage signal over the CAN lines from the ECM and monitors the battery circuits to the IC.

Theft Mode LED

The red theft mode LED flashes when the security system is armed. The IC works with the ECM to disable the starter, injectors, and coils.

TOGGLE Switch

The TOGGLE switch is located on the left edge of the IC. With the engine running, the TOGGLE switch changes the display options to:
- Gear position and intake air temperature
- Coolant temperature and battery voltage
- Display brightness
- Average fuel consumption
- Instantaneous fuel consumption

MODE Switch

The MODE switch is located on the left side of the IC. The MODE switch changes the odometer between:
- Main odometer (ODO)
- Trip 1 (TRIP 1)
- Trip 2 (TRIP 2)
- Service odometer (SERVICE)
- Low fuel odometer (F-trip)

Setup Mode

The setup mode allows the operator to change certain settings in the IC. With the ignition on, press and hold the TOGGLE and MODE switch at the same time until SETUP MODE appears on the display. The following functions are located in the setup menu:
- KEY OFF TO EXIT
- TIME SETTING
- SERVICE COUNTER
- PIN SETTING
- THEFT SETTING
- UNIT SETTING
- CLOCK 12/24
- TOGGLE TO EXIT

Pressing and releasing the MODE switch scrolls through the list.
Pressing and releasing the TOGGLE switch allows the operator to select the changes to the functions or exit the setup mode. The different functions that can be set up are:
- Setting the clock (time and 12 or 24 hour formats)
- Service mileage reset
- PIN change
- Security system prompts
- Unit of measure

**Lap Timer**

To enter the lap timer mode, with the engine running and the vehicle stopped, hold down the TOGGLE switch and press the flash-to-pass switch on the left handlebar three times. See Figure 4-4 for flash-to-pass switch location. Once started, the lap timer restarts a new lap each time the flash-to-pass switch is pressed. The lap timer can store up to 99 lap times. Each time a new lap is started, the timer displays the time for the last completed lap, for 15 seconds. To replay the stored times, hold the flash-to-pass switch for 5 seconds. It replays:
- Individual lap times
- Fastest lap time
- Slowest lap time
- Average lap time

To clear all laps in memory, press and hold the TOGGLE switch for 3 seconds. The LAPS CLEAR message is displayed when lap times are erased.

To exit the lap timer mode:
1. Stop the vehicle.
2. Press and hold TOGGLE switch and quickly press the passing lamp switch three times.

**NOTE**

Recorded lap times remain in memory until they are cleared. Exiting lap timer mode, turning off the vehicle, or losing battery power will not affect lap times stored in memory.

---

**ONBOARD DIAGNOSTIC INFORMATION SYSTEM (ODIS)**

The IC displays the ODIS at the bottom of the LCD. The ODIS displays operational data, configuration menus, and messages for other features through the IC. Refer to Table 4-1 for possible messages and their descriptions.

---

**Table 4-1. General LCD Screen Messages**

<table>
<thead>
<tr>
<th>MESSAGE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUELL WISCONSIN USA</td>
<td>Introductory text displayed when ignition key is turned on.</td>
</tr>
<tr>
<td>SYSTEM VOLTAGE</td>
<td>Displayed when the battery voltage is too low, or too high.</td>
</tr>
<tr>
<td>CT COLD</td>
<td>The word &quot;COLD&quot; flashes on the screen until the measured temperature is above the normal operating temperature range. The display then changes to the &quot;GEAR X at XXX F/C&quot; screen. The initial intake air temperature displays when the ignition is turned on, and updates once the vehicle maintains a speed above 25 mph (40 km/h) for 1 minute.</td>
</tr>
<tr>
<td>SERVICE XXX</td>
<td>Service interval is due at the displayed number of miles (kilometers). This message is displayed on the first startup after the service odometer falls below the 200 mi (322 km) and 1000 mi (1609 km) thresholds.</td>
</tr>
<tr>
<td>SERVICE NOW</td>
<td>Service odometer has elapsed. Vehicle is due for regular maintenance. This message is displayed on each startup until the service counter is reset.</td>
</tr>
<tr>
<td>SIDESTAND (HDI Models)</td>
<td>The sidestand is not in the fully retracted position. On HDI models, the vehicle shuts off power to the ignition and fuel pump when the sidestand is down while the vehicle is in gear, and the clutch is released.</td>
</tr>
<tr>
<td>TIPPED KEY OFF</td>
<td>The bank angle sensor has been tripped. The vehicle shuts off power to the ignition and fuel pump when the tip angle is greater than a predetermined limit. Turn the key switch off, stand the motorcycle upright, and restart.</td>
</tr>
<tr>
<td>MESSAGE</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ENTER PIN</td>
<td>Displayed when the ignition is first turned on while the security system is armed.</td>
</tr>
<tr>
<td>THEFT ERROR</td>
<td>A problem has been detected with the security system or serial communication has been lost.</td>
</tr>
<tr>
<td>LOCKED OUT</td>
<td>Twenty consecutive PIN entry failures have been made, causing the instrument cluster to lock out for 30 minutes. A countdown timer is displayed to show the number of remaining minutes until the PIN can be re-entered.</td>
</tr>
<tr>
<td>COMM ERROR</td>
<td>A communications error has occurred. The instrument cluster failed to receive messages from the ECM.</td>
</tr>
</tbody>
</table>

To enter the diagnostic part of the ODIS system, hold down the TOGGLE and MODE switches simultaneously while turning the ignition on. If the security system is active the PIN will have to be entered after the ignition is turned on. Once the PIN is entered the message DIAG MODE displays on the LCD. Pressing the TOGGLE switch again displays the current and historic DTCs and live data for the motorcycle. After the last DTC is displayed the message LIVE DATA appears. Pressing the TOGGLE switch scrolls through the list of available live data. For a complete list of DTCs, see Initial Diagnostics and Serial Data. For live data, refer to Table 4-2. The TOGGLE switch changes options and the MODE switch exits the diagnostic mode.

**NOTE**

The IC automatically exits the DIAG MODE if the speedometer reads vehicle speed greater than 0.

<table>
<thead>
<tr>
<th>LIVE DATA</th>
<th>DISPLAYED UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>Coolant Celsius</td>
<td>Temperature Celsius</td>
</tr>
<tr>
<td>Coolant Voltage</td>
<td>5 Volt reference</td>
</tr>
<tr>
<td>Airtemp Celsius</td>
<td>Temperature Celsius</td>
</tr>
<tr>
<td>Airtemp Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>TPS Percent</td>
<td>Percent open</td>
</tr>
<tr>
<td>TPS Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>Clutch State</td>
<td>0 or 1</td>
</tr>
<tr>
<td>V Speed State</td>
<td>0 or 1</td>
</tr>
<tr>
<td>MAP KPA</td>
<td>Pressure KPA</td>
</tr>
<tr>
<td>MAP Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>IAC Steps</td>
<td>Steps open</td>
</tr>
<tr>
<td>Fuel KPA</td>
<td>Pressure KPA</td>
</tr>
<tr>
<td>Fuel Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>FRT 02 Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>Rear 02 Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>Tipover Voltage</td>
<td>Volts</td>
</tr>
<tr>
<td>S Stand Voltage</td>
<td>0.6 stand up</td>
</tr>
<tr>
<td></td>
<td>2.6 stand down</td>
</tr>
<tr>
<td>F adapt fuel</td>
<td>Percent</td>
</tr>
<tr>
<td>R adapt fuel</td>
<td>Percent</td>
</tr>
<tr>
<td>Starter Relay St</td>
<td>0 or 1</td>
</tr>
<tr>
<td>Aux Power State</td>
<td>0 or 1</td>
</tr>
<tr>
<td>Software (SW)</td>
<td>Version number</td>
</tr>
<tr>
<td>Cal</td>
<td>Version number</td>
</tr>
</tbody>
</table>
Instrument Cluster (IC) Diagnostics

The IC monitors direct inputs from sensors and switches, along with receiving information from the ECM over the CAN lines.

The IC sets codes when the parameters for the inputs are out of range. These codes begin with a B prefix to separate them from an ECM or a communication code. Refer to Table 4-3 for B codes.

### Table 4-3. Diagnostic Trouble Codes (DTC) Priority Table

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1004</td>
<td>69</td>
<td>Fuel Level Sender Low</td>
<td>4.2 FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005</td>
</tr>
<tr>
<td>B1005</td>
<td>68</td>
<td>Fuel Level Sender High/Open</td>
<td>4.2 FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005</td>
</tr>
</tbody>
</table>

Some sensors and switches send direct inputs to the IC and do not have DTCs associated with them. Therefore, symptoms may occur indicating a fault without any DTCs present. Refer to Table 4-4 for a list of symptoms.

### Table 4-4. Instrument Cluster (IC) Symptom Table

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check Engine Lamp Always On or Inoperative</td>
<td>2.1 INITIAL DIAGNOSTICS</td>
</tr>
<tr>
<td>Oil Pressure Lamp Always On</td>
<td>4.3 OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Oil Pressure Lamp Inoperative</td>
<td>4.3 OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Turn Signal Indicators Inoperative</td>
<td>4.4 TURN SIGNAL INDICATOR INOPERATIVE</td>
</tr>
<tr>
<td>Instrument Cluster (IC) Inoperative</td>
<td>4.5 INSTRUMENT CLUSTER INOPERATIVE</td>
</tr>
<tr>
<td>Low Fuel Lamp Always On</td>
<td>4.6 LOW FUEL LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
<tr>
<td>Low Fuel Lamp Inoperative</td>
<td>4.6 LOW FUEL LAMP ALWAYS ON OR INOPERATIVE</td>
</tr>
</tbody>
</table>
FUEL LEVEL SENDER LOW/HIGH/OPEN, DTC B1004, B1005

DESCRIPTION AND OPERATION

See Figure 4-5. The IC has a direct input from the fuel level sender. The IC monitors this input and sets a DTC if the input falls out of range.

The IC provides battery voltage to the fuel level sender on the (Y/R) wire. The fuel level sender is a thermistor device that is cooled by fuel in the tank, keeping the resistance value high. As the fuel drops below the sender, the thermistor is allowed to warm, which lowers the resistance value. The IC constantly monitors this signal and when the resistance value changes (at approximately 0.8 gallons (3.0 liters) of fuel is left in the tank), the IC illuminates the low fuel lamp.

Table 4-5. Code Description Table

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1004</td>
<td>Fuel level sender low</td>
</tr>
<tr>
<td>B1005</td>
<td>Fuel level sender high/open</td>
</tr>
</tbody>
</table>

Figure 4-5. Fuel Pump Connector [86]

Diagnostic Tips

The IC may take a few minutes to update. When using a new IC to test, wait a few minutes to verify what codes are set. The new IC updates to the ECM after 30 minutes and cannot be restocked. Watch the timer on the IC so it does not update to the ECM before diagnostics are complete.

The IC can only have a VIN written to it once. It cannot learn a new VIN if one has already been written to it. Therefore, when replacing the IC, it must be a new IC.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 4-6. Instrument Cluster Power and Communication
Figure 4-7. Instrument Cluster Inputs and Outputs
DTC B1004

Disconnect the fuel pump connector [88].
Turn the ignition on.
Did DTC B1004 set?

YES
Replace the fuel pump assembly.

NO
Disconnect the IC connector [29]. Test
terminal D (Y/R) wire of connector [88] for a
short to ground.
Is a short to ground present?

YES
Locate and repair the short
to ground in the (Y/R) wire.

NO
Replace the IC with a new IC. Connect connectors
[39] and [88]. Turn the ignition on for a few minutes
to give it time to update. See Diagnostic Tips.
Did DTC B1004 set?

YES
Replace the fuel pump assembly.

NO
Repair complete. Allow sufficient
lines for the new IC to update to
the ECM.

fc01919_en
Disconnect the fuel pump connector (86) and the IC connector (98). Test terminal D (Y/R) wire of connector (86A) for a short to voltage. Is a short to voltage present?

YES

Locate and repair the short to voltage in the (Y/R) wire.

NO

Test terminal D (Y/R) wire of connector (86A) for an open. Is an open present?

YES

Locate and repair the open in the (Y/R) wire.

NO

Measure the resistance between terminals A and D of connector (86B). Is the resistance between 850-1200 Ohms?

YES

Replace the IC with a new IC. Connect connectors (39) and (86). Turn the ignition on for a few minutes to give it time to update. See Diagnostic Tips. Did DTC B1005 set?

NO

Replace the fuel pump assembly.

YES

Remove the new IC and install the original IC. Replace the fuel pump assembly.

NO

The repair is complete. Allow sufficient time for the new IC to update to the ECM.
OIL PRESSURE LAMP ALWAYS ON OR INOPERATIVE

DESCRIPTION AND OPERATION

See Figure 4-8. The oil pressure lamp illuminates at key on for two seconds when the IC performs the bulb check, and then goes out. It will not stay on under normal conditions if the engine is not running. When the engine is running the IC sends out a voltage on terminal 8 (GN/Y) to the oil pressure switch. When the oil pressure drops, the switch closes, grounding the circuit through the switch. When the IC sees this, it illuminates the oil pressure lamp.

![Diagram of oil pressure switch and hose]

1. Oil pressure switch [120]
2. Hydraulic clutch pressure hose

Diagnostic Tips

Verify oil pressure using an oil pressure gauge set.
Several non-electrical problems may cause low oil pressure. It is important to test and rule these out to avoid unnecessary parts replacement. Possible causes include:
- Incorrect oil level or incorrect oil viscosity
- Clogged oil line
- Damaged or improper operation of the bypass valve
- Oil pump malfunction

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 4-9. Instrument Cluster Inputs and Outputs
Oil Pressure Lamp Always On

Turn the ignition on. Does the low oil light illuminate for two seconds and then turn off?

YES

Verify there is sufficient oil in the engine. Start the engine. Does the low oil light stay on?

YES

Disconnect the oil pressure sensor. Does the low oil light stay on?

YES

Test the (GN/Y) wire from the oil pressure sensor to the IC for a short to ground. Is a short to ground present?

YES

Locate and repair the short to ground in the (GN/Y) wire.

NO

Replace the instrument cluster.

3008

NO

The system is operating properly.

NO

Check for any mechanical issues that could cause low oil pressure. See Diagnostic Tips. Were the problem found?

YES

Operate the engine and confirm the repair.

5161

NO

Replace the oil pressure switch.

NO

Replace the instrument cluster.

6204

Use appropriate code.
Oil Pressure Lamp Inoperative

Turn the ignition on. Does the low oil light illuminate for two seconds and then turn off?

YES

Verify there is sufficient oil in the engine. Disconnect the oil pressure switch. Using a jumper connect the oil pressure switch connector [1205] to a good ground. Start the engine. Does the low oil light illuminate?

YES

Replace the oil pressure switch.

NO

Replace the instrument cluster.

5161

Test the (GN/Y) wire from the oil pressure sensor to the IG for an open circuit. Is an open present?

YES

Locate and repair the open in the (GN/Y) wire.

NO

Replace the instrument cluster.

6004

6024
TURN SIGNAL INDICATOR INOPERATIVE

DESCRIPTION AND OPERATION

See Figure 4-10. The IC receives a signal from the left or right turn signal switch on terminal 4 (left) or terminal 5 (right). The IC sends voltage to the right or left turn signal when it receives this signal to flash. The flash for the indicators and the turn signal lamps is controlled internally by the IC. The IC sends voltage through terminal 11 for the right turn signal and through terminal 1 for the left turn signal.

Diagnostic Tips

The IC controls the flash rate for the turn signals internally. There is no flasher in the wiring to the lamps. If one bulb is inoperative, the remaining bulb flashes at double the normal rate. If both bulbs are inoperative, the turn signal indicator flashes at double the normal rate. The redundant battery and ground wires going to the IC are used to supply the current needed for the turn signal circuits.

Diagnostic Procedure

1. Turn the ignition on.
2. Push the turn signal switch to either the left or right turn signal position.
3. If the turn signals are also inoperative see 5.3 LIGHTS to diagnose the turn signals.
4. If the turn signals operate normally but the indicators do not function, replace the instrument cluster. Use job code 6006.

Figure 4-10. Indicator Lamp

1. Left turn signal indicator
2. Neutral indicator
3. Headlamp high beam indicator
4. Right turn signal indicator
DESCRIPTION AND OPERATION

The IC has two redundant battery feeds to support the current used to drive the turn signals. The IC also uses an ignition feed that powers up the IC when the ignition switch is turned on. Two redundant ground circuits supply ground for the IC.

Diagnostic Tips
It may appear the backlighting on the IC is not functioning when the display brightness is set to the lowest setting. If this is the only concern, toggle to the "Display Brightness" display option and check the setting.

The IC can only have a VIN written to it once. It cannot learn a new VIN if one has already been written to it. Therefore, when replacing the IC, it must be a new IC.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 4-11. Instrument Cluster Power and Communication
Does the IC backlighting and display illuminate brightly?

- **YES**
  - Does the engine start?
    - **YES**
      - Are the indicator or warning lamps inoperative?
        - **YES**
          - Refer to Instrument Cluster (IC) Symptoms Table for appropriate diagnostics.
          - **YES**
            - Check for DTCs. Are any DTCs present?
              - **YES**
                - See 2.1 INITIAL DIAGNOSTICS.
              - **NO**
                - Replace the instrument cluster.
        - **NO**
          - Is the speedometer or tachometer inoperative?
            - **YES**
              - Replace the instrument cluster.
            - **NO**
              - See 1.3 DIAGNOSTICS/ TROUBLESHOOTING.
    - **NO**
      - Use the setup menu to adjust the brightness setting in the IC. Is the problem solved?
        - **YES**
          - The repair is complete.
        - **NO**
          - Go to Instrument Cluster Inoperative (Part 2 of 2).
Continued from Instrument Cluster Inoperative (Part 1 of 2).

Turn the ignition off. Disconnect the I/O connector [39]. Turn ignition on.
Test for voltage on terminal 14 of connector [39A].
Is battery voltage present?

**YES**

Test terminals 13 and 3 for continuity to ground.
Is continuity present?

**YES**

Test terminals 12 and 2 for voltage.
Is battery voltage present?

**YES**

Replace the instrument cluster.

**NO**

Locate and repair the open in the ground circuit.

**NO**

Locate and repair the open in the battery circuit to the instrument cluster.

**NO**

Test for continuity between terminal 14 of connector [39B] and terminal 2 of connector [33B].
Is continuity present?

**YES**

Replace the ignition switch.

**NO**

Locate and repair the open in the (R/GY) wire.

6024

5129

6024

5006

5024

6024
LOW FUEL LAMP ALWAYS ON OR INOPERATIVE

DESCRIPTION AND OPERATION
See Figure 4-12. The IC provides battery voltage to the fuel level sender on the (Y/R) wire. The fuel level sender is a thermistor device that is cooled by fuel in the tank, keeping the resistance value high. As the fuel drops below the sender, the thermistor is allowed to warm, lowering the resistance value. The IC constantly monitors this signal and when the resistance value changes (at approximately 0.8 gallons (3.0 liters) of fuel is left in the tank), the IC illuminates the low fuel lamp.

Diagnostic Tips
The fuel level sender will not show a resistance reading if the sensor is working properly and the fuel level is above the sensor.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 4-12. Fuel Pump Connector [B6]
Figure 4-13. Instrument Cluster Inputs and Outputs
Low Fuel Lamp Always On

Enter the Onboard Diagnostic Information System on the IC. Is a code present?

YES

See the appropriate DTC diagnostics.

NO

Verify there is sufficient fuel in the fuel tank. Measure the resistance between terminals D and A of connector [968]. Is the resistance 850-1200 Ohms?

YES

Disconnect the IC connector [39]. Test terminal 15 of connector [968] for a short to ground. Is a short to ground present?

NO

Replace the fuel pump assembly.

Disconnect the IC connector [39]. Test terminal 15 of connector [968] for a short to ground. Is a short to ground present?

YES

Replace and repair the short to ground in the (YR5) wire.

NO

Replace the instrument cluster.
Low Fuel Lamp Inoperative

Turn the ignition on. Does the low fuel lamp illuminate for two seconds and then turn off?

YES
Disconnect the fuel level sender connector [86]. Using a jumper wire, connect terminal D (Y/R) to a good ground. Turn the ignition on. Wait a minute for the low fuel lamp to update. Did the low fuel lamp illuminate?

NO
Replace the instrument cluster.

YES
Test for continuity between connector [39A] and connector [36A] on (Y/R) wire. Is continuity present?

NO
Locate and repair the open in the (Y/R) wire.

YES
Replace the instrument cluster.

NO
Locate and repair the short to voltage in the (Y/R) wire.

Test for a short to voltage in (Y/R) wire. Is a short to voltage present?

Locate and repair the open in the (Y/R) wire.
SUBJECT

5.1 ACCESSORIES ..............................................................5-1
5.2 HORN .................................................................5-7
5.3 LIGHTS ...............................................................5-10
5.4 SECURITY SYSTEM ..................................................5-31
DESCRIPTION AND OPERATION

The auxiliary connector supplies power for accessories that may be added to the motorcycle. This two terminal connector is located behind the fairing below the Instrument Cluster (IC). If the ECM recognizes a low battery voltage condition, it will not energize the auxiliary relay, and therefore, the auxiliary connector will not have power.

COMPONENTS

Auxiliary Connector

See Figure 5-1 or Figure 5-2. The auxiliary connector receives power when the auxiliary relay is energized. The connector has a constant ground to GND1.

Figure 5-1. Behind Fairing Connectors (1125R)

1. Instrument Cluster (IC) [39]
2. 12 V auxiliary connector [160]
3. Headlamp [38]
4. Left front turn signal [31L]
5. Right front turn signal [31R]
6. Left hand controls [24]
7. Right hand controls [22]
8. Ignition switch [33]

Figure 5-2. Behind Fairing Connectors (1125CR)

1. Right hand controls [22]
2. Left hand controls [24]
3. Instrument Cluster (IC) [39]
4. Ignition switch [33]
5. Left front turn signal [31L]
6. Headlamp [38]
7. 12V auxiliary connector [160]
8. Right front turn signal [31R]

Auxiliary Relay

See Figure 5-3. The auxiliary relay receives power from the auxiliary fuse. The ECM grounds the coil side of the relay causing the relay to energize and supply power to the auxiliary connector. The ECM monitors the ground circuit for an open or shorted condition and sets a code if a condition is present. Refer to Table 5-1.
Table 5-1. Auxiliary Power DTCs

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1601</td>
<td>Auxiliary Relay Drive Circuit Fault</td>
</tr>
</tbody>
</table>

DTC P1601 Auxiliary Relay Driver Circuit Fault

The ECM controls the ground to the coil side of the auxiliary relay. The ECM monitors this circuit and sets a code if it does not see the expected input.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 5-3. Relay Block Location
Figure 5-4. Auxiliary Power Connector
Is DTC P1601 present?

YES

Disconnect and test the auxiliary relay. Is the relay good?

NOTE

See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

NO

See 1.3 DIAGNOSTICS/TROUBLESHOOTING.

YES

Disconnect the ECM connector [10] (BK). Test the (BK/GN) wire between terminal 19 of connector [10B] and terminal 12 of the auxiliary relay for an open. Is an open present?

NO

Replace the auxiliary relay.

YES

Locate and repair the open in the (BK/GN) wire.

NO

Test the (BK/GN) wire between terminal 19 of connector [10B] and terminal 12 of the auxiliary relay for a short to ground. Is a short to ground present?

YES

NO

Locate and repair the short to ground in the (BK/GN) wire.

Test the (BK/GN) wire between terminal 16 of connector [10B] and terminal 12 of the auxiliary relay for a short to voltage. Is a short to voltage present?

YES

NO

Locate and repair the short to voltage in the (BK/GN) wire.

Replace and program the ECM.
AUXILIARY POWER INOPERATIVE

The ECM only monitors the ground to the coil side of the auxiliary relay. Therefore, faults could occur that would affect the operation of the auxiliary power circuit without it causing a DTC to set.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary Power Inoperative</td>
<td>Poor ground or open in the switch side circuit of the relay</td>
</tr>
</tbody>
</table>

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 5-5. Auxiliary Power Connector
Auxiliary Power Inoperative

Verify the auxiliary power fuse is good. Is the fuse good?

YES

Disconnect the auxiliary relay. Turn the ignition on with the engine stop switch in the run position. Test for battery voltage at socket terminal 18 (R) of the auxiliary relay. Is battery voltage present?

YES

Test the auxiliary relay. Is the relay good? NOTE: See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

NO

Locate and repair the open in the (R) wire between the auxiliary fuse and auxiliary relay.

1734

NO

Test for battery voltage at socket terminal 20 (GY) of the auxiliary relay. Is battery voltage present?

YES

Replace the auxiliary relay.

1735

NO

Connect the auxiliary relay. Turn the ignition on with the engine stop switch in the run position. Test for battery voltage from terminal 1 (O/R) of connector (1608) to a good ground. Is battery voltage present?

YES

Locate and repair the open in the (GY) wire socket terminal 20 of the auxiliary relay.

1734

NO

Test for battery voltage from terminal 1 to terminal 2 of connector (1608). Is battery voltage present?

YES

System is operating properly. Check connection to auxiliary components.

NO

Locate and repair the open in the (BK) wire from terminal 2 to ground.

5638

Disconnect the ECM. Install breakout box. Using a patch cord, connect terminal 19 (black) to ground. Does the auxiliary relay energize and power the 12V auxiliary connector?

YES

Locate and repair the open in the (BK/GN) wire from connector (1608) socket terminal 19 to auxiliary relay socket terminal 12.

1734

NO

Replace and program the ECM.

1750

NO
DESCRIPTION AND OPERATION

The horn is powered through the horn switch from the brake/horn fuse. The horn is grounded through terminal 1 of connector [122] to GND 1. When the horn switch is pressed, battery voltage is applied to terminal 2 of connector [122] causing the horn to sound.

COMPONENTS

Horn Switch

See Figure 5-6. The horn switch is a pushbutton switch on the left handlebar controls.

SYMPTOMS

The horn circuit does not set DTCs when there is a malfunction. Instead, one of the symptoms shown in Table 5-3 exists to indicate a concern with the system.

Table 5-3. Horn Symptom Table

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn Always On</td>
<td>Short to voltage or a stuck switch</td>
</tr>
<tr>
<td>Horn Inoperative</td>
<td>Open circuit, faulty horn or horn switch</td>
</tr>
</tbody>
</table>

Diagnostic Tips

If the fuse is open, check the circuit between the horn switch and the horn for a short to ground. This would cause the fuse to open only when the horn switch is pressed. A short anywhere in the (R/Y) wire between the brake lamp switches and the tail/stop lamp causes this fuse to blow when the brakes are applied.

Horn Always On

If the horn is always on, perform the following steps:
1. Disconnect the horn switch.
2. If the horn turns off, replace the left switchgear.
3. If the horn does not turn off, repair the short to voltage in the (Y/BK) wire.

**Connector Information**

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

---

Figure 5-8. Horn
DESCRIPTION AND OPERATION

See Figure 5-9 or Figure 5-10. The lighting system includes the headlamps, turn signals, marker lamps, license plate lamp, tail, and brake lamps. The lights are powered by the accessory, brake/horn, and lights fuse. The accessory fuse circuit supplies power for the front marker lamps, the turn signal switch, the license plate lamp, and the tail lamp. The accessory circuit receives power when the ignition switch is in the ON or the PARK position. The headlamps each have an individual connection that runs through a sub-harness and is attached to the main harness through the headlamp connector [38].

COMPONENTS

Park Lighting

The park position allows the lamps to operate when the motorcycle is parked with the ignition and forks locked. In the park position, the power from the ignition switch is supplied to:

- front marker lamps
- turn signal switch
- IC
- tail lamps
- license plate lamp

The IC backlighting illuminates and the front marker lamps are on. The tail lamp and license plate lamp illuminate and the turn signals flash if the turn signal switch is operated.

Headlamp Switch

See Figure 5-11. The headlamp switch is located on the left handlebar controls. This switch is used to select either the high beam or the low beam headlamps.
Turn Signal Switch

See Figure 5-11. The turn signal switch is located on the left handlebar controls. The turn signal switch is an input to the IC. When the switch is pushed to the right, voltage is supplied through the (W/BN) wire at terminal 5 of the IC. When the turn signal switch is pushed to the left, voltage is supplied through the (W/Y) wire at terminal 4 of the IC.

Turn Signals

The front turn signals are located on the housings of the rearview mirrors. The rear turn signals are located at the sides of the rear fender. The turn signals use LEDs instead of conventional bulbs. The IC controls the turn signals. When the turn signal switch is pressed, voltage is sent to the IC. The IC then drives the turn signals for the appropriate side.

Tail/Stop Lamp

The tail/stop lamp illuminates with the ignition switch in the ON or PARK position. When either the front or rear stop lamp switches are applied, the second filament in the bulb illuminates to light the brake lamp. The tail lamp portion of the lamp is powered by the accessory fuse through the (O/W) wire. The stop lamp portion of the lamp receives power through the (R/Y) wire when either one of the stop lamp switches are applied.

License Plate Lamp

The accessory fuse supplies power to the license plate lamp on the (O/W) wire. The license plate lamp illuminates when the ignition is in the ON or PARK position.

Stop Lamp Switches

The front and rear stop lamp switches control the stop lamp portion of the tail/stop lamp. The front stop lamp switch is a mechanical switch. When the front stop lamp lever is applied, the lever presses a mechanical switch, and closes the contacts on the switch. The rear stop lamp switch is a pressure switch. When the rear stop lamp switch is applied, it generates pressure in the brake fluid. This pressure in the fluid causes the contacts for the rear stop lamp switch to close.

The brake/horn fuse supplies power to the stop lamp switches through the (O) wire. When the front stop lamp switch closes (front brake lever pulled in), power flows through the switch to the tail/stop lamp through the (R/Y) wire. When the rear stop lamp switch is applied (rear brake pedal pressed), power flows through the switch to the tail/stop lamp.

Symptoms

The lighting circuit does not set DTCs when there is a malfunction. Instead, symptoms and common causes are described in Table 5-4.

Table 5-4. Lighting Symptom Table

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlamps Inoperative</td>
<td>Burned out lamp, open fuse, open power or ground circuits, poor connection at connector [38]</td>
</tr>
<tr>
<td>Turn Signals Inoperative</td>
<td>Inoperative relay, inoperative switch, malfunctioning IC, open fuse, open in turn signal circuits</td>
</tr>
<tr>
<td>Tail Lamp Inoperative</td>
<td>Burned out lamp, open circuits, open fuse</td>
</tr>
</tbody>
</table>
### Table 5-4. Lighting Symptom Table

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMON CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop Lamp Inoperative</td>
<td>Inoperative brake switch, open fuse, open wires</td>
</tr>
<tr>
<td>Marker Lamps Inoperative</td>
<td>Burned out lamp, open fuse, open in marker lamp circuits, poor connection at the headlamp connector [38]</td>
</tr>
</tbody>
</table>

### HEADLAMPS

See Figure 5-12. The headlamps receive power through the lights fuse and the start relay. The headlamps turn on when the ignition switch is turned on. The start relay energizes and turns off the power to the headlamps when the start switch closes. This allows full battery power to the starter without the drain of the headlamps on the system.

The headlamp switch turns the high beam headlamps on and off. The low beam headlamps and front marker lamps are illuminated in the high or low beam setting. The flash-to-pass switch is a momentary switch that flashes the high beam headlamps as long as the switch is pressed.

### Diagnostic Tips

If the lights fuse is open, test for short to ground on (BE) wire from the fuse to the headlamp and flash-to-pass switches. Also, check for a short to ground on the (W) wire from the headlamp and flash-to-pass switches. If this circuit is grounded, it only opens the fuse when the headlamp switch is in the high position or the flash-to-pass switch is pressed. If a headlamp and front marker lamp are out on the same side, test the shared ground wire to that side.

### Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

---

**Figure 5-12. Start Relay**

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5-12  2009 Buell 1125: Accessories, Horn, Lights, and Security
Figure 5-13. Headlamp and Marker Lamps
Headlamps Inoperative (Part 2 of 2)

Continued from Headlamps Inoperative (Part 1 of 2).
Are the high beam headlamps inoperative?

YES

NO

Are both high beam headlamps inoperative?

Headlamps operating normally. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING.

YES

NO

With the ignition on and the headlamp switch in the high position. Is the high beam indicator on the IC illuminated?

YES

NO

With the ignition on and the headlamp switch in the high position, test for battery voltage from terminal A (W) of the high beam headlamp to a good ground. Is battery voltage present?

YES

NO

Locate and repair the open in the (BK) wire.

Locate and repair the open in the (W) wire.

5038  5194

Press the flash-to-pass switch. Does the high beam indicator illuminate?

YES

NO

Test for continuity between connector (248) terminals 3 and 2 with the headlamp switch in the high position. Is continuity present?

YES

NO

Locate and repair the open in the (BK) ground circuit of the inoperative headlamp.

Locate and repair the open in the (W) wire terminal A of the inoperative headlamp.

5038  5194

YES

NO

Turn ignition on. Test for battery voltage on terminal 2 of connector (24A). Is battery voltage present?

YES

NO

Replace the left switchgear.

Locate and repair open in (W) wire from connector (248) terminal 3.

Locate and repair open in (BE) wire from connector (248) terminal 2.

5194  5194
TURN SIGNALS

See Figure 5-14 or Figure 5-15 and Figure 5-16. The turn signals are controlled by the IC. When the turn signal switch is pushed to the left or right, voltage is sent to the IC on either the right input or the left input. The IC then sends voltage to the corresponding turn signal and controls the flash rate of the turn signals.

Figure 5-14. Behind Fairing Connectors (1125R)

1. Instrument Cluster (IC) [39]
2. 12V auxiliary connector [160]
3. Headlamp [38]
4. Left front turn signal [31L]
5. Right front turn signal [31R]
6. Left hand controls [24]
7. Right hand controls [22]
8. Ignition switch [33]

Figure 5-15. Behind Fairing Connectors (1125CR)

1. Right hand controls [22]
2. Left hand controls [24]
3. Instrument Cluster (IC) [39]
4. Ignition switch [33]
5. Left front turn signal [31L]
6. Headlamp [38]
7. 12V auxiliary connector [160]
8. Right front turn signal [31R]

Figure 5-16. Rear Lamp Connectors

1. Left rear turn signal [19] (GND)
2. Right rear turn signal [18] (Power)
3. License plate lamp [45] (Power)
4. Tail/stop lamp [93] (Power)
5. Tail/stop lamp [93] (GND)
6. License plate lamp [45] (GND)
7. Right rear turn signal [18] (GND)
8. Left rear turn signal [19] (Power)
Diagnostic Tips

When testing voltage for LED turn signals, be sure to use a voltmeter. The current used to operate LEDs may not be sufficient to light a test lamp and may cause false diagnostics.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 5-17. Tail/Stop and Turn Signal Lamps
Are all the turn signals inoperative?

YES

Do the turn signal indicators in the IC operate?

NO

Go to Turn Signals Inoperative (Part 2 of 3).

YES

Replace the instrument cluster.

5005

NO

Do the headlamps operate?

5005

YES

Disconnect the left hand controls connector [24]. Turn ignition on. Test for battery voltage on terminal 5 (O/W) of connector [24A]. Is battery voltage present?

NO

See 5.3 LIGHTS.

YES

Replace the instrument cluster.

6006

NO

Repair the open in the (O/W) wire.

6013
Turn Signals Inoperative (Part 3 of 3)

Continued from Turn Signals Inoperative (Part 2 of 3).
Do either of the left turn signals operate?

YES

Disconnect the inoperative turn signal. Turn the ignition switch on and activate the left turn signals. Using a voltmeter (do not use a test light), test for voltage from the (V) wire at the inoperative turn signal to a good ground. Does the voltage cycle on and off as the other turn signal flashes?

YES

Connect the voltmeter from the (V) wire to the (BK) wire at the inoperative turn signal. Does voltage continue to cycle on and off as the other turn signal flashes?

YES

Replace the turn signal.

NO

Locate and repair the open in the (BK) wire between the turn signal and ground.

5205

NO

Locate and repair the open in the (V) wire.

8797

NO

Replace the instrument cluster.

5006

NO

Disconnect IC connector [39]. Test for continuity on (V) wire from terminal 1 to inoperative turn signal. Is continuity present?

YES

Disconnect IC connector [39]. Turn the ignition on and activate the left turn signals. Test for battery voltage on terminal 4 (W/V) of connector [39B]. Is battery voltage present?

YES

Replace the IC connector [39].

NO

Locate and repair the open in the (W/V) wire.

5211

YES

Replace the left switchgear.

5122

NO
STOP LAMPS

See Figure 5-18. The front brake switch is a mechanical switch located under the fluid reservoir on the right handlebar. See Figure 5-19. The rear brake switch is a pressure switch located on the right side to the rear of the footpeg.

See Figure 5-20. The brake switches receive power through the brake/horn fuse. When the front or rear brake switch is applied, voltage travels through the switch to the tail/stop lamp.

Figure 5-18. Front Brake Switch Connectors [170]

1. Left rear turn signal [19] (GND)
2. Right rear turn signal [18] (Power)
3. License plate lamp [45] (Power)
4. Tail/stop lamp [93] (Power)
5. Tail/stop lamp [93] (GND)
6. License plate lamp [45] (GND)
7. Right rear turn signal [18] (GND)
8. Left rear turn signal [19] (Power)

Figure 5-20. Rear Lamp Connectors

Diagnostic Tips

When testing for a short to ground due to an open fuse, check the (R/Y) wire between the brake switches and the stop lamp. A short to ground on these wires causes the fuse to open only when the brake switches are closed. A short to ground in the (Y/BK) wire between the horn switch and the horn causes this fuse to open when the horn switch is pressed and needs to be checked for a short to ground as well.

Connector Locations

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 5-21. Tail/Stop and Turn Signal Lamps
Stop Lamp Inoperative (Part 1 of 2)

Turn the ignition switch on. Is the tail lamp part of the tail/stop lamp inoperative as well?

YES
Refer to Marker Lamps Inoperative.

NO
Does the horn work?

YES
Does the tail/stop lamp illuminate with the front brake switch applied?

NO
Inspect the brake/horn fuse. Is the fuse good?

YES
Inspect the brake/horn fuse. Is the fuse good?

NO

Disconnect the rear brake switch. Jumper terminals 1 and 2. Does the stop lamp illuminate?

YES
Go to Stop Lamp Inoperative (Part 2 of 2).

NO

Turn the ignition on. Test for voltage on the (R/BK) wire on terminal 9 of the brake/horn fuse. Is battery voltage present?

YES
Test for a short to ground. See Diagnostic Tips. Is a short to ground present?

NO

Locate and repair the open in the (R/BK) wire from terminal 9 of the brake/horn fuse.

YES
Locate and repair the open in the (O) wire from terminal 3 of the brake/horn fuse.

NO
Locate and repair the open in the (R/BK) wire from terminal 9 of the brake/horn fuse.

YES
Locate and repair the open in the (O) wire from terminal 1 of the brake/horn fuse.

NO
Replace the fuse and test operation.

5141
5764
5764
5764
5145

5142
5764
Continued from Stop Lamp Inoperative (Part 1 of 2).
Does the stop lamp illuminate with the rear brake switch applied?

YES
Disconnected the front brake switch. Jumper terminals 1 and 2.
Does the stop lamp illuminate?

YES
Replace front brake switch. 5141

NO

NO

NO

DisConnected the tail/stop lamp. Inspect the bulb. Is the bulb good?

YES
Locate and repair the open in the (RV) wire. 5197

NO

Test for voltage from terminal 1 of connector [170B] to a good ground. Is battery voltage present?

YES
Locate and repair the open in the (RV) from terminal 2 of connector [170B]. 5142

NO

Locate and repair the open in the (O) from terminal 1 of connector [170B]. 5784
MARKER LAMPS

See Figure 5-22 or Figure 5-23. The headlamp connector is located behind the front fairing. See Figure 5-24. The rear tail/stop lamp and license plate lamp connectors are bullet style connectors located under the passenger seat in the tail section.

The marker lamps consist of the front markers lamps, located on the outside edges of the headlamps, the license plate lamp, and the tail lamp. The marker lamps are powered through the accessory fuse when the ignition switch is in the ON or PARK position.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 5-23. Behind Fairing Connectors (1125CR)

1. Right hand controls [22]
2. Left hand controls [24]
3. Instrument Cluster (IC) [39]
4. Ignition switch [33]
5. Left front turn signal [31L]
6. Headlamp [38]
7. 12V auxiliary connector [160]
8. Right front turn signal [31R]

Figure 5-22. Behind Fairing Connectors (1125R)

1. Instrument Cluster (IC) [39]
2. 12 V auxiliary connector [160]
3. Headlamp [38]
4. Left front turn signal [31L]
5. Right front turn signal [31R]
6. Left hand controls [24]
7. Right hand controls [22]
8. Ignition switch [33]

Figure 5-24. Rear Lamp Connectors

1. Left rear turn signal [19] (GND)
2. Right rear turn signal [18] (Power)
3. License plate lamp [45] (Power)
4. Tail/stop lamp [93] (Power)
5. Tail/stop lamp [93] (GND)
6. License plate lamp [45] (GND)
7. Right rear turn signal [18] (GND)
8. Left rear turn signal [19] (Power)
Figure 5-25. Headlamp and Marker Lamps
Marker Lamps Inoperative (Part 1 of 2)

Turn the ignition on. Observe the tail lamp, license plate lamp, and front marker lamps. Do they all illuminate?

**YES**

Turn the ignition to the park position. Do all the same lamps illuminate?

**YES**

System operating normally. See 13 DIAGNOSTICS/TROUBLESHOOTING.

**NO**

Replace the ignition switch.

5129

**NO**

Are the front marker lamps inoperative?

**YES**

Inspect the accessory fuse. Is the fuse good?

**NO**

With the ignition on, test for battery voltage at terminal 12 (RGY) of the accessory fuse. Is battery voltage present?

**YES**

Locate and repair the short to ground in the (OW) wire. Replace the accessory fuse.

5043

**NO**

Locate and repair open in (RGY) wire to accessory fuse.

5043

**YES**

Disconnect the inoperative lamp. Inspect the bulb. Is the bulb good?

**YES**

Go to Marker Lamps Inoperative (Part 2 of 2).

**NO**

Disconnect the license plate lamp. Turn the ignition on. Test for battery voltage on the (OW) wire on connector [45B] to a good ground. Is battery voltage present?

**YES**

Install the accessory fuse. Replace bulb.

5197

**NO**

Locate and repair the open in the (BK) ground circuit.

5038

**YES**

Locate and repair the open in the (OW) wire.

5043

**NO**

Locate and repair the open in the (BK) ground circuit.

5038

**YES**

Locate and repair the open in the (OW) wire.

5043

5043

fc01866_en
Marker Lamps Inoperative (Part 2 of 2)

Continued from Marker Lamps Inoperative (Part 1 of 2), Are both front marker lamps inoperative?

- **YES**
  - Disconnect the headlamp connector [38]. Turn the ignition on. Test for battery voltage on terminal 1 (O/W) of connector [38A] to a good ground. Is battery voltage present?

- **NO**
  - Disconnect the inoperative front marker lamp. Inspect the bulb. Is the bulb good?

  - **YES**
    - Turn the ignition on. Test for battery voltage on the (GY/BK) wire to a good ground of the inoperative lamp. Is battery voltage present?

    - **YES**
      - Replace the bulb.

    - **NO**
      - Replace the bulb.

  - **NO**
    - Locate and repair the open in the (GY/BK) wire.

- **YES**
  - Disconnect one of the front marker lamps. Test for continuity on the (GY/BK) wire from terminal 1 of [38A] to terminal 1 of the front marker lamp. Is continuity present?

    - **YES**
      - Locate and repair the open in the (BK) ground circuit.

    - **NO**
      - Locate and repair the open in the (O/W) wire.
SECURITY SYSTEM

DESCRIPTION AND OPERATION

The security system is a start disable system only. It does not control the lights or the horn. When the security system is active, the ECM does not energize the start relay, the fuel injectors, or the ignition coils unless the correct Personal Identification Number (PIN) is entered in the IC. When the security system is active, the security indicator flashes once every few seconds.

SELECTING THE SECURITY SETTING

The security system can be set up in any one of the following configurations:

- **ON AT KEY OFF**: The security system automatically sets when the ignition switch is turned off. When the ignition is keyed on, the IC requests the PIN be entered before the motorcycle starts.
- **ASK AT KEY OFF**: When the ignition is turned off, the IC requests the PIN to enter the security mode. If the correct PIN is not entered within four minutes, the IC shuts down and the security does not activate. If the correct PIN is entered, then the IC shuts down, and the security system is active and requires a PIN for the motorcycle to start.
- **OFF AT KEY OFF**: The security system is disabled and does not activate. No PIN is needed to start the motorcycle.

To select the desired security setting, perform the following sequence:

1. Turn the ignition switch on.
2. Hold down the MODE and TOGGLE switches until SETUP MENU is displayed.
3. Press and release the MODE switch to scroll through the menu until THEFT SETTING is displayed.
4. Press the TOGGLE switch to access the mode list.
5. Press and release the TOGGLE switch to scroll through the mode list until the IC displays the correct security setting.
6. Press the MODE switch to select the displayed setting. The IC returns to the setup menu.
7. Press and release the MODE switch to continue through the setup menu until TOGGLE TO EXIT is displayed.
8. Press the TOGGLE switch.

ENTERING THE PIN

When activated, a PIN is required to disarm the security system. The PIN is entered using the TOGGLE switch on the IC.

1. Turn the ignition switch on.
2. The IC displays ENTER PIN with four dashes above it.
3. Press and release the TOGGLE switch until the correct number displays for the first digit. If the TOGGLE switch is not pressed for 2 seconds, the IC enters the number currently showing and moves to the next digit.
4. Once the IC moves to the next digit, repeat the above steps until all four digits are selected.
5. The IC either displays WRONG PIN or CORRECT PIN depending whether or not the PIN entered matches. Once the IC communicates the correct PIN was entered, the ECM allows the engine to start.

COMPONENTS

**ECM**

The ECM controls the start relay, fuel injectors, and ignition coils in order to disable starting the engine.

**Instrument Cluster**

The Instrument Cluster sends a message to the ECM when the correct PIN is entered, allowing the ECM to enable the start relay, fuel injectors, and ignition coils.

**Theft Mode LED**

See Figure 5-27. The theft mode LED is the red indicator under the key icon on the IC.

![Figure 5-27. Instrument Cluster](image)
NOTE
The same process starting with Step 2 is used to enter the PIN when the ignition is turned off and the security is set to ASK AT KEY OFF.

CHANGING THE PIN
The PIN is set to 0000 from the factory. Perform the following procedure to change the PIN:
1. With the ignition on and the security disarmed, press and hold the TOGGLE and MODE switches until the SETUP MENU is displayed.
2. Press and release the MODE switch until PIN SETTING displays.
3. Press and release the TOGGLE switch to select the setting.
4. Enter the current four-digit PIN. See 5.4 SECURITY SYSTEM, Entering the PIN for instructions. The IC displays either CORRECT PIN or WRONG PIN depending if the PIN was entered correctly. After the correct PIN is entered, the IC displays NEW PIN.
5. Enter the new PIN.
6. Enter the new PIN again to confirm. Both new PIN entries must match to continue.
7. The IC displays PIN CHANGED to confirm the two PIN entries matched and the PIN changed.
8. The SETUP MENU advances to the next item. Continue to press and release the MODE switch until TOGGLE TO EXIT is displayed. Press and release the TOGGLE switch.

ERROR MESSAGES
The IC displays error messages when it detects an issue with the security system.

LOCKED OUT: The LOCKED OUT message displays when 20 incorrect PINs are entered. This message displays for 30 minutes and the IC will not accept a PIN during that time.

THEFT ERROR: The THEFT ERROR message displays when the IC and the ECM Vehicle Identification Numbers (VINs) do not match or when the IC has lost communication with the ECM.

ECM AND INSTRUMENT CLUSTER (IC) MATCHING
The security system is designed to stay active in the event the ECM or the IC has to be replaced. The VIN, the PIN, the security status, and the total mileage are stored in the ECM and the IC. If either one of these components is replaced, it learns the information from the other.

When Replacing the ECM
When the ECM is replaced, the new ECM copies the VIN and the mileage from the existing IC. Once the VINs match, the ECM matches the IC PIN and security setting. This works with a used ECM as long as the ECM security is active. If the ECM security is active, it sees the IC as an invalid VIN and displays THEFT ERROR on the IC.

When Replacing the Instrument Cluster (IC)
The IC can only have a VIN written to it once. It cannot learn a new VIN if a VIN has already been written to it. Therefore, when replacing the IC, it must be a new IC.

NOTE
When the IC is replaced, there is a 30 minute timer that counts down before the information is written to the IC. This is done so the technician has time to test a new cluster to determine whether the fault is within the cluster or not before the cluster is matched to the ECM. Once the VIN is written to the IC, it cannot be cleared.

If the ECM is in a secure state and a new IC is installed, the ECM will not recognize it and the message THEFT ERROR displays on the IC. Whether or not the ECM is in a secure state, the IC begins to match to the ECM. A 30 minute counter displays instead of the clock on the IC. It counts down and when the 30 minutes are up the VIN is permanently written to the IC. This 30 minute delay is so the new IC can be tested to verify a repair and removed if it did not resolve the issue. If the ignition is turned off, the timer stops but stays where it is and continues to count down when the ignition is turned back on. In order to reset the timer back to 30 minutes, disconnect the battery power completely from the IC.

DTC P1009 Security System Fault or THEFT ERROR Message
The ECM sets a P1009 and THEFT ERROR displays on the IC when the security data shared between the IC and the ECM does not match, or if there is a loss of communication between the IC and the ECM. If there is a loss of communication while the engine is running, COMM ERROR displays until the ignition is turned off. When the ignition is turned back on THEFT ERROR instead of COMM ERROR displays on the IC.

Vehicle Tampering
If modifications have been made to the vehicle to bypass the security system, the vehicle becomes immobilized (unable to start) and the LCD screen displays a THEFT ERROR message when the ignition key is turned to ON. The indicator and warning lamps operate, but the LCD screen functions cannot be accessed.

NOTE
The PIN and theft mode settings are retained in memory when the battery is disconnected from the vehicle.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

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<th>COMMON CAUSE</th>
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<td>Loss of communication on CAN BUS or a mismatched VIN</td>
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THEFT ERROR or DTC P1009 (Part 1 of 2)

Verify DTC P1009 is present. Is DTC current?

YES

It is possible the VIN is mismatched. Was the instrument cluster replaced?

YES

Install the old instrument cluster. Enter the SETUP MENU and select OFF AT KEY OFF. Replace the instrument cluster.

NO

Is DTC U0001 present?

YES

Was the ECM replaced?

YES

See 2.2 SERIAL DATA COMMUNICATION.

NO

NO

Replace and program the ECM.

YES

Was the ECM replaced with a used ECM?

YES

Used ECM security setting is active. Replace with new ECM.

NO

Replace the instrument cluster.

NO
THEFT ERROR or DTC P1009 (Part 2 of 2)

Continued from THEFT ERROR or DTC P1009 (Page 1 of 2).

Disconnect the terminating resistor from connector [243]. Turn the ignition on. Is the THEFT ERROR or COMM ERROR message cleared from the ECM?

NO

Turn the ignition off. Disconnect the ECM connector [11]. Measure the resistance from terminal 1 to terminal 2 of the CAN connector [243B]. Is the resistance less than 100 Ohms?

NO

Replace the terminating resistor.

YES

Disconnect IC connector [36]. Test for continuity between terminals 1 and 2 of connector [243B]. Is continuity present?

NO

Is the resistance greater than 150 Ohms?

NO

Disconnect IC connector [36]. Test the (PK/GY) wire for continuity between terminal 1 of connector [243B] and terminal 9 of connector [36B]. Is continuity present?

YES

Test for continuity in the (PK/GY) wire between terminal 2 of connector [243B] and terminal 10 of connector [36B]. Is continuity present?

NO

Locate and repair open in (PK/GY) wire.

YES

Locate and repair short to ground in (PK/Y) or (PK/GY) wire.

NO

Locate and repair short to voltage in (PK/Y) or (PK/GY) wire.

YES

Replace the instrument cluster.

NO

Locate and repair short to voltage present.

NO

Test terminal 1 and terminal 2 of connector [243B] for a short to ground. Is a short to ground present?

YES

Disconnect IC connector [36]. Test terminals 1 and 2 of connector [243B] for a short to ground. Is a short to ground present?

NO

Replace and program the ECM.
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DDFI-3 OVERVIEW

This chapter describes the operation of the 1125cc engine when coupled with the Buell Dynamic Digital Fuel Injection (DDFI-3) System. It is essential to have a working knowledge of the many components surrounding the engine to accurately troubleshoot and correct problems that may occur. 6.2 ELECTRONIC CONTROL MODULE and 6.3 SENSORS AND DRIVERS briefly explains the operation of the ECM and function of the various sensors and drivers. See 1.2 DIAGNOSTIC TOOLS for instructions on using the test equipment called out in the flowcharts and test procedures in this chapter.

The Buell DDFI-3 System provides microprocessor-based electronic engine management for the 1125cc high performance engine. The DDFI-3 system has the following features:

- Independently mapped spark and fuel control
- Compensated fuel delivery through coolant temperature, intake air temperature, barometric, and manifold air pressure.
- Engine load measurement via throttle position sensing
- Single point spark delivery
- Separate ignition coils for each cylinder
- Sequential port indirect (manifold) fuel injection
- Open/closed loop air/fuel control
- Automatic enrichment at start-up
- Two electric cooling fans for improved thermal management
- Engine speed and position determined by using a single CKP sensor
- Engine idle speed electronically managed with an IAC system
- Returnless fuel system

The DDFI-3 System performance is monitored by an ECM using sensors and switches to regulate engine operation. The ECM makes decisions for enabling ignition, starting, spark, and fuel delivery. Sensors include:

- Crank Position (CKP)
- Throttle Position (TP)
- Sidestand (HDI only)
- Bank Angle Sensor (BAS)
- Clutch switch
- Neutral switch
- Fuel Pressure Sensor (FPS)
- Engine Coolant Temperature (ECT)
- Intake Air Temperature (IAT)
- Barometric Pressure (BARO)
- Vehicle Speed Sensor (VSS)
- Oxygen (O2)
- Manifold Absolute Pressure (MAP)

DDFI-3 OPERATION

The Buell DDFI-3 operates as an open or closed loop system, allowing it to adjust for all possible operating conditions. During open loop operation, the system uses programmed fuel and spark maps in the ECM providing easy cold starting and maximum power at Wide Open Throttle (WOT). The adaptive fuel value, learned during closed loop operation, is applied to open loop operation to adjust fuel and spark maps for optimal performance.

During closed loop operation, the O2 sensors provide input for an optimal air/fuel mixture resulting in reduced emissions, good fuel economy, and smooth power. In order for the system to enter closed loop operation, certain conditions must be met:

- O2 sensors must be at the normal operating temperature of the engine.
- Operating below 4200 RPM with engine under steady or light load conditions.

By using both open and closed loop systems, engine performance is continuously tuned to compensate for changing conditions and providing maximum performance. A simplified signal flow diagram for the DDFI-3 system is shown in Figure 6-1.

For operational explanations of sensors and drivers, see 6.6 STARTING SENSORS AND DRIVERS.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
ELECTRONIC CONTROL MODULE

See Figure 6-2. The ECM receives and processes signals from the sensors and applies output signals to the drivers to crank, start, idle, and run the engine. This topic describes the configuration of the ECM for this vehicle.

Figure 6-2. ECM

36-2 Alternator Rotor

The alternator rotor has 36 teeth evenly spaced around its circumference with two consecutive teeth missing (sync gap). In this configuration, the ECM determines engine position, engine phase, and engine speed from the CKP sensor input. Phase (TDC compression) is determined by the ECM during startup and, when necessary, while running.

No engine ignition events can occur until the ECM determines the relationship of piston position to crankshaft position. The following paragraphs in this section describe synchronization and phasing by the ECM to provide smooth operation of the engine at all speeds.

Crank Position Signal Synchronization

In the 36-2 crank configuration, crankshaft position is determined by the ECM finding the two-tooth (sync gap) in the CKP sensor signal. This is usually accomplished the first time the sync gap is encountered.

The ECM monitors the CKP signal status every engine revolution. If the ECM determines synchronization is lost, it immediately terminates ignition events and synchronizes on the next occurrence of the sync gap.

Engine Phase

Phasing is accomplished by the ECM identifying a widening in the CKP signal caused by the deceleration of the crankshaft, as a piston approaches TDC on its compression stroke. Since the rear cylinder approaches TDC earlier than the front cylinder, engine phase can be readily discriminated.

Phasing is normally accomplished on the first TDC cycle after engine synchronization. Once phased, the ECM can begin normal ignition events.

If the ECM experiences a system reset or loss of synchronization while the engine is running it also loses phase. When phase is lost one of the following occurs.

1. If an engine-not-running (Crank Mode) RPM is detected, the ECM executes the normal start-up phasing process.

2. If Engine Run Mode is detected, the ECM executes a running re-phase sequence. The front cylinder is fired every engine revolution. The ECM monitors the power stroke after the fire event to determine if sufficient acceleration occurred to indicate the ECM fired on the compression stroke. When two valid power strokes are detected, the ECM locks phase and resumes normal ignition events.

Engine Run Mode

Many functions of the DDFI-3 system require an engine run-mode determination. Engine run is determined by the level of engine RPM. Generally, the engine is considered to be running when engine RPM exceeds a minimum of 450 RPM.
DESCRIPTION AND OPERATION

Sensors and drivers play an important part in the ECM's ability to provide the proper operational parameters for engine efficiency, emissions control, and fuel economy. When a failure occurs, a DTC is generated by, and stored in, the ECM. These codes help the technician diagnose engine trouble to the proper sensor or driver. See 2.1 INITIAL DIAGNOSTICS.

SENSORS

Not all sensor problems cause an engine shutdown, but sensor failure can seriously degrade overall engine performance. A notable exception is the CKP sensor, which, if faulty, completely disables engine operation. The following are brief explanations of sensor types and their functions within the DDFI-3 system.

Crank Position (CKP) Sensor

The CKP sensor is a variable reluctance device that generates AC voltage as the teeth on the alternator rotor pass by the sensor. The signal is routed to the ECM where it is used to determine crankshaft position, engine speed (RPM), and engine phase (TDC compression).

Without the presence of the CKP signal, the ECM will not allow the ignition and fuel injection drivers to operate, and thus the engine will not run. The ECM uses crankshaft compression slow down events to determine engine phase. Therefore, the spark plugs must be installed when checking for spark.

Throttle Position (TP) Sensor

The TP sensor is a variable resistor (potentiometer) having a linear resistance range, mounted on the throttle plate shaft. The 1125 uses one sensor, mounted on the left side of the forward cylinder throttle body. The output of the sensor is a voltage, dependent on the position of the throttle plate, and used by the ECM to determine ignition timing and fuel required at any given RPM and engine load. The output of the TP sensor is read by the ECM every 10mS.

In order to function properly, the TP sensor must be mechanically zeroed. This procedure verifies the throttle plates are in their fully closed position, while simultaneously requesting the software to record the electrical value at that position. See the service manual. If the sensor fails, the throttle body must be replaced.

Sidestand Sensor (HDI Only)

The sidestand sensor uses a Hall-effect device to monitor sidestand position. When the sidestand is fully retracted, the sensor picks up the presence of a metal bolt fastened to the aluminum sidestand. When extended, the engine only starts and runs if the ECM receives a signal from the neutral switch indicating the transmission is in neutral, or a signal from the clutch switch indicating the clutch is engaged. Otherwise, the engine stalls as the clutch is released with the transmission in gear.

Bank Angle Sensor (BAS)

The BAS operates from the ECM 5 Volt sensor reference, and is grounded through the ECM on a common sensor ground circuit. The BAS sends a signal to the ECM ranging from 0.24-3.4V under normal operating conditions. A signal between 3.5-4.79V causes the ECM to turn off the engine. When the vehicle is righted, the ignition must be switched off, and then on, in order to restart the engine.

If the signal from the BAS is below 0.24V or above 4.79V, the ECM sets a code. DTC P1151 is set when the BAS output is shorted low to ground); and P1152 is set when the BAS output is shorted high (to voltage). An open circuit output acts like a shorted high, and set DTC P1152. If a code occurs, the engine continues to run.

A tipped vehicle will not set a DTC.

Clutch Switch

The ECM provides 5 Volts to the clutch switch, which is open when the clutch is disengaged (released). With the clutch engaged (pulled in), the switch closes, allowing voltage to ground. The ECM will not allow the engine to start unless the transmission is in neutral or the clutch is engaged.

Neutral Switch

The ECM provides 5 Volts to the neutral switch, which is open when the transmission is in gear. With the transmission in neutral, the switch is closed, allowing voltage to ground. The ECM will not allow the engine to start unless the transmission is in neutral or the clutch is engaged.

Fuel Pressure Sensor

The duty cycle of the fuel pump is controlled by the ECM which supplies a pulse-width modulated ground to the fuel pump. Voltage for the fuel pump is supplied from the fuel pump fuse through the key switch relay. The ECM can command a fuel pressure range from 58-75 psi (400-517 kPA), depending upon demands of the engine. The ECM provides 5 Volts to the sensor which varies the signal voltage back to the ECM based on fuel rail pressure (low pressure = low voltage signal). Vehicle speed, engine speed, coolant temperature, and atmospheric variables all contribute to determining the desired fuel pressure.

The ECM incorporates automatic compensation for differences of the desired pressure versus the actual pressure. For instance, if the pressure is lower than desired, the ECM opens the injectors for a longer time to adjust the amount of fuel delivered.

Engine Coolant Temperature (ECT) Sensor

The ECT sensor is a thermistor device, which means that at a specific temperature it has a specific resistance across its terminals. As this resistance varies, so does the voltage.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on ECM [11] terminal 9.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 Volts. The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining Idle Air Control (IAC) pintle position.

At 230°F (110°C) the ECM commands the instrument cluster to illuminate the over-temperature lamp.

At the same time, the ECM begins to soft skip spark (1 of 4 removed) and then hard skip spark (1 of 2 removed) when the
engine is above a certain RPM and throttle threshold. Spark skips will not occur at idle and lower operating conditions in order to prevent engine stalls.

**Intake Air Temperature (IAT) Sensor**

The IAT sensor is a thermistor device. As such, it will have a specific resistance across its terminals at a specific temperature. As the temperature varies, the thermistor resistance varies, and so does the voltage on ECM [11] terminal 14.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on ECM [11] terminal 14.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 Volts. The ECM monitors this voltage to compensate for various operating conditions.

**Barometric Pressure (BARO) Sensor**

The BARO sensor is supplied 5 Volts from the ECM and sends a signal back to the ECM, which varies according to atmospheric barometric pressure. The BARO sensor is a constantly running direct fuel modifier. It sends continuous information to the ECM, where the signal is processed and the injectors adjusted for variations in ambient barometric pressure. Changes in barometric pressure are influenced by weather and altitude. Air density is a combination of barometric pressure and air temperature. When air is more dense (lower altitudes and lower temperatures), more fuel is needed to maintain the proper air/fuel ratio for efficient engine operation. Intake air temperature combined with barometric pressure is used by the ECM to compensate for these variations.

**Vehicle Speed Sensor (VSS)**

The VSS is a Hall-effect device mounted close to the teeth of the trigger wheel. The output signal frequency varies with vehicle speed. Output voltage from the sensor is 5V per increment of distance traveled. The ECM processes the vehicle speed signal and transmits it via the CAN bus to the instrument cluster to indicate vehicle speed.

**O2 Sensor (Front and Rear)**

The O2 sensor detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0.1-1.0 Volt. The normal output is 0.5 Volts which represents a balance between a lean (not enough fuel) and rich (too much fuel) air/fuel mixture. An output less than 0.5 Volts represents a lean mixture; greater than 0.5 Volts represents a rich mixture. The change in output level signals the ECM to modify the air/fuel ratio.

It is important to note the O2 sensor does not operate efficiently until it is at vehicle operating temperature. Therefore, before any troubleshooting takes place, bring the sensor to operating temperature. Leaks in the exhaust system, leaky exhaust valves, misfires, or any engine problem allowing unburned oxygen into the exhaust stream could create a DTC indicating a bad sensor. Look for problems related to an improper air/fuel mixture before replacing the sensor.

**Manifold Absolute Pressure (MAP) Sensor**

The MAP sensor is supplied 5 Volts from the ECM and sends a signal back to ECM. This signal varies in accordance with engine vacuum and atmospheric barometric pressure. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ECM. The ECM then adjusts the spark and fuel timing advance curves for optimum performance. The output of the sensor can also be used to determine if the engine is rotating when a fault with CKP sensor is present.

**DRIVERS**

Drivers (ECM output devices or system outputs) are the workhorses of the DDFI-3 system. Drivers are provided ground by the ECM to pump, inject, and ignite the air/fuel mixture in the engine, and to activate relays.

**Fuel Pump**

The fuel pump, located on the bottom right side of the fuel tank/frame, is provided battery voltage when the RUN/STOP and IGNITION switches are on. The pump is controlled on the ground side by the ECM which is monitoring the fuel pressure sensor. Output pressure from the pump varies from 58-75 psi (400-517 kPa) in response to engine demand.

**Ignition Coils and Spark Plugs**

The ignition coils, also referred to in the parts list as stick coils, create the energy to fire the spark plugs and ignite the air/fuel mixture in the cylinders. Advancing or retarding the spark is controlled by the ECM to suit load and speed conditions of the engine.

Each cylinder has its own ignition coil which is provided power by the ignition relay. Each coil is controlled independently by the ECM. In the event of the engine or coolant overheating, the ECM can soft skip spark (1 of 4 removed) or hard skip spark (1 of 2 removed) when the engine is above a certain RPM and throttle threshold.

**Fuel Injectors**

The ignition relay provides battery power to the fuel injectors. The ECM provides the path to ground to trigger the injectors. The fuel injectors are pulse-width modulated solenoids for metering fuel into the intake tract. The pulse-width of the ground path to the injectors is varied by the ECM in response to inputs from the various sensors, thus varying the length of time the injector is open. If the ECM senses the fuel pressure is less than required for the engine cycle, it increases or decreases the injector open time to maintain the proper air/fuel mixture.

In the event of the engine or coolant overheating, the ECM can skip an injector (hold it closed) when in the skip spark mode. Both injectors are required for proper operation. The ECM monitors the ground signal to provide a diagnostic indication of a failed injector or injector circuit.

**Idle Air Control (IAC)**

The idle air control motor is a stepper-motor used to regulate the amount of air entering the intake manifold during idle. The ECM controls engine idle speed by moving the Idle Air Control (IAC) pintle to open or close a passage around the throttle plate. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.
Cooling Fans
The cooling fans run continuously once the engine operating temperature is reached. The cooling fans are provided battery voltage from the (Y/BN) wire. The ECM controls the fan by providing ground.

Start Relay
When the starter switch is pushed, the start relay is activated and battery voltage is sent to the starter solenoid, and power is interrupted on the light circuit. The ECM controls the ground to the relay, which it disables during security and tip over conditions.

Active Intake
The active intake system uses a solenoid under the airbox which is connected to the throttle valve via a cable. The throttle valve is automatically closed by the solenoid under certain operating conditions to reduce engine noise. The active intake solenoid is provided battery voltage by the ignition relay. The ECM provides ground to activate the solenoid.
These symptoms do not generate DTCs but are an indication of system problems. Correcting the DTCs may eliminate the need to perform the tests above.

To locate faulty circuits or other system problems, follow the diagnostic flowcharts in this section. Always begin with 2.1 INITIAL DIAGNOSTICS. Refer to the information there and then work through the applicable flowchart box by box.

When working through a flowchart, refer to the illustrations, associated circuit diagram, and the wire harness connector table in B.1 CONNECTORS as necessary. The wire harness connector table identifies the connector number, description, type, and general location.

To perform the circuit checks efficiently, it is necessary to be familiar with the wire connectors. Use the BREAKOUT BOX (Part No. B-48115) and a DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) when performing diagnostic routines. See 1.2 DIAGNOSTIC TOOLS.

### Table 6-1. Engine Starts Hard

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine coolant temperature circuit</td>
<td>Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>Perform fuel pressure test. If DTCs P0192, P0193, or P0087 are present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Fuel or Ignition system fault</td>
<td>Perform misfire diagnostics.</td>
</tr>
<tr>
<td>Battery discharged</td>
<td>Charge and test the battery. Perform charging system diagnosis if problem continues.</td>
</tr>
<tr>
<td>Crank position sensor circuit</td>
<td>Repair the circuit. If DTC P0339 is present, diagnose and correct DTC.</td>
</tr>
<tr>
<td>Manifold leak</td>
<td>Perform intake leak test.</td>
</tr>
<tr>
<td>Ignition coil circuit</td>
<td>Repair the circuit. If DTCs P2300, P2301, P2303, or P2304 are present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Leaky injectors</td>
<td>Check for mechanical failures of the fuel injectors. If DTC P0117 or P0118 is present, diagnose and correct them.</td>
</tr>
<tr>
<td>Valve sticking</td>
<td>Perform compression test.</td>
</tr>
</tbody>
</table>

### Table 6-2. Engine Performance Problems

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine coolant temperature circuit</td>
<td>Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Crank position sensor circuit</td>
<td>Repair the circuit. If DTC P0339 is present, diagnose and correct DTC.</td>
</tr>
<tr>
<td>Fuel or Ignition system fault</td>
<td>Perform misfire diagnostics.</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>Perform fuel pressure test. If DTCs P0192, P0193, or P0087 are present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Manifold Leak</td>
<td>Perform intake leak test.</td>
</tr>
<tr>
<td>Note: If manifold leak is large enough, the IAC closes and DTC P0506 sets.</td>
<td></td>
</tr>
<tr>
<td>Throttle plates not opening fully</td>
<td>Perform Throttle Cable Adjustment. See the service manual.</td>
</tr>
</tbody>
</table>
### Table 6-2. Engine Performance Problems

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVAP hose disconnected from induction module (California models only)</td>
<td>Connect</td>
</tr>
<tr>
<td>Fuel system contaminated</td>
<td>Drain and refill with fresh fuel.</td>
</tr>
<tr>
<td>Cooling fan(s) inoperative</td>
<td>Repair the circuit. If DTC P0691, P0692, P0693, or P0694 are present, diagnose and correct DTCs.</td>
</tr>
</tbody>
</table>

### Table 6-3. Engine Emits Black Exhaust or Fouls Plugs

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine coolant temperature circuit</td>
<td>Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>Repair the circuit. If DTC P0192, P0193, or P0087 are present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Clogged air filter</td>
<td>Repair the circuit. If DTC P0112 or P0113 is present, diagnose and correct DTCs.</td>
</tr>
<tr>
<td>Leaky injectors</td>
<td>Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs.</td>
</tr>
</tbody>
</table>

### Table 6-4. Diagnostic Trouble Codes (DTC) Priority Table

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0087</td>
<td>29</td>
<td>Fuel Rail/System Pressure Too Low</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0107</td>
<td>63</td>
<td>Map Sensor Low/Open</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
<tr>
<td>P0108</td>
<td>62</td>
<td>Map Sensor High</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
<tr>
<td>P0112</td>
<td>22</td>
<td>Intake Air Temperature Sensor Voltage Low</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td>P0113</td>
<td>21</td>
<td>Intake Air Temperature Sensor High/Open</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td>P0117</td>
<td>20</td>
<td>Engine Coolant Temperature Sensor Circuit Low</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td>P0118</td>
<td>19</td>
<td>Engine Coolant Temperature Sensor Circuit High</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td>P0122</td>
<td>11</td>
<td>Throttle Position Sensor Circuit Low</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td>P0123</td>
<td>10</td>
<td>Throttle Position Sensor Circuit High</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td>P0131</td>
<td>50</td>
<td>Front Oxygen Sensor Circuit Low/Engine Lean</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0132</td>
<td>46</td>
<td>Front Oxygen Sensor Circuit High/Engine Rich</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0134</td>
<td>48</td>
<td>Front Oxygen Sensor Open/Inactive</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>DTC</td>
<td>PRIORITY ORDER</td>
<td>FAULT CONDITION</td>
<td>DIAGNOSTIC PROCEDURE</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>P0151</td>
<td>51</td>
<td>Rear Oxygen Sensor Circuit Low/Engine Lean</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0152</td>
<td>47</td>
<td>Rear Oxygen Sensor Circuit High/Engine Rich</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0154</td>
<td>49</td>
<td>Rear Oxygen Sensor Open/Inactive</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0192</td>
<td>26</td>
<td>Fuel Pressure Sensor Circuit Low</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0193</td>
<td>25</td>
<td>Fuel Pressure Sensor Circuit High</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0261</td>
<td>35</td>
<td>Front Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0262</td>
<td>34</td>
<td>Front Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0264</td>
<td>37</td>
<td>Rear Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0265</td>
<td>36</td>
<td>Rear Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0337</td>
<td>7</td>
<td>Crank Position Sensor Circuit Low</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0338</td>
<td>8</td>
<td>Crank Position Sensor Circuit High</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0339</td>
<td>9</td>
<td>Crank Position Sensor Circuit Intermittent</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0502</td>
<td>40</td>
<td>Vehicle Speed Sensor Circuit Low</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td>P0503</td>
<td>41</td>
<td>Vehicle Speed Sensor Intermittent/Erratic High</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td>P0506</td>
<td>54</td>
<td>Idle Air Control System RPM Higher Than Expected</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0507</td>
<td>55</td>
<td>Idle Air Control System RPM Lower Than Expected</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0511</td>
<td>53</td>
<td>Idle Air Control Circuit Fault</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0562</td>
<td>39</td>
<td>Battery Voltage Low</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0563</td>
<td>38</td>
<td>Battery Voltage High</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0603</td>
<td>3</td>
<td>ECM EEPROM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0604</td>
<td>1</td>
<td>ECM RAM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0605</td>
<td>2</td>
<td>ECM ROM Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0607</td>
<td>4</td>
<td>ECM Microprocessor Failure</td>
<td>6.5 ECM ERRORS: DTC P0603, P0604, P0605, P0607</td>
</tr>
<tr>
<td>P0616</td>
<td>61</td>
<td>Starter Relay Circuit Low</td>
<td>6.14 START RELAY: DTC P0617</td>
</tr>
<tr>
<td>P0617</td>
<td>60</td>
<td>Starter Relay Circuit High</td>
<td>6.14 START RELAY: DTC P0617</td>
</tr>
<tr>
<td>P0628</td>
<td>28</td>
<td>Fuel Pump Circuit Low</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0629</td>
<td>27</td>
<td>Fuel Pump Circuit High</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0691</td>
<td>58</td>
<td>Right Fan Control Circuit Low</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>DTC</td>
<td>PRIORITY ORDER</td>
<td>FAULT CONDITION</td>
<td>DIAGNOSTIC PROCEDURE</td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
<td>-----------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>P0692</td>
<td>56</td>
<td>Right Fan Control Circuit</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>0693</td>
<td>59</td>
<td>Left Fan Control Circuit</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>0694</td>
<td>57</td>
<td>Left Fan Control Circuit</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P1047</td>
<td>52</td>
<td>Feedback Fuel Cylinder Difference too Great</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P1110</td>
<td>66</td>
<td>Active Intake Control Circuit Short Low/Open</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1111</td>
<td>65</td>
<td>Active Intake Control Circuit Short High</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1112</td>
<td>64</td>
<td>Active Intake Control Throttle Position Sensor Feedback Failure</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1151</td>
<td>16</td>
<td>Bank Angle Sensor Shorted Low</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1152</td>
<td>15</td>
<td>Bank Angle Sensor Shorted High</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1154</td>
<td>17</td>
<td>Clutch Position Sensor Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1155</td>
<td>18</td>
<td>Neutral Switch Input Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1501</td>
<td>13</td>
<td>Sidestand Sensor Low</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1502</td>
<td>12</td>
<td>Sidestand Sensor High/Open</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1503</td>
<td>14</td>
<td>Sidestand Down at Vehicle Speed</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1601</td>
<td>67</td>
<td>Auxiliary Relay Driver Circuit Fault</td>
<td>5.1 ACCESSORIES</td>
</tr>
<tr>
<td>P2228</td>
<td>24</td>
<td>BARO Pressure Sensor Circuit Low</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2229</td>
<td>23</td>
<td>BARO Pressure Sensor Circuit High</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2300</td>
<td>31</td>
<td>Front Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2301</td>
<td>30</td>
<td>Front Ignition Coil Control Circuit High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2303</td>
<td>33</td>
<td>Rear Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2304</td>
<td>32</td>
<td>Rear Ignition Coil Control Circuit High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
</tbody>
</table>
DESCRIPTION AND OPERATION

The ignition switch supplies power to the ECM. If the ECM does not appear to receive power, check the ground sources. An open ECM fuse can also disable the ECM. When the ignition relay is energized by the run switch, power is applied to the DLC [91A] at terminal 4 (GY) wire.

The flowchart in this section is concerned with an ECM that is either not receiving power or is not operational. For all DTCs listed in Table 6-5, replace the ECM.

Table 6-5. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0603</td>
<td>ECM EEPROM failure</td>
<td>Replace ECM</td>
</tr>
<tr>
<td>P0604</td>
<td>ECM RAM failure</td>
<td>Replace ECM</td>
</tr>
<tr>
<td>P0605</td>
<td>ECM ROM failure</td>
<td>Replace ECM</td>
</tr>
<tr>
<td>P0607</td>
<td>ECM microprocessor failure</td>
<td>Replace ECM</td>
</tr>
</tbody>
</table>

CONNECTOR INFORMATION

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

---

Figure 6-3. ECM Power Circuit
Attach Breakout Box (B-68115) to the ECM. Place ignition switch ON. Check for battery voltage between Breakout Box [10] terminals 8 (Black) and 9 (Black). Is voltage present?

---

YES

Check for battery voltage between Breakout Box [10] terminals 8 (Black) and 17 (Black). Is battery voltage present?

---

YES

Replace ECM

NO

Disconnect interface connector [145] and check for battery voltage on [145B] terminal 6 (Y). Is battery voltage present?

---

YES


NO

Locate and repair open between interface connector [145B] and ECM fuse.

---

NO

Disconnect interface connector [145] and check for battery voltage on [145B] terminal 19 (R/G/Y). Is battery voltage present?

---

YES

Locate and repair open between ECM [10] and terminal 19 of 145A.

NO

Check for continuity from terminal 2 of 33B (R/G/Y) and terminal 19 of 145A. Is continuity present?

---

YES

Replace ignition switch.

NO

Locate and repair open.
DESCRIPTION AND OPERATION

Primary sensors and drivers are the devices that manage engine start-up. If these devices are not in proper operating condition, the engine may not start, may start then stall, or misfire.

Refer to Table 6-6 for devices in this category (listed in DTC ranking order).

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0112</td>
<td>22</td>
<td>Intake Air Temperature Sensor Voltage Low</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td>P0122</td>
<td>11</td>
<td>Throttle Position Sensor Circuit Low</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td>P0123</td>
<td>10</td>
<td>Throttle Position Sensor Circuit High</td>
<td>6.8 THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112</td>
</tr>
<tr>
<td>P0261</td>
<td>35</td>
<td>Front Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0262</td>
<td>34</td>
<td>Front Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0264</td>
<td>37</td>
<td>Rear Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0265</td>
<td>36</td>
<td>Rear Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0337</td>
<td>7</td>
<td>Crank Position Sensor Circuit Low</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0338</td>
<td>8</td>
<td>Crank Position Sensor Circuit High</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0339</td>
<td>9</td>
<td>Crank Position Sensor Circuit Intermittent</td>
<td>6.7 CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339</td>
</tr>
<tr>
<td>P0617</td>
<td>60</td>
<td>Starter Relay Circuit High</td>
<td>6.14 START RELAY: DTC P0617</td>
</tr>
<tr>
<td>P1151</td>
<td>16</td>
<td>Bank Angle Sensor Shorted Low</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1152</td>
<td>15</td>
<td>Bank Angle Sensor Shorted High</td>
<td>6.10 BANK ANGLE SENSOR (BAS): DTC P1151, P1152</td>
</tr>
<tr>
<td>P1154</td>
<td>17</td>
<td>Clutch Position Sensor Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1155</td>
<td>18</td>
<td>Neutral Switch Input Circuit Low</td>
<td>6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1155</td>
</tr>
<tr>
<td>P1501</td>
<td>13</td>
<td>Sidestand Sensor Low</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1502</td>
<td>12</td>
<td>Sidestand Sensor High/Open</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P1503</td>
<td>14</td>
<td>Sidestand Down at Vehicle Speed</td>
<td>6.9 SIDESTAND SENSOR: DTC P1501, P1502, P1503 (HDI ONLY)</td>
</tr>
<tr>
<td>P2300</td>
<td>31</td>
<td>Front Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2303</td>
<td>33</td>
<td>Rear Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2304</td>
<td>32</td>
<td>Rear Ignition Coil Control Circuit High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
</tbody>
</table>
Figure 6-4. Primary Input Sensors and Drivers
CRANK POSITION (CKP) SENSOR: DTC P0337, P0338, P0339

DESCRIPTION AND OPERATION
See Figure 6-5. The CKP sensor is located on the left side engine cover, below the base of the rear cylinder. The ECM monitors the CKP signal (AC voltage) on terminals 18+ (R/BE) and 26- (BK/BE) of connector [11]. If the CKP signal is not detected or cannot synchronize, the engine will not start and DTC P0339 sets.

NOTE
The engine must be cranked for more than five seconds without CKP signal to set codes.

Table 6-7. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0337</td>
<td>Crank position sensor circuit low</td>
</tr>
<tr>
<td>P0338</td>
<td>Crank position sensor circuit high</td>
</tr>
<tr>
<td>P0339</td>
<td>Crank position sensor circuit intermittent</td>
</tr>
</tbody>
</table>

Figure 6-5. CKP Sensor Location (Shroud removed for clarity.)

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-6. CKP, ECT, IAT, O2 sensors, and Cooling Fans
THROTTLE POSITION (TP) SENSOR: DTC P0122, P0123, P1112

DESCRIPTION AND OPERATION

See Figure 6-7. The TP sensor is located on the left side of the forward throttle body. The TP sensor operates from a 5V reference voltage from the ECM and returns a signal to the ECM on the (VY) wire. The output signal from the TP sensor varies from:
- Approximately 0.3-1.0 Volts at idle (closed throttle).
- Approximately 3.5-4.5 Volts at WOT.

A DTC sets if the TP sensor output falls outside the acceptable range. See Figure 6-7 for electrical connection.

NOTE
If the ECM or throttle body is replaced, the zero-set procedure must be performed.

Table 6-8. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0122</td>
<td>Throttle position sensor circuit low</td>
</tr>
<tr>
<td>P0123</td>
<td>Throttle position sensor circuit high</td>
</tr>
<tr>
<td>P1112</td>
<td>Active intake control throttle position sensor feedback failure</td>
</tr>
</tbody>
</table>

Diagnostic Tips
An intermittent may be caused by any of the following conditions:
- **Poor Connection**: Inspect the ECM harness connector for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- **TP Sensor Scaling**: Observe the TP sensor voltage display while operating the throttle with engine stopped and ignition switch on. The TP sensor voltage displayed should vary from less than 1 Volt (closed throttle) to greater than 3.5 Volts (WOT). As the throttle is slowly moved, the voltage change should be smooth without any observed spikes or drops in voltage.

Figure 6-7. Throttle Position (TP) Sensor Location

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-8. 5V Reference Circuit
**DTCs P0122 and P0123 (Part 1 of 2)**

Attach the ECM to Breakout Box (B-48115). Plug the DVOM (Part No. HD-30978) into terminal 4 (+) and terminal 27 (-) of Breakout Box connector (11) (Gray). With ignition switch ON, gradually open the throttle while observing voltage.

- **Does the voltage steadily increase with no voltage spikes or drops observed from 0.3-1.0 volt at idle (closed throttle) to 3.5-4.5 volts at wide open throttle?**

  - **YES**
  - **Is the check engine lamp continuously ON and either DTC P0122 or P0123 set?**
    - **YES**
      - **Replace ECM.**
      - **Check for intermittents. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING. Are intermittents present?**
        - **YES**
          - **Locate and repair open or poor connection.**
        - **NO**
          - **Replace throttle body. Clear codes and road test. Did check engine lamp come on and set DTC P0122 or P0123?**
            - **YES**
              - **Install original throttle body and replace ECM. Read test again to verify.**
            - **NO**
              - **System operating correctly.**
    - **NO**
      - **Disconnect TP sensor connector [88] and ECM connector [11] (Gray). Measure voltage at [11B] terminals 4 and 24 to ground. Does voltage measure greater than 5 volts on either wire?**
        - **YES**
          - **Go to DTCs P0122 and P0123 (Part 2 of 2).**
        - **NO**
          - **Locate and repair short to voltage on wire showing voltage.**
      - **Does voltage measure greater than 4.5 volts?**
        - **YES**
          - **Discontinue TP sensor connector [88] and ECM connector [11] (Gray). Measure voltage at [11B] terminals 4 and 24 to ground. Does voltage measure greater than 5 volts on either wire?**
            - **YES**
              - **Go to DTCs P0122 and P0123 (Part 2 of 2).**
            - **NO**
              - **Test for continuity between terminals 4 and 24 of [11B]. Is continuity present?**
                - **YES**
                  - **Replace the ECM.**
                - **NO**
                  - **Locate and repair wire showing voltage.**
DTCs P0122 and P0123 (Part 2 of 2)

Continued from DTCs P0122 and P0123 (Part 1 of 2).
Disconnect TP sensor connector [88]. Measure voltage between terminal 3 (R/W) wire (+) and terminal 1 (BK/W) wire (-) with ignition switch ON. Does voltage measure 5.0 Volts +/- 0.25 Volts?

YES

Check resistance between ECM connector [11] (Gray) terminal 4 to chassis ground. Is resistance greater than 1.0 megohm?

NO


YES


NO

NO

NO

NO

YES

Replace throttle body.

NO

Locate and repair short to ground on (V/Y) wire.

YES

Locate and repair short in (R/W) wire.

NO

Locate and repair open in (BK/W) wire.

YES

Replace ECM.

NO

Locate and repair short between (R/W) and (BK/W) wires.
DESCRIPTION AND OPERATION

See Figure 6-9. The sidestand sensor uses a Hall-effect sensor to monitor sidestand position. When the sidestand is fully retracted, the sensor picks up the presence of the metal bolt fastened to the aluminum sidestand. When the sidestand is extended, the engine starts and runs only if the ECM receives a signal from the neutral switch indicating the transmission is in neutral, or a signal from the clutch switch indicating that the clutch is engaged. Otherwise, the engine stalls as the clutch is released with the transmission in gear.

The ECM provides 5 Volt power and ground to the sidestand sensor. A signal is sent on the (TN/W) wire to the ECM based on the sidestand position. This signal allows the ECM to determine whether the sidestand is retracted or extended.

The sidestand circuit also provides a fail enable mode. This mode allows the engine to start and run if the system recognizes a problem with the sidestand sensor circuit.

Table 6-9. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1501</td>
<td>Sidestand sensor low</td>
</tr>
<tr>
<td>P1502</td>
<td>Sidestand sensor high</td>
</tr>
<tr>
<td>P1503</td>
<td>Sidestand down at vehicle speed</td>
</tr>
</tbody>
</table>

Figure 6-9. Sidestand Sensor

Diagnostic Tips

Unplug the neutral switch connector [131]. Use the DVOM to test for continuity to ground. When in neutral, continuity should exist (can be verified by the neutral light being illuminated on the instrument cluster). When the transmission is in gear, there should be no continuity to ground through the neutral switch (verify by the neutral light on the instrument cluster being extinguished).

When the sidestand is retracted, voltage on the connector [11] terminal 34 (GY) should be approximately 0.6 V. When the sidestand is extended, the voltage should jump to approximately 2.6 V.

Use brown pin probes when taking measurements at the sidestand sensor connector [133].

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-10. CKP, ECT, IAT, O2 sensors, and Cooling Fans
DTCs P1501, P1502, and P1503 (Part 2 of 3)

Continued from DTCs P1501, P1502, and P1503 (Part 1 of 3):

**YES**

Connect the ECM. With the ignition switch ON and the engine stop switch in the RUN position. Test for voltage on terminal 1 connector [133B]. Is voltage present?

**YES**

Is voltage approximately 5V?

**YES**

Turn off ignition switch. Connect Breakout Box (Part No. B-49115) to wiring harness connector [11B] (Gray) leaving ECM connector [11A] (Gray) disconnected. Test for continuity from connector [11B] (Gray) terminal 34 to connector [133B] terminal 2. Is continuity present?

**YES**

Connect Breakout Box (Part No. B-49115) to ECM connector [11A] and sidestand sensor connector [133]. Test terminal 34 of the Breakout Box for voltage with the sidestand retracted and extended. Are the voltages within specification?

**YES**

Replace ECM.

**NO**

Locate and repair open in the (TN/W) wire.

**NO**

Locate and repair short to voltage in the (R/W) wire.

**NO**

Replace ECM.

**NO**

Replace sidestand sensor.

**NO**

Locate and repair open in the (R/W) wire.

**NO**

Locate and repair short to ground in the (R/W) wire.

**NO**

Test for continuity from connector [133B] terminal 1 to connector [11B] (Gray) terminal 24. Is continuity present?

**NO**

Locate and repair open in the (R/W) wire.

**NO**

Locate and repair short to ground in the (R/W) wire.

**NO**

Test for continuity from connector [133B] terminal 1 to ground. Is continuity present?

**NO**

Locate and repair open in the (R/W) wire.

**NO**

Locate and repair short to ground in the (R/W) wire.

**NO**

Test for continuity from connector [133B] terminal 1 to connector [11B] (Gray) terminal 24. Is continuity present?
DESCRIPTION AND OPERATION

See Figure 6-11. The Bank Angle Sensor (BAS) is located above the ECM inside the left radiator shroud. The BAS operates from a 5V sensor reference voltage and sensor ground provided by the ECM.

The BAS sends a signal to the ECM ranging from 0.24-3.4V under normal operating conditions. A BAS signal between 3.5-4.79V indicates to the ECM that the vehicle has tipped over, and will turn off the engine. When the vehicle is righted, turn the ignition OFF and then ON again to restart the engine.

If the signal from the BAS is below 0.24V or above 4.79V, the ECM sets a code. Refer to Table 6-10 and Table 6-11. A BAS code will not disable the vehicle and the engine will continue to run. A tipped vehicle will not set a DTC.

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1151</td>
<td>BAS shorted low</td>
</tr>
<tr>
<td>P1152</td>
<td>BAS shorted high</td>
</tr>
</tbody>
</table>

Table 6-11. Bank Angle Sensor Voltage

<table>
<thead>
<tr>
<th>MODE</th>
<th>VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>0.24-3.4</td>
</tr>
<tr>
<td>Disable</td>
<td>3.5-4.79</td>
</tr>
</tbody>
</table>

Figure 6-11. Bank Angle Sensor Location (Connector end showing)

Connector Information

For additional information on the connectors in the following diagram(s), see 6.1 CONNECTORS.
Figure 6-12. Bank Angle Sensor
DTCs P1151 and P1152 (Part 1 of 2)

Is BAS connected?

**YES**
- Disconnect BAS connector [134]. Measure voltage on [134B] between terminal 5 (LGN/GY) and terminal 6 (BK/W).
  - What is the voltage?
  - 4.75-5.25 Volts
  - 11-13 Volts
  - 0.0 Volt

- **4.75-5.25 Volts**
  - Measure voltage between terminal 4 (R/W) and terminal 6 (BK/W).
  - Is voltage 4-6 Volts?
  - **YES**
  - Is BAS properly installed?
    - **YES**
      - Are ferrous metals located within 0.25 in. (6.4 mm) of sides, face or top of BAS?
        - **YES**
          - Return to original configuration.
        - **NO**
          - Install properly.
    - **NO**
      - Install properly.
  - **NO**
    - Repair short to voltage on (LGN/GY) wire.

- **11-13 Volts**
  - Repair short to voltage on (LGN/GY) wire.

- **0.0 Volt**

- **NO**
  - Go to DTCs P1151 and P1152 (Part 2 of 2).

**Repair open in (R/W) wire between connector [134B] terminal 4 and connector [11B] terminal 25.**
Continued from DTCs P1151 and P1152 (Part 1 of 2).

Disconnect connectors [10] (Black) and [11] (Gray) from ECM and plug into Breakout Box (B-48115) leaving the ECM disconnected. Check continuity between connector [134] terminal 5 (LGN/GY) and connector [11] (Gray) terminal 17. Is continuity present?

**YES**

Check continuity between connector [134B] terminal 5 and connector [11B] (Gray) terminal 19 (BK/W). Is continuity present?

**NO**

Locate and repair open in (LGN/GY) wire.

**YES**

Check (LGN/GY) circuit continuity to ground from connector [134B] terminal 5. Is continuity present?

**NO**

Locate and repair open on (BK/W) wire.

**YES**

Locate and repair short to ground on (LGN/GY) wire.

**NO**

Replace ECM.
DESCRIPTION AND OPERATION

See Figure 6-13. The clutch position sensor is located and attached separately on the backside of the left hand control. The sensor (momentary contact switch) is activated by the clutch lever.

See Figure 6-14. The neutral switch is located on the right side of the engine case, under the front pulley. The switch is activated when the shift lever is in neutral. In addition to providing an interlock function in the starting circuit, activation of the switch also illuminates the neutral (N) lamp on the instrument cluster.

DTCs P1154 and P1155 set when either the clutch switch circuit or neutral switch circuit is shorted to ground at speeds greater than 10 mph (16 km/h) for more than 60 seconds. Refer to Table 6-12 for the codes and their descriptions.

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1154</td>
<td>Clutch position sensor circuit low</td>
</tr>
<tr>
<td>P1155</td>
<td>Neutral switch input circuit low</td>
</tr>
</tbody>
</table>

Figure 6-14. Neutral Switch Location

Figure 6-13. Clutch Position Sensor Location

Diagnostic Tips
If the DTC is historic, check for intermittents

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-15. Neutral and Clutch Switch, IAC and Fuel Pump
Connect Breakout Box (Part No. B-48115) to the ECM harness, leaving the [11] (Gray) disconnected. Measure continuity between Breakout Box terminal 2 (Gray) (+) and ground (-). Is continuity present?

YES

Disconnect connector [95]. Measure continuity between Breakout Box terminal 2 (Gray) (+) and ground (-). Is continuity present?

YES

Locate and repair short to ground on (TN/LON) wire between [95] and [95D].

NO

NO

Replace clutch switch.

NO

Replace ECM.
With the ignition switch OFF and the transmission in 1st or 2nd gear, connect Breakout Box (Part No. B-48115) to the ECM harness, leaving the ECM disconnected. Measure the continuity between Breakout Box terminal B (Gray) and ground. Is continuity present?

YES

Disconnect neutral switch [131]. Measure continuity between Breakout Box terminal 8 (Gray) and ground. Is continuity present?

YES

Locate and repair short to ground on (T/N/Y) wire.

NO

Replace ECM.

NO

Replace neutral switch.
IGNITION COILS: DTC P2300, P2301, P2303, P2304

DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-48115</td>
<td>BREAKOUT BOX</td>
</tr>
</tbody>
</table>

See Figure 6-16. There is no traditional spark plug wire when using this coil because the shaft connects directly to the spark plug itself. A combination of codes set if the ignition coil rise-time is out of range. This could occur if there is an open ignition coil or loss of power to the ignition coil. When multiple codes set, the cause may be an ignition coil failure.

See Figure 6-17 and Figure 6-18. The ignition coils receive power on terminal 3 (GY) wire when the ignition relay energizes. Refer to Table 6-13 for possible DTCs and their descriptions.

Table 6-13. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2300</td>
<td>Front ignition coil control circuit low</td>
</tr>
<tr>
<td>P2301</td>
<td>Front ignition coil control circuit high</td>
</tr>
<tr>
<td>P2303</td>
<td>Rear ignition coil control circuit low</td>
</tr>
<tr>
<td>P2304</td>
<td>Rear ignition coil control circuit high</td>
</tr>
</tbody>
</table>

Figure 6-17. Ignition Coil Location (Front)

Figure 6-16. Ignition Coil

Figure 6-18. Ignition Coil Location (Rear)

Diagnostic Tips

- See Figure 6-19. Cranking the engine with a test lamp in place of the ignition coil may cause DTCs to set. This
condition is normal and does not by itself indicate a malfunction. Clear the codes if this condition occurs.

- To isolate the wire harness during testing, disconnect the ignition coil and install the BREAKOUT BOX (Part No. B48115) to the harness leaving the ECM disconnected.
- Use gray pin probes when checking ignition coil connectors.

Figure 6-19. Ignition Coil Circuit Test

Figure 6-20. ECM Driver Test

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-21. Injectors, Coils, and Active Intake
Rear Ignition Coil.
Install test lamp into terminals 1 and 3 of connector [83RB]. Use Harness Connector Test Kit (Part No. HD-41404-6), gray pin probes and patch cords, See Figure 6-19. Does test lamp flash when engine is cranked?

YES
Measure resistance from terminal 2 of connector [83RB] to ground. Is resistance less than 0.5 Ohms?

YES
Faulty ignition coil connection or ignition coil. Repair wiring as necessary. If wiring is okay, replace ignition coil.

NO
Install breakout box between harness and ECM. Insert test lamp adapter into terminals 9 and 31 of the black side of the breakout box. Next, insert test lamp adapter into terminals 9 and 32 of the black side of the breakout box. See Figure 6-20. Does test lamp flash when engine is cranked?

NO

YES
Check for voltage at terminal 3 of [83RB]. Is battery voltage present?

YES
Disconnect ECM from breakout box. Measure resistance between terminal 1 of connector [83RB] to terminals 31 and 32 of breakout box (Black). Is resistance less than 0.5 Ohms?

YES
Perform wiggle test. See 1.3 Diagnostics/Troubleshooting. Any intermittents found?

YES
Repair as necessary.

NO
Locate and repair open or poor connection between terminal 1 of connector [83RB] and terminals 31 and 32 of connector [103].

NO
Replace ECM.

NO
Replace ECM.
FUEL INJECTORS: DTC P0261, P0262, P0264, P0265

DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-48115</td>
<td>BREAKOUT BOX</td>
</tr>
</tbody>
</table>

See Figure 6-22 and Figure 6-23. The fuel injectors are solenoids that allow pressurized fuel to be sprayed into the engine combustion chambers through the intake flange. The fuel injectors are timed to the engine cycle and triggered sequentially.

Electrical power for the fuel injectors comes from the ignition relay. The ECM provides the ground path to trigger fuel injector operation. Refer to Table 6-14 for DTCs and explanations.

**NOTE**

Front and rear fuel injectors are interchangeable on the 1125 engine.

Table 6-14. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0261</td>
<td>Front fuel injector circuit low</td>
</tr>
<tr>
<td>P0262</td>
<td>Front fuel injector circuit high</td>
</tr>
<tr>
<td>P0264</td>
<td>Rear fuel injector circuit low</td>
</tr>
<tr>
<td>P0265</td>
<td>Rear fuel injector circuit high</td>
</tr>
</tbody>
</table>

Figure 6-22. Fuel Injector Location (Front)

Figure 6-23. Fuel Injector Location (Rear)

Figure 6-24. Fuel Injector Circuit Tester (Typical Connections)
Diagnostic Tips
Ignition relay failure or certain wiring harness problems causes 12V power to be lost to both fuel injectors, both ignition coils, ECM, and fuel pump.

Purge fuel line before testing fuel injector operation. See the service manual.

Use BREAKOUT BOX (Part No. B-48115) as shown in Figure 6-24 but place jumpers in terminals 32 (high) and 33 (low) or 34 (high) and 33 (low) for the rear and front injectors, respectively.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Turn ignition OFF. Check resistance between terminal 1 of connector [848] or [853] and terminal 87 of ignition relay. Is resistance less than 1 Ohm?

YES

Test the ignition relay. Is the ignition relay good?

NOTE
See 1.3 DIAGNOSTICS/TROUBLESHOOTING if the relay terminal called out does not match the relay being checked.

YES

Locate and repair open or poor connection on (GY) wire.

NO

Locate and repair opens in (GY/O) wire from terminal 30 of ignition relay to ignition fuse.

NO

Replace the ignition relay.
DESCRIPTION AND OPERATION

See Figure 6-26. When the starter switch is pushed, the start relay is activated and battery current flows to the starter solenoid and removes power from the lighting circuit, allowing maximum battery current to flow to the starter motor. When the starter switch is released, the start relay de-energizes, the starter solenoid disconnects voltage from the starter motor, and the lighting circuit functions normally. The ECM controls the ground to the relay, which it disables during security and tip over conditions. The ECM sets DTC P0617, when it detects voltage always present on ECM terminal 7 of connector [10].

NOTE

The start relay is not repairable. Replace the unit if it fails.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 6-26. Start Relay
Figure 6-27. ECM Power and Ground
Remove start relay. Turn ignition to ON and the engine stop switch to RUN. Measure voltage on socket terminal 85. Is voltage present?

**YES**

Locate and repair short to voltage from socket terminal 85 to terminal 7 of connector [10A] (GNO) wire.

**NO**

Test start relay. 
**NOTE**
See 1.3 DIAGNOSTICS/TROUBLESHOOTING. If the relay terminal called out does not match the relay being checked.

**YES**

Replace ECM.

**NO**

Replace start relay.
RUNNING SENSORS AND DRIVERS

DESCRIPTION AND OPERATION
Dynamic sensors and drivers are the devices that manage engine operation between start-up and WOT. If these devices are not in proper operating condition, the engine may idle or run rough, lack power, overheat, or use excessive amounts of fuel.

Refer to Table 6-15 for devices in this category.

<table>
<thead>
<tr>
<th>DTC</th>
<th>PRIORITY ORDER</th>
<th>FAULT CONDITION</th>
<th>DIAGNOSTIC PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0087</td>
<td>29</td>
<td>Fuel Rail/System Pressure Too Low</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0107</td>
<td>63</td>
<td>MAP Sensor Low/Open</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
<tr>
<td>P0108</td>
<td>62</td>
<td>MAP Sensor High</td>
<td>6.25 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108</td>
</tr>
<tr>
<td>P0113</td>
<td>21</td>
<td>Intake Air Temperature Sensor High/Open</td>
<td>6.17 INTAKE AIR TEMPERATURE (IAT) SENSOR: DTC P0112, P0113</td>
</tr>
<tr>
<td>P0117</td>
<td>20</td>
<td>Engine Coolant Temperature Sensor Circuit Low</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td>P0118</td>
<td>19</td>
<td>Engine Coolant Temperature Sensor Circuit High</td>
<td>6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118</td>
</tr>
<tr>
<td>P0131</td>
<td>50</td>
<td>Front Oxygen Sensor Circuit Low/Engine Lean</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0132</td>
<td>48</td>
<td>Front Oxygen Sensor Circuit High/Engine Rich</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0134</td>
<td>48</td>
<td>Front Oxygen Sensor Open/Inactive</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0151</td>
<td>51</td>
<td>Rear Oxygen Sensor Circuit Low/Engine Lean</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0152</td>
<td>47</td>
<td>Rear Oxygen Sensor Circuit High/Engine Rich</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0154</td>
<td>49</td>
<td>Rear Oxygen Sensor Open/Inactive</td>
<td>6.22 OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047</td>
</tr>
<tr>
<td>P0192</td>
<td>26</td>
<td>Fuel Pressure Sensor Circuit Low</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0193</td>
<td>25</td>
<td>Fuel Pressure Sensor Circuit High</td>
<td>6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087</td>
</tr>
<tr>
<td>P0261</td>
<td>35</td>
<td>Front Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0262</td>
<td>34</td>
<td>Front Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0264</td>
<td>37</td>
<td>Rear Fuel Injector Circuit Low</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0265</td>
<td>36</td>
<td>Rear Fuel Injector Circuit High</td>
<td>6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265</td>
</tr>
<tr>
<td>P0502</td>
<td>40</td>
<td>Vehicle Speed Sensor Low</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td>P0503</td>
<td>41</td>
<td>Vehicle Speed Sensor Intermittent/Erratic High</td>
<td>6.21 VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503</td>
</tr>
<tr>
<td>P0506</td>
<td>54</td>
<td>Idle Air Control System RPM Higher Than Expected</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>DTC</td>
<td>PRIORITY ORDER</td>
<td>FAULT CONDITION</td>
<td>DIAGNOSTIC PROCEDURE</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>P0507</td>
<td>55</td>
<td>Idle Air Control System - RPM Lower Than Expected</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0511</td>
<td>53</td>
<td>Idle Air Control Circuit Fault</td>
<td>6.23 IDLE AIR CONTROL (IAC): DTC P0506, P0507, P0511</td>
</tr>
<tr>
<td>P0562</td>
<td>39</td>
<td>Battery Voltage Low</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0563</td>
<td>38</td>
<td>Battery Voltage High</td>
<td>6.26 BATTERY VOLTAGE: DTC P0562, P0563</td>
</tr>
<tr>
<td>P0628</td>
<td>28</td>
<td>Fuel Pump Circuit Low</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0629</td>
<td>27</td>
<td>Fuel Pump Circuit High</td>
<td>6.20 FUEL PUMP: DTC P0628, P0629</td>
</tr>
<tr>
<td>P0691</td>
<td>58</td>
<td>Right Fan Control Circuit Low</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0692</td>
<td>56</td>
<td>Right Fan Control Circuit High</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0693</td>
<td>59</td>
<td>Left Fan Control Circuit Low</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P0694</td>
<td>57</td>
<td>Left Fan Control Circuit High</td>
<td>6.24 RIGHT AND LEFT FAN CONTROL: DTC P0691, P0692, P0693, P0694</td>
</tr>
<tr>
<td>P1110</td>
<td>66</td>
<td>Active Intake Control Circuit Short Low/Open</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1111</td>
<td>65</td>
<td>Active Intake Control Circuit Short High</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P1112</td>
<td>64</td>
<td>Active Intake Control Throttle Position Sensor Feedback Failure</td>
<td>6.27 ACTIVE INTAKE SYSTEM: DTC P1110, P1111, P1112</td>
</tr>
<tr>
<td>P2228</td>
<td>24</td>
<td>BARO Pressure Sensor Circuit Low</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2229</td>
<td>23</td>
<td>BARO Pressure Sensor Circuit High</td>
<td>6.18 BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229</td>
</tr>
<tr>
<td>P2300</td>
<td>31</td>
<td>Front Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2301</td>
<td>30</td>
<td>Front Ignition Coil Control Circuit High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2303</td>
<td>33</td>
<td>Rear Ignition Coil Control Circuit Low</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
<tr>
<td>P2304</td>
<td>32</td>
<td>Rear Ignition Coil Control Circuit High</td>
<td>6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304</td>
</tr>
</tbody>
</table>
ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118

DESCRIPTION AND OPERATION

See Figure 6-29. The ECM supplies and monitors a 5 Volt signal applied to one side of the ECT sensor. The ECT sensor is a thermistor device, meaning that at a specific temperature, the sensor has a specific resistance across its terminals. As this resistance varies, so does the voltage at the temperature sensor input at the ECM. Refer to Table 6-16.

- At high temperatures, the resistance of the sensor is very low, with a corresponding lowering of the signal voltage.
- At low temperatures, the resistance of the sensor is very high. This allows the voltage to rise close to the supplied voltage of 5 Volts. The ECM monitors this voltage to compensate for various operating conditions.

An overheated engine, represented by hot engine coolant temperature, causes the ECM to command a soft skip spark (1 of 4 removed) and then a hard skip spark (1 of 2 removed) when the engine is above a certain RPM and throttle threshold.

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0117</td>
<td>Engine coolant temperature circuit low</td>
</tr>
<tr>
<td>P0118</td>
<td>Engine coolant temperature circuit high</td>
</tr>
</tbody>
</table>

Figure 6-29. ECT Sensor Location (Engine Removed for Clarity)

Diagnostic Tips

An intermittent may be caused by any of the following conditions:

- **Poor Connection**: Inspect ECM harness connector [11] for backed out terminals, improper mating, inoperative locks improperly formed or damaged terminals, poor terminal to-wire connection and damaged harness.

- **Shifted Sensor Resistance Value**: Compare the temperatures of the ECT and IAT sensors with the engine at ambient temperature in order to evaluate the possibility of a shifted (out of calibration) sensor which may result in driveability problems. The sensor temperatures should be within 10 degrees of each other.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-30. CKP, ECT, IAT, O2 sensors, and Cooling Fans
DTCs P0117 and P0118 (Part 1 of 2)

Disconnect the ECT sensor connector [80]. Measure the resistance between [90A] terminals 1 and 2. Is the resistance between 33.791-74.328 Ohms, when engine temperature ranges 68-86°F (20-30 °C)?

YES

Attach Breakout Box (B-48115) to the ECM harness, leaving the ECM disconnected. Measure the resistance between ECT sensor connector [90B] terminal 2 and Breakout Box (Gray) terminal 9, and [90B] terminal 1 and Breakout Box (Gray) terminal 29. Are both circuits less than 1.0 Ohm?

NO

Replace ECT sensor.

YES

Using a DVM, measure the resistance between Breakout Box terminal 9 (W/R) of [11] (Gray) and ground. Is it greater than 1.0 megaOhm?

NO

Locate and repair open or poor connection on faulty circuit.

YES

Go to DTCs P0117 and P0118 (Part 2 of 2).

NO

Locate and repair short to ground on (W/R) wire.
DTCs P0117 and P0118 (Part 2 of 2)

Continued from DTCs P0117 and P0118 (Part 1 of 2).
With DVOM still connected, check for intermittents. Are intermittents present?

**YES**
- Perform wiggle test. See 1.3 DIAGNOSTICS/TROUBLESHOOTING. Repair as necessary.

**NO**
- Connect Breakout Box to ECM and disconnect ECT sensor connector. Turn ignition switch ON. Using a DVOM, measure the voltage between Breakout Box connector [11] (Gray), terminals 9 and 28. Is voltage approximately 5.0 Volts?

**NO**
- Less than 4.7 Volts:
  - Replace ECT sensor and road test. Did check engine lamp turn on and set DTCs P0117 or P0118?

**YES**
- Install original ECT sensor and replace ECM, then road test.

**NO**
- System OK

**NO**

**YES**
- Locate and repair short to ground on (WR) wire.

**NO**
- Replace ECM.

**NO**
- Greater than 5.3 Volts:
  - Unplug ECM leaving Breakout Box connected at the vehicle harness. Measure voltage between Breakout Box connector [11] (Gray) terminal 9 and ground. Is the voltage 0.0 Volt?

**YES**
- Check ECT sensor signal wire (W/R) for short to 12 Volts and repair.

**NO**
- Replace ECM.
INTAKE AIR TEMPERATURE (IAT) SENSOR:
DTC P0112, P0113

DESCRIPTION AND OPERATION

See Figure 6-31. The ECM supplies and monitors a 5 Volt signal applied to one side of the IAT sensor. The IAT sensor is a thermistor device, meaning that at a specific temperature, the sensor has a specific resistance across its terminals. As this temperature varies, so will the voltage vary at the temperature sensor input on the ECM. If the 5V signal goes out of range the ECM sets a DTC. Refer to Table 6-17.

- At high temperatures, the resistance of the sensor is very low, with a corresponding lowering of the signal voltage.
- At low temperatures, the resistance of the sensor is very high. This allows the voltage to rise close to the supplied voltage of 5 Volts.

The ECM monitors this voltage to compensate for various operating conditions.

Table 6-17. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0112</td>
<td>Intake Air Temperature sensor voltage low</td>
</tr>
<tr>
<td>P0113</td>
<td>Intake Air Temperature sensor high/open</td>
</tr>
</tbody>
</table>

Figure 6-31. IAT Sensor Location

1. Intake air temperature sensor
2. Cooling fan number 2 (left)

Diagnostic Tips

An intermittent may be caused by any of the following conditions:

**Poor Connection:** Inspect ECM harness connector [11] for backed out terminals, improper mating, inoperative locks improperly formed or damaged terminals, poor terminal to-wire connection and damaged harness.

**Shifted Sensor Resistance Value:** Compare the temperatures of the ECT and IAT sensors with the engine at ambient temperature in order to evaluate the possibility of a shifted (out of calibration) sensor which may result in driveability problems. The sensor temperatures should be within 10 degrees of each other.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-32. CKP, ECT, IAT, O2 sensors, and Cooling Fans
DTCs P0112 and P0113 (Part 1 of 2)

Disconnect the IAT sensor connector [B8]. Measure the resistance between [BGA] terminals 1 and 2. Is the resistance between 33.791-74.328 Ohms, when engine temperature ranges 66-86°F (20-30°C)?

YES

Attach Breakout Box (B-48115) to the ECM harness, leaving the ECM disconnected. Measure the resistance between IAT sensor connector [B8] terminal 1 and Breakout Box (Gray) terminal 14, and [B98] terminal 2 and Breakout Box [11] (Gray) terminal 28. Are both circuits less than 1.0 Ohm?

YES

Using a DVM, measure the resistance between Breakout Box terminal 14 (LGN/Y) of [11] (Gray) and ground. Is it greater than 1.0 megohm?

YES

Go to DTCs P0112 and P0113 (Part 2 of 2).

NO

NO

NO

Replace IAT sensor.

LOCATE and repair open or poor connection on faulty circuit.

LOCATE and repair short to ground on (LGN/Y) wire.

LOCATE and repair open or poor connection on faulty circuit.
DTCs P0112 and P0113 (Part 2 of 2)

Continued from DTCs P0112 and P0113 (Part 1 of 2).
With a DVOM still connected, check for intermittents. Are intermittents present?

YES
Perform wiggle test. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING. Repair as necessary.

NO
Connect Breakout Box to ECM and disconnect IAT sensor connector. Turn ignition switch ON. Using a DVOM, measure the voltage between Breakout Box connector [11] (Gray) terminal, 14 and 28. Is voltage approximately 5.0 Volts?

YES

NO
Less than 4.7 Volts.

Replace IAT sensor. Clear DTCs and road test. Did check engine lamp turn on and set DTCs P0112 or P0113?

YES
Install original IAT sensor and replace ECM, then road test.

NO
System OK.


YES
Locate and repair short to ground on (LGN/Y) wire.

NO
Replace ECM.

NO

Greater than 5.3 Volts.

Unplug ECM leaving Breakout Box connected at vehicle harness. Measure voltage between Breakout Box connector [11] (Gray) terminal 14 and ground. Is the voltage 0.0 Volt?

YES
Check IAT sensor signal wire (LGN/Y) for short to 12 Volts and repair.

NO
Replace ECM.
BAROMETRIC PRESSURE (BARO) SENSOR: DTC P2228, P2229

DESCRIPTION AND OPERATION

See Figure 6-33. The BARO sensor functions similar to the manifold absolute pressure sensor. It is located under the seat, at the rear of the throttle body baseplate. In this position, the sensor monitors the ambient air pressure located outside of the airbox. When the ambient air pressure drops, less fuel is needed to maintain the proper air/fuel mixture. The output of the sensor allows the ECM to compensate for changes in barometric pressure due to altitude or weather variations.

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2228</td>
<td>Barometric pressure sensor circuit low</td>
</tr>
<tr>
<td>P2229</td>
<td>Barometric pressure sensor circuit high</td>
</tr>
</tbody>
</table>

Figure 6-33. Barometric Pressure Sensor

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-34. 5V Reference Circuit
DTCs P2228 and P2229 (Part 1 of 2)

Connect Breakout Box (B-49115). With ignition ON, measure voltage between Breakout Box connector [11] (Gray) terminals 5 and 28. Is voltage between 3.5-5.0 Volts?

- **YES**
  - Perform wiggle test. See 1.3 DIAGNOSTICS/TROUBLESHOOTING. Are intermittents present?
    - **YES**
      - Repair as necessary.
    - **NO**
      - Replace BARO sensor. Perform road test. Did check engine lamp illuminate and set DTC P2228 or P2229?
        - **YES**
          - Install original BARO sensor. Replace ECM (reprogram, relaim) and road test again to verify repair.
        - **NO**
          - System operating normally.

- **NO**
  - Go to DTCs P2228 and P2229 (Part 2 of 2).
DTCs P2228 and P2229 (Part 2 of 2)

Continued from DTCs P2228 and P2229 (Part 1 of 2).
With the ignition switch ON, check the 5 Volt reference supply at the BARO sensor connector [228B].
Is the voltage between terminal 1 (R/W) and terminal 2 (BK/W) approximately 5.0 Volts?

YES
Connect Breakout Box to [11B] leaving ECM disconnected.
OPEN CHECK: Measure resistance between BARO connector [228B] terminal 3 and Breakout Box terminal 5.
Is resistance less than 1 Ohm?

YES
SHORT CHECK: Measure resistance between BARO sensor connector terminal 3 and chassis ground.
Is resistance greater than 1 megohm?

YES
Replace BARO sensor.

NO
Locate short to 12 volts on (R/W) wire in wire harness. Repair as necessary.

NO
Connect Breakout Box to [11B] leaving ECM disconnected. Check continuity between barometric pressure connector [228B] terminal 1 and Breakout Box terminal 24. Then measure continuity between BARO connector [228B] terminal 2 and Breakout Box terminal 28.
Is resistance less than 1 Ohm?

YES
Check resistance between BARO connector [228B] terminal 1 and Breakout Box terminal 28.
Is resistance greater than 1 megohm?

YES
Replace ECM. Reprogram and learn password.

NO
Locate and repair short between (R/W) and (BK/W) wires.

NO
Locate and repair open wire.
DESCRIPTION AND OPERATION

See Figure 6-35. The fuel pressure sensor is mounted in the fuel line feeding the fuel rail. Variations in fuel rail pressure are converted to a voltage output to the ECM for fuel pump control. For all fuel pressure sensor DTCs, the ECM drives the pump to maximum pressure. Refer to Table 6-19. The ECM incorporates automatic compensation for differences of the desired pressure versus the actual pressure. For instance, if the pressure is lower than desired, the ECM opens the injectors for a longer time to adjust the amount of fuel delivered.

NOTE
If the fuel pump fails, or when the vehicle is out of fuel, DTC P0087 sets. The output of the ECM still attempts to drive the fuel pump to maximum output under these conditions.

Table 6-19. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0192</td>
<td>Fuel pressure sensor circuit low</td>
</tr>
<tr>
<td>P0193</td>
<td>Fuel pressure sensor circuit high</td>
</tr>
<tr>
<td>P0087</td>
<td>Fuel pressure sensor too low</td>
</tr>
</tbody>
</table>

Figure 6-35. Fuel Pressure Sensor Location

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-36. 5V Reference Circuit
DTCs P0192, P0193, and P0087 (Part 1 of 3)

Is there fuel in fuel tank?

YES

Perform Fuel Pressure Test. See the service manual. Is the fuel pressure approximately 75 PSI (517 kPa) at ignition ON, and fluctuates between 55-60 PSI (380-415 kPa) while the engine is running?

NO

Fill fuel tank with fresh fuel.

YES

No pressure.

Low pressure or pressure too low.

High pressure.

No trouble found. Review symptoms.

Go to DTCs P0192, P0193, and P0087 (Part 2 of 3).

Is DTC P0087 set?

GO TO DTCs P0192, P0193, and P0087 (Part 3 of 3).

YES

Check for restricted fuel pump inlet screen. Is screen restricted?

NO

Check voltage at fuel pump connector [86A] terminal B (OXY) to ground. Is battery voltage present?

YES

Measure voltage drop between battery positive terminal (+) B of connector [86A] to locate source of voltage drop. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING.

NO

Replace fuel pump.

YES

Flush out fuel tank and fuel lines. Refill fuel tank with fresh fuel and restart. Did DTC P0087 reset?

NO

 Replace fuel pressure sensor.

YES

Check for restrictions in the fuel line and fuel rail, or for clogged fuel injectors. Any restrictions found?

NO

System operating normally.

YES

Flush out fuel lines, fuel rail, and fuel injectors.

NO

Replace fuel pump.

YES

Replace fuel pump.
Continued from DTCs P0192, P0193, and P0087 (Part 1 of 3).
Check for battery voltage at terminal B (O/G/Y) on fuel pump connector [86A].
Is battery voltage present?

YES

Attach Breakout Box [B-48115] to ECM. Measure voltage between Breakout Box [10] (Black) terminals 27 and 28, and ground. Turn ignition switch ON. Does meter read battery voltage?
NOTE
The voltage reading will fluctuate for 2-3 seconds while the fuel pump is cycled.

YES

Inspect fuel pump wiring. Is wiring OK?

YES

Replace fuel pump assembly.

NO

Replace fuel pump wiring.

NO

NO

Locate and repair open in (O/G/Y) wire.

YES

Connect Breakout Box to ECM harness leaving ECM disconnected. Check continuity between fuel pump connector [86A] terminal C and ECM connector [10] (Black) terminals 27 and 28. Is continuity present?

YES

Replace ECM.

NO

Replace and repair open on (BN/Y) wire.
DTCs P0192, P0193, and P0087 (Part 3 of 3)

Continued from DTCs P0192, P0193, and P0087 (Part 1 of 3).

Is the connector on the fuel pressure sensor [227] fully seated?

YES

Connect Breakout Box. With the ignition switch ON and the fuel pressure sensor disconnected, check the voltage at [227A] terminal B (+) to terminal A (-). Is 5V present?

YES

Turn off ignition switch and disconnect Breakout Box from ECM. Check resistance between Breakout Box [118] (Gray) terminal 10 to [227A] terminal C (GN/BE). Is resistance less than 0.5 Ohms?

YES

Check continuity between [227A] terminal C (GN/BE) to ground. Is continuity present?

YES

Locate and repair short (GN/BE) and retest.

YES

Measure resistance from [227A] terminal C (GN/BE) to [227A] terminal A, and then terminal B. Is resistance greater than 1.0 megohms?

YES

Replace fuel pressure sensor.

NO

NO

NO

NO

NO

Replace ECM.

Locate and repair open wiring and retest.

Locate and repair shorted wiring and retest.
FUEL PUMP: DTC P0628, P0629

DESCRIPTION AND OPERATION

See Figure 6-37. The pump is located inside the fuel tank. The fuel pump provides the means for moving fuel from the fuel tank to the fuel injectors. See Figure 6-38 for major components of the fuel pump. The fuel pump is controlled through a ground in the ECM. Refer to Table 6-20. The DTCs set if:

- (BN/Y) wire is shorted to 12 Volts.
- (BN/Y) wire is shorted to ground. This causes the fuel pump to run continuously even when the motor is not running.
- Fuel pump motor stalls.

NOTE
If the fuel pump is faulty, DTC P0087 sets.

Table 6-20. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0628</td>
<td>Fuel pump control circuit low</td>
</tr>
<tr>
<td>P0629</td>
<td>Fuel pump control circuit high</td>
</tr>
</tbody>
</table>

Figure 6-38. Fuel Pump Assembly

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

Figure 6-37. Fuel Pump Location
Figure 6-39. Neutral and Clutch Switches, IAC, and Fuel Pump
**DTCs P0628 and P0629**

Attach Breakout Box (B-48115) to ECM. Measure voltage between Breakout Box [10] (Black) terminals 27 and 28, and ground. Turn ignition switch ON. Does meter read battery voltage?

**NOTE**

The voltage reading will fluctuate for 2-3 seconds while the fuel pump is cycled.

---

**YES**

With DVOM still connected, check for intermittents by performing wiggle test while repeating first test of this flowchart. See 1.3 DIAGNOSTICS/TROUBLESHOOTING. Are intermittents present?

**YES**

Disconnect ECM. Does fuel pump run continuously?

**YES**

Check continuity of (O/G/Y) wire between fuel pump fuse and fuel pump connector (B/E/A) terminal B. Is continuity present?

**YES**

Check continuity of (B/N/Y) wire between connectors [10] (Black) terminals 27 and 28 and connector (B/E/A) terminal C with pin probes. Is continuity less than 1.0 Ohm?

**YES**

Locate and repair short to ground on (B/N/Y) wire.

**NO**

Locate and repair the open wire or poor connection on the (B/N/Y) wire.

**NO**

Replace fuel pump.

**NO**

System operating normally.

---

**NO**

Check fuel pump fuse. Is fuse good?

**NO**

Check continuity between (O/G/Y) wire at fuel pump fuse and ground. Is continuity present?

---

**NO**

Does the fuel pump run continuously?
VEHICLE SPEED SENSOR (VSS): DTC P0502 AND P0503

DESCRIPTION AND OPERATION

See Figure 6-40. The VSS is a Hall-effect device mounted close to the teeth of the trigger wheel. The output signal frequency varies with vehicle speed. Output voltage from the sensor is 5V per increment of distance traveled. The ECM processes the vehicle speed signal and transmits it via the CAN bus to the instrument cluster to indicate vehicle speed. The VSS is supplied battery voltage from the brake/horn circuit (O). The ECM provides ground (BK/W) and receives the speed signal on the (W wire). Refer to Table 6-21.

Table 6-21. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0502</td>
<td>VSS output low</td>
</tr>
<tr>
<td>P0503</td>
<td>VSS output high</td>
</tr>
</tbody>
</table>

Figure 6-40. VSS Location

Diagnostic Tips

If a short low/open or a short high condition, DTC P0608 sets, reflecting a problem in the VSS, ECM, IC, or wiring harness.

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-41. Vehicle Speed Sensor
DTCs P0502 and P0503

Disconnect VSS connector [65]. With the ignition switch ON, check the voltage between connector [65B] terminals A (+) and C (-).

Is battery voltage present?

YES

Connect Speedometer Tester (Part No. HD-41354) with the input/output cable supplied (Part No. HD-41354-1) or point to point leads to VSS connector [65B] terminals B (signal) and C (ground). Turn Speedometer Tester power on and allow the tester to self-test. On the tester, perform the following:

1. Press the CLEAR button;
2. Press 1; then
3. Press ENTER.

Enter 144Hz by pressing 144 and then press ENTER.

Does the speedometer on the instrument cluster indicate approximately 60 mph (96 km/h)?

YES

Replace VSS.

NO

Check short to ground on (W) wire.

YES

Locate and repair short to ground on (W) wire.

NO

NO

Does brake lamp illuminate and horn actuate?

YES

Replace Brake/Horn fuse. Check resistance between connector [65B] terminals A and terminal 3 of the Brake/Horn fuse. Is resistance less than 1 Ohm?

YES

Connect breakout box to ECM harness leaving ECM disconnected. Check resistance between terminal 19 (Gray) of breakout box and terminal C of [66B]. Is resistance less than 1 Ohm?

YES

Replace ECM.

NO

Replace Break/Horn fuse and retest.

NO

Locate and repair open or poor connection on the (O) wire.

NO

Locate and repair open or poor connection on the (BK/W) wire.

NO

Locate and repair open or poor connection on the (BK/W) wire.

Note: Check and inspect interface connector [143] when performing continuity checks.
OXYGEN (O2) SENSOR: DTC P0131, P0132, P0134, P0151, P0152, P0154, P1047

DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-39978</td>
<td>DIGITAL MULTIMETER (FLUKE 78)</td>
</tr>
</tbody>
</table>

See Figure 6-42 and Figure 6-43 for front and rear O2 sensor location. The O2 sensor provides a signal to the ECM, to indicate whether the engine is running rich or lean:

- A low voltage signal (less than 0.41 V) indicates the engine is running lean.
- A high voltage signal (greater than 0.56 V) indicates the engine is running rich.

When the air/fuel mixture is ideal, approximately 14.7 parts air to 1 part fuel, the voltage is approximately 0.48 V. Refer to Table 6-22 for possible DTCs associated with these sensors.

**NOTE**

DTC P1047 could be caused by a mechanical concern and may cause O2 sensor codes to set.

### Table 6-22. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0131</td>
<td>Front oxygen sensor circuit low/engine lean</td>
</tr>
<tr>
<td>P0132</td>
<td>Front oxygen sensor circuit high/engine rich</td>
</tr>
<tr>
<td>P0134</td>
<td>Front oxygen sensor open/inactive</td>
</tr>
<tr>
<td>P0151</td>
<td>Rear oxygen sensor circuit low/engine lean</td>
</tr>
<tr>
<td>P0152</td>
<td>Rear oxygen sensor circuit high/engine rich</td>
</tr>
<tr>
<td>P0154</td>
<td>Rear oxygen sensor open/inactive</td>
</tr>
<tr>
<td>P1047</td>
<td>Feedback fuel cylinder difference too great</td>
</tr>
</tbody>
</table>

![Figure 6-43. Rear O2 Sensor Location](image)

**Diagnostic Tips**

The DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) displays the signal from the oxygen sensors in volts.

This voltage is an average value tending towards lean, rich, or ideal value depending on the operating temperature of the engine, engine speed, and throttle position. An open/short to voltage or short to ground in the (V/G) wire causes the engine to run rich (short to ground) or lean (short to voltage). When a fault is detected, the ECM remains in an open loop. The engine must be running below 5000 RPM for the ECM to detect an O2 sensor failure.

Check for the following conditions:

- **Poor Connection:** Inspect ECM harness connector, fuel injector connectors, and O2 sensor connector [137] wiring for backed out terminals, improper mating, inoperative locks improperly formed or with damaged terminals, poor terminal-to-wire connection, and damaged harness.
- **Dirty/Stuck Open Injectors:** The motorcycle may run lean (dirty/dagged injectors) or rich (stuck open injectors) if there is an injector problem. This could also cause poor fuel economy and performance.
- **Loose O2 Sensor:** If the O2 sensor is loose, engine performance may be affected. This could also show up as a slow changing O2 sensor voltage.
- **Loose/Leaking Exhaust or Cracked/Leaking Intake Manifolds:** This can cause a poor ground connection for the sensor, or allow fresh air into the exhaust system or excessive air into the intake system. If fresh air enters either system, the O2 sensor reads a lean condition, causing the system to go rich.

### Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
DTCs P0131, P0132, P0134, P0151, P0152, and P0154 (Part 1 of 2)

Disconnect O2 sensor from harness. Check voltage on [13EB] (front) or [137B] (rear) to ground with ignition switch ON.

Is circuit voltage approximately 0.5 Volts?

NO

0 Volts.

Install Breakout Box leaving harness side connector [11] (Gray) disconnected from the Breakout Box. Turn ignition ON. Check voltage on terminal 31 (front) or 32 (rear) to ground. Is voltage approximately 0.5 volts?

NO

Greater than 1 Volt.

Install Breakout Box leaving harness side connector [11] (Gray) disconnected from the Breakout Box. Measure voltage to ground on terminal 31 (front) or 32 (rear) on the grey side of the Breakout Box. Is voltage greater than 1 volt?

YES

Go to DTCs P0131, P0132, P0134, P0151, P0152, and P0154 (Part 2 of 2).

NO

Turn ignition switch OFF. Connect breakout box to ECM harness leaving ECM disconnected. Check resistance from terminal 31 of breakout box to terminal 1 of [13EB] (front) or terminal 32 of breakout box to terminal 1 of [137B] (rear). Is resistance less than 1 Ohm?

YES

Replace ECM.

NO

Replace ECM

YES

Connect breakout box to ECM harness leaving ECM disconnected. Turn ignition switch ON. Leaving appropriate O2 sensor disconnected, check terminal 31 (front) or 32 (rear) for short to voltage. Is voltage present?

NO

Turn ignition switch OFF. Check continuity between terminal 31 (front) or 32 (rear) of breakout box (gray) to all remaining terminals on the grey side of breakout box. Locate and repair shorted wires.

YES

Check terminal 31 (front) or 32 (rear) of breakout box (gray) for continuity to ground. Locate and repair short to ground on (PKO, front) or (PK/GN, rear) wire.

NO

Locate and repair open or poor connection on (PKO, front) or (PK/GN, rear) wire.

YES

Locate and repair short to voltage on (PKO) or (PK/GN) wire.
Turn ignition OFF and reconnect O2 sensor. Turn ignition switch ON and start engine. Allow engine to reach operating temperature.
With engine idling, does voltage quickly fluctuate between 0.1-0.8 Volts?

YES
Perform wiggle test. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING. Are intermittents present?

NO
0.0-0.4 Volts.

Inspect fuel pressure within Onboard Diagnostic Information System. See 4.1 INSTRUMENT CLUSTER AND GAUGES. Is the pressure too low?

NO
0.5-1.0 Volts.

Inspect fuel pressure within Onboard Diagnostic Information System. See 4.1 INSTRUMENT CLUSTER AND GAUGES. Is the pressure too high?

NO
SLOW or no change.

Connect breakout box to ECM harness leaving ECM disconnected. Check continuity between terminal 31 (front) (Gray) and [138B] (PKO), or terminal 32 (rear) (Gray) and [157B] (PK/GN). Is continuity present?

YES
Replace front or rear O2 sensor as indicated.

NO
Locate and repair open (PKO) or (PK/GN) wire.

YES
Repair fuel pressure problem.

NO
Check for air leaks at induction module. Are air leaks present?

YES
If no fuel pressure sensor codes are present, Replace fuel pump.

NO
Check for injectors stuck open. See 6.13 FUEL INJECTORS: DTC P0261, P0262, P0264, P0265.

YES
Replace original O2 sensor and replace ECM. Road test again to verify repair.

NO
Install original O2 sensor and replace ECM. Road test again to verify repair.

Replace O2 sensor. Clear DTCs and road test. Did check engine lamp illuminate and set DTC P0131, P0132, P0134, P0151, P0152, or P0154?

YES
Repair as necessary.

NO
System operating normally.
DESCRIPTION AND OPERATION

See Figure 6-45. The ECM controls engine idle speed by moving the IAC motor to open or close a passage around the throttle plates. It does this by sending voltage pulses to the proper motor winding of the IAC motor, causing the pintle to move in or out of the IAC motor a given distance for each pulse received. Refer to Table 6-23.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.

The IAC motor position in steps can be observed by using the Onboard Diagnostic Information System (ODIS). See 4.1 INSTRUMENT CLUSTER AND GAUGES.

- A high number of steps represents a retracted pintle and an open passage around throttle plates. This correlates with an increase in the amount of air flowing through the throttle body.
- Five steps represents a fully extend pintle. A five reading indicates an abnormal condition in which the pintle has been fully extended and has consequently closed the passage around the throttle plates.

Each time the ignition switch is turned ON, the ECM resets the IAC motor by sending enough pulses to extend the pintle and effectively close the passage around the throttle plates. The fully extended value is the ECM reference point. A given number of steps are then calculated by the ECM for use in setting the proper idle speed and IAC position.

Table 6-23. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0506</td>
<td>Idle Air Control system - RPM higher than expected</td>
</tr>
<tr>
<td>P0507</td>
<td>Idle Air Control system - RPM lower than expected</td>
</tr>
<tr>
<td>P0511</td>
<td>Idle Air Control circuit fault</td>
</tr>
</tbody>
</table>

Diagnostic Tips

When the ignition is keyed ON, the IAC motor pintle extends and then retracts to a fixed position for increased airflow and idle speed during the engine start sequence. This ON reset procedure takes 2 seconds to perform.

Test lamp behavior may follow two patterns. The color of the lights is not relevant to IAC motor operation:

- Normal behavior: At ignition switch ON, test lights alternately flash to confirm ECM signals.
- Problem indicated: One or more lights fail to illuminate during ignition switch ON/OFF cycle.

Engine idle speed can be adversely affected by the following:

- A loss of idle speed control does not necessarily imply the IAC motor or wiring has failed. It can be caused by a number of conditions such as an intake air leak, improperly adjusted throttle stop (factory set) or a misfiring cylinder.

- Leaking injectors cause fuel imbalance and poor idle quality due to different air/fuel ratios in each cylinder. To check for leaky injectors, first remove the air cleaner. Refer to Air Cleaner in the service manual. Turn key ON for two seconds, five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores. See the service manual.

- To confirm IAC function, disconnect the fuel pump. Turn engine stop and ignition switch on and listen for IAC
movement (clicking or humming noise) for a few seconds after the ignition switch is turned on.

- Vacuum leaks. To check for vacuum, see the service manual.
- Contaminated fuel.
- Excessive oil in crankcase (oil sumping).
- TP sensor reading of greater than 5% (possible throttle cable misadjustment) or battery voltage reading of less than 9 Volts will disable idle speed control.

---

**NOTE**

It is possible that one of the circuits is shorted to voltage which should have been indicated by a steady light. Disconnect the IAC connector and test for voltage at the harness terminals with the ignition switch ON, after IAC has reset.

**Connector Information**

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-46. Neutral and Clutch Switches, IAC, and Fuel Pump
DTCs P0506, P0507, and P0511 (Part 1 of 2)

Remove air cleaner cover and element.
Is throttle valve completely closed?

YES

Remove the throttle body to observe IAC pinhole operation. Monitor IAC pinhole for two seconds after turning ignition switch ON. Does pinhole extend and then retract during two-second ignition switch ON reset procedure?

YES

Check intake manifold for leaks. See Intake Leak Test. Are leaks present?

YES

Inspect fuel pressure within Onboard Diagnostic Information System. See 4.1 INSTRUMENT CLUSTER AND GAUGES.

NO

Lubricate and adjust throttle cables.

NO

Disconnect IAC motor and connect test lamp. Turn ignition switch ON for two seconds, then turn ignition switch OFF. Check test lamp during ignition switch ON/OFF cycle.

Problem indicated.

NO

Normal behavior.

Repair faulty IAC connection or replace IAC motor assembly.

Remove test lamp. Connect Breakout Box (Part No. B-48115) to connector [10B] leaving the ECM disconnected. Is battery voltage present on terminal 17 (Black)?

YES

Measure resistance of the wires between IAC motor connector [898] and corresponding Breakout Box connector [11]. Does resistance on each wire measure 0.5 Ohms or less?

YES

Turn ignition switch ON. With ECM still disconnected, check voltage on all four terminals at connector [898]. Is voltage present?

YES

Locate and repair short to voltage.

NO

Go to DTCs P0506, P0507, and P0511 (Part 2 of 2).
DTCs P0506, P0507, and P0511 (Part 2 of 2)

Continued from DTCs P0506, P0507, and P0511 (Part 1 of 2).

Turn ignition switch OFF. Measure resistance between each terminal on connector [896] and ground. Is resistance greater than 1 megohm for all terminals?

YES

Check continuity between IAC wires with harness isolated. Is continuity present?

NO

Locate and repair short to ground.

YES

Repair shorted IAC wires.

NO

Inspect ECM connections. Are connections OK?

YES

Replace ECM.

NO

Repair ECM connections.
DESCRIPTION AND OPERATION

Cooling Fan
An ECT sensor signal, indicating the engine coolant temperature is above a preset temperature, causes the ECM to command the fans on. The cooling fans run continuously once the engine operating temperature is reached. The cooling fans are provided battery voltage from the (Y/BN) wire. The ECM controls the fan by providing ground. When the ignition is off, the fans may run for approximately two and a half minutes depending on the temperature of the vehicle when ignition was turned off. Refer to Table 6-24.

Table 6-24. Cooling Fan Specifications

<table>
<thead>
<tr>
<th>KEY</th>
<th>FAN ON</th>
<th>FAN OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>170 °F (77 °C)</td>
<td>160 °F (71 °C)</td>
</tr>
<tr>
<td>OFF</td>
<td>189 °F (87 °C)</td>
<td>169 °F (76 °C)</td>
</tr>
</tbody>
</table>

DTCs occur when the ECM detects an open or short in the fan driver circuits. DTCs can also set if the ECM detects high current when the fans are turned on. This can be caused by blocked fan blades or a fan motor issue. Refer to Table 6-25 for possible DTCs.

Table 6-25. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0691</td>
<td>Right fan control circuit low</td>
</tr>
<tr>
<td>P0692</td>
<td>Right fan control circuit high</td>
</tr>
<tr>
<td>P0693</td>
<td>Left fan control circuit low</td>
</tr>
<tr>
<td>P0694</td>
<td>Left fan control circuit high</td>
</tr>
</tbody>
</table>

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-47. CKP, ECT, IAT, O2 sensors, and Cooling Fans
**DTCs P0691 and P0692 (Part 1 of 2)**

Does right fan run continuously?

**YES**

Disconnect connector [10] (Black) at ECM. Turn ignition switch ON.

Does right fan run?

**YES**

Repair short to ground in (BKGO) wire between EDM and right fan.

**NO**

Go to DTCs P0691 and P0692 (Part 2 of 2):

Is engine hot?

**NOTE**

Fan operates when engine coolant temperature exceeds 170°F (77°C).

**YES**


**YES**

Connect connector [10] (Black), and turn ignition switch ON. Does the right fan run continuously?

**NO**

See 6.16 ENGINE COOLANT TEMPERATURE (ECT): DTC P0117, P0118 and retest.

**NO**

Detective ECM or ECM connection.

**System operating normally.**
DTCs P0691 and P0692 (Part 2 of 2)

Continued from DTCs P0691 and P0692 (Part 1 of 2).

Check fan fuse (10 Amp),
Is fuse ok?

- **YES**
  - Connect Breakout Box (Part No. B-48115) to ECM connector [10] (Black) (leave ECM disconnected). With ignition switch ON, check for voltage at Breakout Box terminals 2 and 3. Is battery voltage present?
    - **YES**
      - Connect jumper wire between ground and the following Breakout Box connector [10] (Black) terminals 2 and 3. Does the right fan run?
        - **YES**
          - Replace ECM.
        - **NO**
          - **NO**
    - **NO**
      - With ignition switch ON, check for battery voltage at [97B] terminal 1 right fan connector. Is battery voltage present?
        - **YES**
          - **YES**
            - Check for continuity between Breakout Box connector [10] (Black) terminals 2 and 3 and Terminal 5 of [97B]. Is continuity present?
              - **YES**
                - Locate and repair open in circuit between right fan connector [97B] (Y/BN) wire and fuse block.
              - **NO**
                - **NO**
                  - **NO**
        - **NO**
          - **NO**
    - **NO**
      - Repair short to ground in (Y/BN) wire.
      - Is there an obstruction preventing the right cooling fan from rotating?
        - **YES**
          - Disconnect connector [97]. Measure resistance between terminal 1 and terminal 2 of connector [97A]. Is resistance greater than 1 Ohm?
        - **NO**
          - **NO**
    - **NO**
      - **NO**

- **NO**
  - Disconnect fan connector [97]. Check for continuity to ground between fuse block terminal 4 and chassis ground. Is continuity present?
    - **YES**
      - **YES**
        - Repair short to ground in (Y/BN) wire.
      - **NO**
        - **NO**
    - **NO**
      - **NO**

Disconnect right fan harness at the fan. Place a jumper wire between terminal 1 and 2 of [97A] and battery positive (+). Place a jumper between terminal 2 of [97A] and ground. Does the right fan run at full speed?

- **YES**
  - System operating normally.
- **NO**
  - Replace right fan.
DTCs P0693 and P0694 (Part 1 of 2)

Does left fan run continuously?

YES

Disconnect connector [10] (Black) at ECM. Turn ignition switch ON. Does left fan run?

NO

Go to DTCs P0693 and P0694 (Part 2 of 2).

YES

Repair short to ground in (Y/O) wire between ECM and left fan.

NO

Is engine hot?

NOTE
Fan operates when cylinder head temperature exceeds 170° F (77° C).

YES


NO

Connet connector [10] (Black) and turn ignition switch ON. Does the left fan run continuously?

YES

Repair ECM connector or replace ECM.

NO

System operating normally.

See 6.16 ENGINE COOLANT TEMPERATURE (ECT); DTC P0117, P0118 and retest.
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: DTC P0107, P0108

DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-23738</td>
<td>VACUUM PUMP</td>
</tr>
</tbody>
</table>

See Figure 6-48. The MAP sensor is supplied 5 Volts from the ECM and sends a signal back to the ECM. The signal varies with engine vacuum (more vacuum, lower signal output) and atmospheric barometric pressure. Barometric pressure is influenced by weather and altitude.

Table 6-26. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0107</td>
<td>MAP sensor low/open</td>
</tr>
<tr>
<td>P0108</td>
<td>MAP sensor high</td>
</tr>
</tbody>
</table>

Diagnostic Tips

Codes set if the MAP sensor is out of range. P0108 can only be set when the engine is running. The MAP sensor uses the same power circuit as the fuel pressure, barometric, sidestand, and throttle position sensors. Therefore, if the 5 V power circuit is open or shorted to ground, other codes set. Refer to Table 6-26 for DTCs applicable to the MAP sensor.

NOTE

Do not over-pump vacuum pump when performing the MAP sensor output check. Sensor damage could result.

Use a VACUUM PUMP (Part No. HD-23738) to apply a vacuum to the pressure port of the sensor. The signal voltage should drop as vacuum is increased.

Figure 6-48. MAP Sensor Location

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-49. 5V Reference Circuit
DTCs P0107 and P0108 (Part 1 of 2)

Connect Breakout Box (B-481150). With ignition ON, measure voltage between Breakout Box connector [11] (Gray) terminals 8 and 27. Is voltage between 3.5-5.0 Volts with engine not running and 1.5-3.0 Volts at hot idle?

YES
Perform wiggle test to check for intermittents. See 1.3 DIAGNOSTICS/ TROUBLESHOOTING. Are intermittents present?

YES
Identify the source of intermittents and repair as necessary.

NO
Replace MAP sensor, Perform road test. Did check engine lamp illuminate and set DTC P0107 or P0108?

YES
Replace ECM, Road test to verify repair.

NO
System operating normally.

NO
Go to DTCs P0107 and P0108 (Part 2 of 2).
DTCs P0107 and P0108 (Part 2 of 2)

Continued from DTCs P0107 and P0108 (Part 1 of 2).

Disconnect connector [80]. Removal of throttle body is necessary to access connector. With ignition ON, measure voltage between terminal 1 (R/W) and terminal 2 (BK/W) of [80A]. Is voltage approximately 5.0 Volts?

**NO**

Greater than 6V.

Connect Breakout Box to [11B] leaving ECM disconnected. Measure resistance between MAP sensor connector [80B] terminal 3 and Breakout Box terminal 6 (Gray). Is resistance less than 1 Ohm?

**YES**

Measure the resistance between MAP sensor connector [80B] terminal 3 and chassis ground. Is resistance greater than 1 megohm?

**YES**

Replace MAP sensor.

**NO**

Locate and repair grounded (V/GEN) wire.

Locate short to 12 Volts on (R/W) wire in wire harness. Repair as necessary.

**NO**

Less than 4.5V.

Connect Breakout Box to [11B] leaving ECM disconnected. Check continuity between MAP connector [80B] terminal 1 and Breakout Box terminal 24 (Gray). Then measure continuity between MAP sensor connector [80B] terminal 2 and Breakout Box terminal 27 (Gray). Is resistance less than 1 Ohm?

**NO**

Locate and repair short between (R/W) and (BK/W) wires.

**YES**

Check resistance between Breakout Box terminals 24 and 27 (gray). Is resistance greater than 1 megohm?

**YES**

Replace ECM.

**NO**

Locate and repair open wire.
DESCRIPTION AND OPERATION
See Figure 6-50. The DTCs set if the ECM detects battery positive voltage less than 9.6 Volts or greater than 16 Volts. Refer to Table 6-27 for DTC descriptions.

- A low voltage condition typically occurs during the first 10 seconds of starter activation and the ECM does not detect a voltage rise as engine RPM increases. This could also indicate a charging system fault and loose wire connections.
- A high voltage condition is usually caused by a faulty voltage regulator.

Table 6-27. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0562</td>
<td>Battery voltage low</td>
</tr>
<tr>
<td>P0563</td>
<td>Battery voltage high</td>
</tr>
</tbody>
</table>

Diagnostic Tips
This test checks for voltage drops in the ECM power circuit. If a significant voltage drop is not present, the condition may be caused by excessive starter current draw.

Figure 6-50. Under Seat

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-51. ECM Power and Ground
DTCs P0562 and P0563

See 3.4 BATTERY TESTING. Perform battery and charging system tests. Is the battery and charging system OK?

YES

Repair charging system or replace battery.

NO

Disconnect fuel pump connector [86] to purge fuel from system. Attach Breakout Box [5-48115] to ECM. Measure voltage at Breakout Box connector [10] (Black) terminal 9 and ground, while cranking engine. Disregard voltage during first two seconds of cranking. Is voltage above 9.8 Volts?

YES

Measure voltage drop between battery positive terminal (+) and Breakout Box connector [10] (Black) terminal 9 with ignition switch ON. Is voltage drop greater than 0.5 Volt?

YES

Locate and repair poor connection between terminal 9 of ECM connector [10] and P/Y wire at starter solenoid.

NO

Check for excessive starter current draw. See 3.2 TESTING STARTER ON MOTORCYCLE.
DESCRIPTION AND OPERATION

See Figure 6-52. The active intake system uses a solenoid, which is connected to the throttle valve via a cable. The throttle valve is automatically closed by the solenoid under certain conditions to reduce engine noise. Refer to Table 6-28 for DTCs that set if the ECM detects the output for the active intake control is not in agreement with the feedback circuit (minimum TP sensor voltage when actuated).

Likely causes for a DTC are:

- Mechanical fault in the active intake solenoid, throttle valve, or cable.
- Electrical fault in the solenoid circuit.
- Electrical fault in the throttle position sensor circuit.
- TPS reading not changing to low voltage when the solenoid is activated.

### Table 6-28. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1110</td>
<td>Active intake control circuit short low/open</td>
</tr>
<tr>
<td>P1111</td>
<td>Active intake control circuit short high</td>
</tr>
<tr>
<td>P1112</td>
<td>Active intake control throttle position sensor feedback failure</td>
</tr>
</tbody>
</table>

Connector Information

For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.

![Active Intake Solenoid and Connector Location](wed01782)

1. Active Intake Solenoid Connector [178]
2. Active Intake Solenoid
DTCs P1110, P1111, and P1112 (Part 1 of 2)

Are the active intake system moving parts pinched, stuck, or binding?

- **YES**
  - Repair as needed.

- **NO**
  - Remove the active intake solenoid connector [178A] and inspect connections. Are all connections tight and free of corrosion?
    - **YES**
      - Disconnect active intake solenoid [178A] at the solenoid. Measure voltage at terminal 2 with the ignition switch ON and the engine stop switch to RUN. Is battery voltage present?
        - **YES**
          - Measure voltage at [178A] terminal 1 (GY/O). Is battery voltage present?
            - **YES**
              - Locate and repair short to voltage on (GY/O) wire.
            - **NO**
              - Connect breakout box to ECM harness leaving ECM disconnected. Measure continuity between connector [178A] terminal 1 and [16B] terminal 10. Is continuity present?
                - **YES**
                  - Go to DTCs P1110, P1111, and P1112 (Part 2 of 2).
                - **NO**
                  - Locate and repair open in (GY/O) wire.
        - **NO**
          - Disconnect ECM connector [16] (Black). Measure continuity to ground from connector [178A] socket terminal 2. Is continuity present?
            - **YES**
              - Locate and repair short to ground (GY) wire.
            - **NO**
              - Measure continuity from ignition relay [62] terminal 87 to connector [178B] terminal 2. Is continuity present?
DTCs P1110, P1111, and P1112 (Part 2 of 2)

**Continued from DTC P1110, P1111, and P1112 (Part 1 of 2).**

Measure the resistance from active intake solenoid terminal 1 to terminal 2 [176B]. Is resistance less than 4.0 Ohms?

*NOTE*

*Use Harness Test Kit (Part No. HD-41404). See 1.2 DIAGNOSTIC TOOLS.*

**YES**

**NO**

Connect battery voltage to [176B] terminal 2 of active intake solenoid. Hold throttle wide open. Observe throttle plate and connect active intake solenoid terminal 1 to ground. Does the active air intake solenoid attempt to pull throttle almost closed?

*NOTE*

*Use Harness Test Kit (Part No. HD-41404). See 1.2 DIAGNOSTIC TOOLS.*

**YES**

**NO**

Hold throttle wide open. Energize active intake solenoid. Does throttle close to an angle less than 11 degrees?

**YES**

**NO**

Replace active intake solenoid.

Replace active intake solenoid.

**Replace ECM.**

See Cable Adjustment in service manual.
DESCRIPTION AND OPERATION

PART NUMBER | TOOL NAME
--- | ---
HD-26792 | SPARK TESTER

If the starter will not crank engine, the problem is not ignition related. See 3.1 STARTING SYSTEM DIAGNOSTICS.

Diagnostic Tips

There may be trouble codes associated with this problem. Check for DTCs and clear them before proceeding to Spark and Fuel Injector tests.

Spark Plug Cleaning

If the engine is run repeatedly for short periods of time, the spark plugs can become fouled. The ECM monitors recent run events, and enables Spark Plug Cleaning if two out of the last four run events did not bring the engine to operating temperature. When the ECM enters Spark Plug Cleaning mode, it alternately rapid fires the spark plugs when the ignition switch is turned ON. This mode can also be manually enabled by holding the throttle wide open and turning the ignition ON.

Spark Test

1. Remove ignition coil from spark plug.
2. Visually check condition of plug and ignition coil.
3. See Figure 6-54. Attach ignition coil to SPARK TESTER. Clip tester to cylinder head bolt.

**NOTE**
Cranking the engine with the SPARK TESTER (Part No. HD-26792) in place of an ignition coil can sometimes cause DTC P2300, P2301, P2303, or P2304 to set. This condition is normal and does not by itself indicate a malfunction. Codes must be cleared if this condition occurs.

4. While cranking starter, look for spark.
5. Repeat procedure on other ignition coil.

**NOTE**
Engine will not spark with spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

If spark is evident, check the actual spark plugs for problems (cracks, open electrode, inoperative insulator, and others). Replace questionable spark plugs.

Fuel Injector Test

**WARNING**
To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge fuel line of high pressure gasoline.
Engine Cranks But Will Not Start (Part 2 of 2)

Continued from Engine Cranks But Will Not Start Test (Part 1 of 2):
Check spark plug condition. Replace if fouled. Check spark at both plugs while cranking.
Is spark present?

**YES**
- Disconnect fuel injector connectors [84] and [85] and attach Fuel Injector Test Lamp (HD-34730-2C). Check each connector while cranking the engine. Does the lamp flash?
  **YES**
  - Check engine compression.
  **NO**
  - See DTC P0261, P0262, P0264, and P0235.

**NO**
- Using DVOM, check for battery voltage at ignition coils [85P] and [83R] terminal 3. Power present after ignition switch is ON?
  **YES**
  - Connect Breakout Box to the ECM and use test adapter for testing ignition coils. Perform Ignition Coils, DTCs P2300, P2301, P2303, and P2304 tests. Do ignition coils pass tests?
    **YES**
    - See DTC P0337, P0338, and P0338. Did the CKP sensor pass the test?
      **YES**
      - If problem persists, source is most likely mechanical rather than electrical.
      **NO**
      - Repair as indicated by results of CKP sensor test.
    **NO**
    - Repair as indicated by results of ignition coil test.
  **NO**
  - Loosten and repair open in (GY) wire between ignition relay terminal 87 and ignition coil.
STARTS, THEN STALLS

DESCRIPTION AND OPERATION
The starts, then stalls condition may be created by the fuel system, the idle air control system or an ECM failure.

There may be DTCs set causing this condition. Solve the problems with the DTCs before performing the tests in this section. The DTCs that may be involved with starts, then stalls are:

- Fuel injectors: DTCs P0261, P0262, P0264, and P0265
- Fuel pump: DTCs P0628 and P0629
- Fuel pressure sensor: DTCs P0087, P0192, and P0193
- Ignition coils: DTCs PP2300, P2301, P2303, and P2304
- Idle air control actuator: DTCs P0506, P0507, and P0511
- All modes: DTCs P0603, P0604, P0605, and P0607

Diagnostic Tips
The vehicle will stall on HDI models, if the sidestand is extended when the transmission is in gear and the clutch is released.

Connector Information
For additional information on the connectors in the following diagram(s), see B.1 CONNECTORS.
Figure 6-56. 5V Reference Circuit
Figure 6-57. Neutral and Clutch Switches, IAC, and Fuel Pump
Engine Starts Then Stalls

Fresh fuel in fuel tank?

YES
Check for DTCs. See 2.1 INITIAL DIAGNOSTICS. Are DTCs found?

YES
Refer to applicable DTC chart. Start tests with the highest priority DTC.

NO
Add fuel.

With ignition switch ON and run/stop switch in RUN, sidestand up, transmission in neutral (lamp illuminated), does the engine start and stay running?

YES
See 6.11 CLUTCH AND NEUTRAL SWITCHES: DTC P1154, P1156. Is it a clutch switch or neutral switch problem?

NO
See 6.23 IDLE AIR CONTROL (IAC) DTC P0506, P0507, and P0511.

YES
Repair circuitry or replace clutch or neutral switches.

NO
Will engine start with throttle opened partially and stall when throttle is closed?

YES
Check fuel pressure while cranking engine. Is fuel pressure OK?

NO
See 6.19 FUEL PRESSURE SENSOR: DTC P0192, P0193, P0087, and perform the steps in the flowcharts.

YES
Replace fuel injectors. Does the problem still exist?

NO
System operating normally.

YES
Replace ECM.

NO
System operating normally.
MISFIRE AT IDLE OR UNDER LOAD

DESCRIPTION AND OPERATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-26792</td>
<td>SPARK TESTER</td>
</tr>
<tr>
<td>YA840</td>
<td>IN-LINE SPARK TESTER</td>
</tr>
</tbody>
</table>

Misfire conditions may be caused by:
- Battery condition and connections.
- Fuel system problems. Refer to tables in 2.1 INITIAL DIAGNOSTICS.
- Ignition system faults.

Diagnostic Tips

If the engine is run repeatedly for short periods of time, the spark plugs can become fouled. The ECM monitors recent run events, and enables Spark Plug Cleaning if two out of the last four run events did not bring the engine to operating temperature. When the ECM enters Spark Plug Cleaning mode, it alternately rapid fires the spark plugs when the ignition switch is turned ON. This mode can also be manually enabled by holding the throttle wide open and turning the ignition to ON.

WARNING

Wipe up spilled fuel and dispose of rags in a suitable manner. An open spark around gasoline could cause a fire or explosion, resulting in death or serious injury. (00518b)

Spark Test

See Figure 6-58. Use SPARK TESTER (Part No. HD-26792) to verify adequate spark. Perform the following protest:

1. Turn ignition switch OFF.
2. Remove rear ignition coil and spark plug. Visually check plug condition. Check the spark plug and ignition coil for carbon tracking. If evident, replace spark plug(s) or ignition coil as required.
3. Attach spark tester to ignition coil. Clip tester to cylinder head bolt.
4. While cranking engine, watch for spark to jump spark tester gap on leads.
5. Reinstall and repeat procedure on front ignition coil and spark plug.

NOTE

Engine will not spark with spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

When performing the steps in the flowcharts, a known good part can be used to verify whether a suspected part is faulty. The ignition coils do not require full installation to be functional. Verify faulty ignition coil by performing resistance test. See 6.12 IGNITION COILS: DTC P2300, P2301, P2303, P2304.

In-line Spark Tester

See Figure 6-59. The use of a SNAP-ON IN-LINE SPARK TESTER (Part No. YA840), or equivalent, can help determine whether the problem exists in the ignition or fuel systems.

1. Turn ignition switch OFF.
2. Remove ignition coil and install SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) between coil and spark plug.
3. Start engine and inspect tester light. The light will flash on each spark event if power is transmitted to the plug.
4. Reinstall and repeat procedure on front ignition coil and spark plug.

If the tester lamp flashes without interruption on both cylinders during the misfire event, verify spark plug condition and gap, and inspect the fuel system for proper operation. If the test lamp does not flash, or the flash is interrupted during the misfire event, the problem is ignition related.

NOTE

An SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) can also be used in conjunction with a load-able dynamometer to diagnose misfire under load.
Misfire at Idle or Under Load

Is fuel contaminated?

YES

Drain and flush fuel tank. Refill with fresh fuel.

NO

Perform Spark Test. Did spark jump also at both coils?

Check for:
- Faulty, worn or cracked spark plug(s)
- Spark plug gap too great
- Spark plug fouling due to engine mechanical fault
- Faulty or poor connection at spark plug(s)
- Loose wires on primary side of ignition coils
- Intermittent ECM operation (power input and output)

YES

Exchange ignition coil with known good unit. Perform spark test. Did spark jump gap during engine cranking?

NO

Replace faulty ignition coil(s) and spark plugs.

YES

Original ignition coil is faulty. Replace.

NO

Test the CKP sensor to verify signal. Is the CKP sensor signal present?

YES

If problem persists, source is most likely mechanical rather than electrical.

NO

Repair as indicated by results of crank position sensor test and recheck problem.
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 AMP MULTILOCK CONNECTORS</td>
<td>A-1</td>
</tr>
<tr>
<td>A.2 DELPHI CONNECTORS</td>
<td>A-5</td>
</tr>
<tr>
<td>A.3 DEUTSCH ELECTRICAL CONNECTORS</td>
<td>A-7</td>
</tr>
<tr>
<td>A.4 DEUTSCH STANDARD TERMINAL REPAIR</td>
<td>A-11</td>
</tr>
<tr>
<td>A.5 METRI-PACK TERMINALS</td>
<td>A-12</td>
</tr>
<tr>
<td>A.6 150 METRI-PACK CONNECTORS</td>
<td>A-14</td>
</tr>
<tr>
<td>A.7 280 METRI-PACK CONNECTORS</td>
<td>A-16</td>
</tr>
<tr>
<td>A.8 480 METRI-PACK CONNECTORS</td>
<td>A-18</td>
</tr>
<tr>
<td>A.9 630 METRI-PACK CONNECTORS</td>
<td>A-19</td>
</tr>
<tr>
<td>A.10 MOLEX CONNECTORS</td>
<td>A-20</td>
</tr>
<tr>
<td>A.11 SEALED SPLICE CONNECTORS</td>
<td>A-22</td>
</tr>
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AMP MULTILOCK CONNECTOR REPAIR

<table>
<thead>
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<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41609</td>
<td>AMP MULTILOCK CRIMPER</td>
</tr>
<tr>
<td>TT600-3</td>
<td>SNAP-ON PICK</td>
</tr>
</tbody>
</table>

General

AMP MultiLock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-1. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-1. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.

Removing Terminals from Housing

1. See Figure A-2. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

If socket/pin terminal tool is not available, a push pin/safety pin or a SNAP-ON PICK (Part No. TT600-3) may be used.

4. Press the tang in the housing to release the terminal.
   a. **Socket**: Lift the socket tang (8) up.
   b. **Pin**: Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.
NOTES

- Up and down can be determined by the position of the release button, the button is the top of the connector.
- On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.
- On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.

2. Gently tug on wire end to verify that the terminal is locked in place.

3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

---

**Inserting Terminals into Housing**

**NOTE**

See Figure A-3. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

---

**Preparing Wire Leads for Crimping**

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.
1. See Figure A-6. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).

2. Raise locking bar by pushing up on bottom flange (2).

**NOTE**
See Figure A-4 and Figure A-5. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-6. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.

4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.

5. Insert stripped end of lead (5) until ends make contact with locking bar.

6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.

7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

8. Raise up locking bar (7) and remove crimped terminal.

---

**Crimping Terminals to Leads**

*NOTE*
Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.
Inspecting Crimped Terminals

See Figure A-7. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.

Figure A-7. AMP Multilock Connector: Terminal Crimp

1. Insulation crimp
2. Wire core crimp

1. Open position
2. Locking bar flange
3. Insert contact
4. Release locking bar
5. Insert lead
6. Squeeze
7. Raise locking bar
8. Remove crimped terminal

Figure A-6. AMP Multilock Connector: Terminal Crimping Procedure
DELPHI CONNECTORS

DELPHI CONNECTOR REPAIR

General
Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings
See Figure A-8. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings
Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE
Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector (139B), the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.6 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-9. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

Installing Socket Terminals

NOTE
For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels inside chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.
1. Remove wire lock
2. Remove terminal lock
3. Pry tang outward

Figure A-9. Delphi Connector: Removing Socket Terminals
DEUTSCH ELECTRICAL CONNECTORS

DEUTSCH CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41475</td>
<td>DEUTSCH CONNECTOR SERVICE</td>
</tr>
<tr>
<td></td>
<td>KIT</td>
</tr>
<tr>
<td>HD-41475-100</td>
<td>FLAT BLADE L-HOOK</td>
</tr>
</tbody>
</table>

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with left side accessories, such as the front and rear left turn signals, are gray. All other connectors, including those associated with right side accessories, are black.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

See Figure A-10. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

NOTES

- Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.
- Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.
- Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. For One External Latch: Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
   b. For Two External Latches: (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
   For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.

Figure A-10. Deutsch Connector

Removing Socket Terminals

1. See Figure A-11. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-14. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

If wire leads require new terminals, see the instructions for crimping terminals.

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-13. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.
5. Install internal seal (4) on lip of socket housing, if removed.

6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

**NOTES**

- See Figure A-12. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.

- If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.

Figure A-11. Deutsch Connector: Remove Secondary Locking Wedge

Figure A-12. Deutsch Connector: 3-Place Locking Wedges
Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.

2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

   **NOTES**
   
   - If wire leads require new terminals, see the instructions for crimping terminals.
   - If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.

   - When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

   **NOTES**
   
   - The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.

   - See Figure A-12. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.

   - If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed or not entering its fully installed position.

Installing Pin Terminals

1. See Figure A-15. Fit wire seal (1) into back of pin housing (2).

2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

   **NOTE**
   
   A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

   **NOTES**
   
   - The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.

   - See Figure A-12. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.

   - If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.
Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

1. Wire seal
2. Pin housing
3. Pin terminal
4. Locking wedge

Figure A-15. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Table A-2. Deutsch Connector: Terminal Crimping Instructions

<table>
<thead>
<tr>
<th>TYPE</th>
<th>CRIMPING INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (with crimp tails)</td>
<td>A.4 DEUTSCH STANDARD TERMINAL REPAIR</td>
</tr>
</tbody>
</table>
DEUTSCH STANDARD TERMINAL CRIMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-39965-A</td>
<td>DEUTSCH TERMINAL CRIMP TOOL</td>
</tr>
</tbody>
</table>

Preparing Wire Leads for Crimping
1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead
1. See Figure A-16. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE
If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps
Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

<table>
<thead>
<tr>
<th>WIRE GAUGE (AWG)</th>
<th>CRIMP TOOL DIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Front</td>
</tr>
<tr>
<td>16-18</td>
<td>Middle</td>
</tr>
</tbody>
</table>

Figure A-16. Crimping a Deutsch Standard Terminal
METRI-PACK TERMINAL CRIMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-38125-6</td>
<td>PACKARD TERMINAL CRIMP TOOL</td>
</tr>
<tr>
<td>HD-38125-7</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
<tr>
<td>HD-38125-8</td>
<td>PACKARD CRIMPING TOOL</td>
</tr>
</tbody>
</table>

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads. Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-17. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

Metri-Pack terminal crimps require two steps. Always perform Crimping Wire Core before Crimping Insulation/Seal.

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized neat for the core crimp.
3. Position the core crimp in the die. Be sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.

Crimping Insulation/Seal

NOTE

Always perform Crimping Wire Core before Crimping Insulation/Seal.

1. See Figure A-18. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.

3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

**Inspecting Crimps**

1. See Figure A-18. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.

2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.

![Figure A-18. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps](image)

1. Wire core crimp
2. Insulation crimp
3. Seal crimp
150 METRI-PACK CONNECTOR REPAIR

General
Metri-Pack connectors are embossed with the initials (P.E.D.). There are two types of connectors in this series:
- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings
Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings
Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal
1. See Figure A-19 for pull-to-seat connector or Figure A-20 for push-to-seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

   NOTE
   For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

   NOTE
   The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
   a. For pull-to-seat: Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. For push-to-seat: There is a small opening for the pin.

4. When a click is heard, remove the pin and repeat the procedure.

   NOTE
   The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

   NOTE
   On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
   a. For pull-to-seat: Push on the lead to extract the terminal from the mating end of the connector.
   b. For push-to-seat: Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

   NOTE
   For wire location purposes, alpha characters are stamped into the socket housings.

   1. See Figure A-19 for pull-to-seat connector or Figure A-20 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.

   2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.

   3. Gently pull or push on the lead to verify that the terminal is locked in place.

   For push-to-seat: See Figure A-20. Seat wires in separate channels of wire lock and then push channels inside chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.
1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

Figure A-19. 150 Metri-Pack Connector: Pull-to-Seat

1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

Figure A-20. 150 Metri-Pack Connector: Push-to-Seat
280 METRI-PACK CONNECTOR REPAIR

General
See Figure A-21. Called Packard connectors, Metri-Pack series connectors are embossed with the initials (P.E.D.)

Separating Pin and Socket Housings
Depress the wireform and use a rocking motion to detach the socket connector half.

Mating Pin and Socket Housings
Align the groove in the socket housing with the tab in the pin housing. Push the pin and socket halves of the connector together until the latch clicks.

Removing Socket Terminals
1. See Figure A-22. Pry rubber seal from wire end of connector and move seal down wires (1) toward conduit. Hold the connector so that the wireform is facing down.
2. Looking into the wire end of the connector, insert the point of a safety pin (2) between the top of the terminal and the inside chamber wall.
3. Push safety pin completely into chamber while watching terminal on mating end of connector. When terminal is observed moving forward slightly, tang is depressed. Remove safety pin.

NOTE
Repeat as necessary until the terminal can be pushed out of the connector.

4. Push on wire end of the lead to extract the terminal from the mating end of the connector.
5. If necessary, crimp new terminals on wires. See A.5 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.

Installing Socket Terminals

NOTE
Terminal cavities are lettered on the socket housing. To match the wire lead colors to the terminal cavity, refer to the wiring diagram.

1. See Figure A-22. Using a thin flat blade, like a hobby knife (4), carefully bend the tang outward away from the terminal body.
2. Gently pull on the wire lead (5) to draw the terminal back into the chamber. The tang faces opposite the wireform as it enters the chamber.

NOTE
A "click" is heard when the terminal is properly seated.

3. Push on lead to verify that terminal is locked in place.
4. Fit rubber wire seal back into wire end of connector.

Crimping Terminals
If necessary, crimp new terminals on the wire leads. Refer to A.5 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.
1. Pry rubber seal from connector
2. Insert safety pin to depress tang
3. Push on lead to remove terminal
4. Raise tang with hobby knife
5. Pull on lead to draw terminal into chamber

Figure A-22. 280 Metri-Pack Connector: Remove/Install Socket Terminal
480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories. Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

See Figure A-23. An AFL housing (5) is used on many ignition/light switches. The secondary lock (4) must be opened before removing the terminal from the housing.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-23. Using small flat blade screwdriver, press button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

1. See Figure A-23. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.

2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.

3. Pivot the end of the pin toward the terminal body to press the tang.

4. Remove the pin and then pull terminal out of the wire end of connector housing.

5. If necessary, crimp new terminals on wires. See A.5 METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.

2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.

3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.

4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

If removed, install new anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.

Figure A-23. 480 Metri-Pack Connector: Remove Socket Terminal
### 630 METRI-PACK CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNAP-ON TT600-3</td>
<td>SNAP-ON PICK</td>
</tr>
</tbody>
</table>

#### General

Refused to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

#### Separating Pin and Socket Housings

**NOTE**

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

#### Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

**NOTE**

If removed, install connector on barbed anchor or other OE retaining device.

#### Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.

3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp new terminals on wires. Refer to A.5 METRI-PACK TERMINALS.

#### Installing Socket Terminal

**NOTE**

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
MOLEX CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48114</td>
<td>MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER</td>
</tr>
</tbody>
</table>

Separating Pin and Socket Housings
See Figure A-24. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings
1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals
1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
   a. **Socket Housing**: See Figure A-25. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
   b. **Pin Housing**: See Figure A-26. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

   **NOTE**
   Do not remove the secondary lock from the connector housing.

2. See Figure A-27. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
   a. **Socket Housing**: The pin holes are inside the terminal openings.
   b. **Pin Housing**: The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals
1. See Figure A-28. From the wiring diagram, match the wire color to its numbered terminal cavity.

   **NOTE**
   Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.
Figure A-26. Molex Connector: Secondary Lock D-Holes (Pin Housing)

Figure A-27. Molex Connector: Terminal Remover (HD-48114)

Figure A-28. Molex Connector: Pin Cavities and Wire Terminal

1. Cavity number
2. Tang
3. Cavity slot
SEALED SPLICE CONNECTORS

SEALED SPLICE CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-25070</td>
<td>ROBINAIR HEAT GUN</td>
</tr>
<tr>
<td>HD-38125-8</td>
<td>PACKARD CRIMPING TOOL</td>
</tr>
<tr>
<td>HD-39969</td>
<td>ULTRA TORCH UT-100</td>
</tr>
<tr>
<td>HD-41183</td>
<td>HEAT SHIELD ATTACHMENT</td>
</tr>
</tbody>
</table>

General
Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE
If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-4.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-4 for the strip length.

Table A-4. Sealed Splice Connectors

<table>
<thead>
<tr>
<th>WIRE GAUGE</th>
<th>COLOR</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20 (0.5-0.8 mm)</td>
<td>Red</td>
<td>70565-93</td>
<td>3/8 in. (9.5 mm)</td>
</tr>
<tr>
<td>14-16 (1.0-2.0 mm)</td>
<td>Blue</td>
<td>70566-93</td>
<td>3/8 in. (9.5 mm)</td>
</tr>
<tr>
<td>10-12 (3.0-5.0 mm)</td>
<td>Yellow</td>
<td>70567-93</td>
<td>3/8 in. (9.5 mm)</td>
</tr>
</tbody>
</table>

NOTE
If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE
See Figure A-30. The connector is crimped twice - one side and then the other.

1. See Figure A-29. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-30. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.

WARNING
Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/exlosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE
It is acceptable for the splice to rest against the heat shrink tool attachment.

Inspecting Seals
See Figure A-30. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.

Figure A-29. Packard Crimping Tool (HD-38125-8)
1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted sealant

Figure A-30. Sealed Splice Connector
**CONNECTOR LOCATIONS**

**Function/Location**
On the motorcycle, a connector can be identified by its function and location. Refer to Table B-1.

**Place and Color**
The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

**Connector Number**
On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

**Repair Instructions**
The repair instructions in Appendix A are by connector type. Refer to Table B-1.

### Table B-1. 2009 1125 Connector Locations

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>Electronic Control Module (ECM) (black)</td>
<td>34-place Amp (Tyco)</td>
<td>Inside left radiator shroud</td>
</tr>
<tr>
<td>[11]</td>
<td>Electronic Control Module (ECM) (gray)</td>
<td>34-place Amp (Tyco)</td>
<td>Inside left radiator shroud</td>
</tr>
<tr>
<td>[18]</td>
<td>Right rear turn signal</td>
<td>2 1-place bullet</td>
<td>Under tail section</td>
</tr>
<tr>
<td>[19]</td>
<td>Left rear turn signal</td>
<td>2 1-place bullet</td>
<td>Under tail section</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Amp (Tyco)</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[24]</td>
<td>Left hand controls</td>
<td>8-place Amp (Tyco)</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[31R]</td>
<td>Right front turn signal</td>
<td>2 1-place bullet</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[31L]</td>
<td>Left front turn signal</td>
<td>2 1-place bullet</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Amp (Tyco)</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp connector</td>
<td>6-place Deutsch</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument cluster</td>
<td>20-place Amp (Tyco)</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[45]</td>
<td>License plate lamp</td>
<td>2 1-place bullet</td>
<td>Under tail section</td>
</tr>
<tr>
<td>[46]</td>
<td>Stator</td>
<td>4-place Deutsch</td>
<td>Under seat</td>
</tr>
<tr>
<td>[61]</td>
<td>Fuse block</td>
<td>Socket terminals</td>
<td>Under seat</td>
</tr>
<tr>
<td>[62]</td>
<td>Relay block</td>
<td>Spade terminals</td>
<td>Under seat</td>
</tr>
<tr>
<td>[65]</td>
<td>Vehicle Speed Sensor (VSS)</td>
<td>3-place Deutsch</td>
<td>Under seat</td>
</tr>
<tr>
<td>[77]</td>
<td>Voltage regulator</td>
<td>2-place Dekko</td>
<td>Under seat</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>2-place Amp (Tyco)</td>
<td>Inside left radiator shroud</td>
</tr>
<tr>
<td>[80]</td>
<td>Manifold Absolute Pressure (MAP) sensor</td>
<td>3-place Bosch</td>
<td>Under throttle body, between cylinders</td>
</tr>
<tr>
<td>[83F]</td>
<td>Front ignition coil</td>
<td>3-place Bosch</td>
<td>Front cylinder head</td>
</tr>
<tr>
<td>[83R]</td>
<td>Rear ignition coil</td>
<td>3-place Bosch</td>
<td>Rear cylinder head</td>
</tr>
<tr>
<td>[84]</td>
<td>Front fuel injector</td>
<td>2-place Sumitomo</td>
<td>Front intake flange</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear fuel injector</td>
<td>2-place Sumitomo</td>
<td>Rear intake flange</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel pump</td>
<td>4-place Delphi</td>
<td>Right side of frame</td>
</tr>
<tr>
<td>[87]</td>
<td>Idle Air Control (IAC)</td>
<td>4-place Delphi</td>
<td>Left side of throttle body</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position (TP) sensor</td>
<td>3-place Bosch</td>
<td>Left side of throttle body</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature (IAT) sensor</td>
<td>2-place Amp (Tyco)</td>
<td>Left side of intake snorkel</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Coolant Temperature (ECT) sensor</td>
<td>2-place Bosch</td>
<td>Front cylinder head, under throttle body</td>
</tr>
<tr>
<td>[91A]</td>
<td>Data link connector</td>
<td>4-place Deutsch</td>
<td>Behind left radiator shroud</td>
</tr>
<tr>
<td>[93]</td>
<td>Tail/stop lamp</td>
<td>2-place Amp (Tyco) and 1-place Amp (Tyco)</td>
<td>Back of tail lamp, under tail section</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Sumitomo</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[97]</td>
<td>Cooling fan #1 (right)</td>
<td>2-place Sumitomo</td>
<td>Inside right radiator shroud</td>
</tr>
<tr>
<td>[120]</td>
<td>Oil pressure switch</td>
<td>Spade terminal</td>
<td>Right side of engine</td>
</tr>
<tr>
<td>[121]</td>
<td>Rear brake switch</td>
<td>2-place Amp (Tyco)</td>
<td>Right side forward of rear wheel</td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>TYPE</td>
<td>LOCATION</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn</td>
<td>2 1-place Fargo</td>
<td>Behind left radiator shroud, under fan</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>2-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place slotted spade</td>
<td>Under sprocket cover</td>
</tr>
<tr>
<td>[133]</td>
<td>Sidestand sensor</td>
<td>3-place Deutsch</td>
<td>Under sprocket cover</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank Angle Sensor (BAS)</td>
<td>6-place Sumitomo</td>
<td>Inside left radiator shroud</td>
</tr>
<tr>
<td>[137]</td>
<td>Oxygen sensor, rear</td>
<td>1-place Delphi</td>
<td>Right side of engine, above water pump</td>
</tr>
<tr>
<td>[138]</td>
<td>Oxygen sensor, front</td>
<td>1-place Delphi</td>
<td>Behind right fan</td>
</tr>
<tr>
<td>[145]</td>
<td>Interface connector</td>
<td>20-place Molex</td>
<td>Behind left radiator shroud</td>
</tr>
<tr>
<td>[160]</td>
<td>12V Auxiliary Connector</td>
<td>2-place Sumitomo</td>
<td>Behind fairing</td>
</tr>
<tr>
<td>[170]</td>
<td>Front brake switch</td>
<td>2 1-place spade</td>
<td>Underside of front brake assembly</td>
</tr>
<tr>
<td>[178]</td>
<td>Active intake solenoid</td>
<td>2-place Deutsch</td>
<td>Under seat</td>
</tr>
<tr>
<td>[215]</td>
<td>Cooling fan #2 (left)</td>
<td>2-place Sumitomo</td>
<td>Inside left radiator shroud</td>
</tr>
<tr>
<td>[227]</td>
<td>Fuel pressure sensor</td>
<td>3-place Delphi</td>
<td>Fuel line aft of throttle body</td>
</tr>
<tr>
<td>[228]</td>
<td>Barometric (BARO) pressure sensor</td>
<td>3-place Bosch</td>
<td>Under seat, rear of airbox</td>
</tr>
<tr>
<td>[234]</td>
<td>Fan sub-harness connector</td>
<td>4-place Deutsch</td>
<td>Behind left radiator shroud</td>
</tr>
<tr>
<td>[243]</td>
<td>CAN connector</td>
<td>2-place Deutsch</td>
<td>Behind left radiator shroud</td>
</tr>
</tbody>
</table>
WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol verifying that no connection exists between two wire traces (9), symbols for actual (10) and virtual (11) splices, and a symbol identifying two wires that are twisted together (12).

Actual splices (10) are splices where two wires are connected together at a specific location along a wire. Virtual splices (11) are splices shown connected anywhere along a wire, usually used in a wiring or schematic diagram for clarity.

Figure B-1. Connector/Wiring Diagram Symbols (typical)

Table B-2. Wire Color Codes

<table>
<thead>
<tr>
<th>ALPHA CODE</th>
<th>WIRE COLOR</th>
</tr>
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<tbody>
<tr>
<td>BE</td>
<td>Blue</td>
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<tr>
<td>BK</td>
<td>Black</td>
</tr>
<tr>
<td>BN</td>
<td>Brown</td>
</tr>
<tr>
<td>GN</td>
<td>Green</td>
</tr>
<tr>
<td>GY</td>
<td>Gray</td>
</tr>
<tr>
<td>LGN</td>
<td>Light Green</td>
</tr>
<tr>
<td>O</td>
<td>Orange</td>
</tr>
<tr>
<td>PK</td>
<td>Pink</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
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<td>TN</td>
<td>Tan</td>
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<td>V</td>
<td>Violet</td>
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<td>W</td>
<td>White</td>
</tr>
<tr>
<td>Y</td>
<td>Yellow</td>
</tr>
<tr>
<td>DIAGRAM</td>
<td>LOCATION</td>
</tr>
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<td>------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Battery Power Distribution: 2009 1125 Models</td>
<td>Figure B-2</td>
</tr>
<tr>
<td>Ignition and Accessory Power: 2009 1125 Models</td>
<td>Figure B-3</td>
</tr>
<tr>
<td>Sensor Grounds: 2009 1125 Models</td>
<td>Figure B-4</td>
</tr>
<tr>
<td>ECM Power Grounds: 2009 1125 Models</td>
<td>Figure B-5</td>
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<tr>
<td>Chassis Grounds: 2009 1125 Models</td>
<td>Figure B-6</td>
</tr>
<tr>
<td>Main Chassis Wiring Harness: 2009 1125 Models</td>
<td>Figure B-7</td>
</tr>
<tr>
<td>Main Engine Wiring Harness: 2009 1125 Models</td>
<td>Figure B-8</td>
</tr>
<tr>
<td>Component Wiring Diagrams (Headlamp Assembly Sub-Harness, Cooling Fan Sub-Harness, and Hand Control Switches): 2009 1125 Models</td>
<td>Figure B-9</td>
</tr>
</tbody>
</table>
Figure B-2. Battery Power Distribution: 2009 1125 Models
Figure B-4. Sensor Grounds: 2009 1125 Models
Figure B-5. ECM Power Grounds: 2009 1125 Models
Headlamp Assembly Subharness

1125R

Cooling Fan Subharness
(If Equipped)

1125CR

[Figure B-9. Component Wiring Diagrams (Headlamp Assembly Sub-Harness)]
# Metric Conversion

## Conversion Table

### Table C-1. Metric Conversions

<table>
<thead>
<tr>
<th>MILLIMETERS TO INCHES (MM x 0.03937 = IN)</th>
<th>INCHES TO MILLIMETERS (IN x 25.40 = MM)</th>
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<td>m</td>
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<tr>
<td>.1</td>
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2009 Buell 1125: Appendix C Conversions C-1
FLUID CONVERSIONS

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

C-2 2009 Buell 1125: Appendix C Conversions
TORQUE CONVERSION

UNITED STATES SYSTEM
The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (in-lbs).
- inch pounds (in-lbs) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM
All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.850785 = inch pounds (in-lbs).
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (in-lbs) X 0.112985 = Newton meters (Nm).
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