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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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.

NOTES

- To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.
- In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.

SERVICE BULLETINS

In addition to the information presented in this manual, Buell Motor Company will periodically issue Service Bulletins to Buell dealers. Service Bulletins cover interim engineering changes and supplementary information. Consult the Service Bulletins to keep your product knowledge current and complete.

USE GENUINE REPLACEMENT PARTS

WARNING

Do not use aftermarket parts and custom made front forks which can adversely affect performance and handling. Removing or altering factory installed parts can adversely affect performance and could result in death or serious injury. (00001a)

To ensure satisfactory and lasting repairs, carefully follow the manual instructions and use only genuine Buell replacement parts. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

Statements in this manual preceded by the following words are of special significance.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (00119a)

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. (00139a)

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140a)

NOTE

Refers to important information, and is placed in italic type. It is recommended that you take special notice of these items.

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this manual are effective methods for performing service operations.
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

Blast, Firebolt, Glaze, Gloss, Harley, Harley-Davidson, Lightning, Sunwash, Supersmart, Tender, Triple Tail, Thunderstorm, Ulysses, Uniplanar and ZTL 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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GENERAL

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<td>Free speed</td>
<td>3000 RPM (min) @ 11.5 V</td>
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<tr>
<td>Free current</td>
<td>90 Amp (max) @ 11.5 V</td>
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<tr>
<td>Stall current</td>
<td>400 Amp (max) @ 2.4 V</td>
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<tr>
<td>Stall torque</td>
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<th>IN.</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush length (minimum)</td>
<td>0.433</td>
<td>11.0</td>
</tr>
<tr>
<td>Commutator diameter (minimum)</td>
<td>1.141</td>
<td>28.981</td>
</tr>
</tbody>
</table>

Table 1-3. Torque Values

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery terminal fasteners</td>
<td>72-96 in-lbs</td>
</tr>
<tr>
<td>Starter battery positive cable nut</td>
<td>60-85 in-lbs</td>
</tr>
<tr>
<td>Starter mounting bolts</td>
<td>13-20 ft-lbs</td>
</tr>
</tbody>
</table>
1.2 ELECTRIC STARTER SYSTEM

GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear and drive housing. The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idler gear and a clutch gear in the drive housing. The idler gear is supported by rollers. The clutch gear is part of the overrunning clutch/drive assembly. The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

Wiring Diagrams

For additional information concerning the starting system circuit, see the wiring diagrams in this section and Section 2, Engine Management.

Start Relay

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

Starter Interlock

See Section 2, Engine Management, for operation and troubleshooting information.

OPERATION

See Figure 1-1. When the starter switch is pushed, the starter relay is activated and battery current flows into the pull-in winding (10) and the hold-in winding (11), to ground. The magnetic forces of the pull-in and hold-in windings in the solenoid push the plunger (7) causing it to shift to the left. This action engages the pinion gear (1) with the clutch ring gear (13). At the same time, the main solenoid contacts (8) are closed, so battery current flows directly through the field windings (3) to the armature (4) and to ground. Simultaneously, the pull-in winding (10) is shorted. The current continues flowing through the hold-in winding (11) keeping the main solenoid contacts (8) closed. At this point, the starter begins to crank the engine. After the engine has started, the pinion gear (1) turns freely on the pinion shaft through the action of the overrunning clutch (12). The overrunning clutch prevents the clutch ring gear (13) (which is now rotating under power from the engine) from turning the armature (4) too fast. When the starter switch is released, the current of the hold-in winding (11) is fed through the main solenoid contacts (8) and the direction of the current in the pull-in winding (10) is reversed. The solenoid plunger (7) is returned to its original position by the return spring, which causes the pinion gear (1) to disengage from the clutch ring gear (13).
1. Starter at moment starter switch is closed
2. Starter during cranking
3. Pinion gear
4. Idler gear
5. Field winding
6. Armature
7. Brush
8. Ball bearing
9. Solenoid plunger
10. Main solenoid contacts
11. Battery
12. Pull-in winding
13. Hold-in winding
14. Overrunning clutch
15. Clutch ring gear
16. Starting circuit (see wiring diagram)

Figure 1-1. Starter Operation
### Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See Figure 1-2. Perform test for 1.5 DIAGNOSTICS/TRoubleshooting, Voltage Drops.

2. Remove starter motor. Connect jumper wires as described in Free Running Current Draw Test under 1.8 TESTING STARTER ON BENCH.

3. Connect BREAKOUT BOX (Part No. B-48115) to Electronic Control Module (ECM).

4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) gray terminal socket probe and patch cord.

5. See Starter Current Draw Test under 1.7 TESTING STARTER ON MOTORCYCLE.

6. See Free Running Current Draw Test under 1.8 TESTING STARTER ON BENCH.

### Job/Time Code Values

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

---

**Figure 1-2. Starter Terminals**

1. Motor terminal
2. Battery terminal
3. Solenoid terminal
Figure 1-3. Starting Circuit (Ulysses, Lightning)

Table 1-4. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Spade terminal</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
Figure 1-4. Starting Circuit (Firebolt)

Table 1-5. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Spade terminal</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
Starter Test 1

Check Battery using visual inspection, voltage test, and either conductance test or load test.

Check connections at battery and starter components. Is system operational?

YES

STARTER SPINS, BUT DOES NOT ENGAGE.
See Starter Test: Starter Spins But Does Not Engage.

YES

STARTER RUNS ON.
Disconnect Starter Solenoid connector [128]. Is 12V present on (S3) wire with Start Switch not pressed?

YES

Solenoid clicks. See Starter Test: Solenoid Clicks.

NO

STARTER STALLS OR SPINS TOO SLOWLY.
See Starter Test: Starter Stalls or Spins Too Slowly.

YES

Relay clicks. See Starter Test: Relay Clicks.

NO

Is 12V present on Start Relay terminal "86" with Start Switch not pressed? NOTE Depending on relay used, relay socket terminal could be shown as "1" or "U".

YES

Replace Starter Solenoid.

5845

OR

OR


NO

Replace Start Switch.

5818

Replace Start Relay.

5832
Perform voltage drop tests between Battery and relay terminal on solenoid. Is voltage drop less than 1.0 volt?

YES

Perform voltage drop tests from battery positive to starter motor terminal. Crank engine. Is voltage drop greater than 1.0 volt?

YES

Backtrack to pinpoint poor connections or relay contact problems using voltage drop tests.

NO

Perform voltage drop tests from Battery positive to Starter Battery terminal. Crank engine. Is voltage drop greater than 1.0 volt?

YES

Perform voltage drop tests between Battery negative and Starter studs or bolts. Is voltage drop greater than 1.0 volt?

NO

NO

Perform voltage drop tests between Battery and relay terminal on solenoid. Is voltage drop less than 1.0 volt?

YES

Perform voltage drop tests from battery positive to starter motor terminal. Crank engine. Is voltage drop greater than 1.0 volt?

NO

NO

Perform voltage drop tests from Battery positive to Starter Battery terminal. Crank engine. Is voltage drop greater than 1.0 volt?

YES

Repair connection between Battery and Starter.

NO

Repair or replace solenoid (contacts).

YES

Clean ground connections.

NO

STOP

Go to Starter Test: Relay Clicks. Begin with box marked with bold asterisk.
Test for voltage at starter solenoid connector (128) (GN) wire.
Is 12V present when Start Switch is pressed?

YES

NO

Does Starter turn when switch is pressed?

YES

NO

Test for voltage to Start Relay. Is 12V present on Start Relay socket terminal "30"?
NOTE
Depending on relay used, relay socket terminal could be shown as "3" or "E".

YES

NO

Test for voltage from Start Relay. Is 12V present on Start Relay socket terminal "87" when Start Switch is pressed?
NOTE
Depending on relay used, relay socket terminal could be shown as "5" or "K".

YES

NO

Repair open or poor connections on (BE) wire feeding Start Relay socket terminal "3".

YES

NO

Repair open or poor connections on (GN) wire between Start Relay and Starter Solenoid.

YES

NO

Replace Start Relay.

Replace or repair Starter.

Replace Starter Solenoid.
Nothing Clicks: Starter Test 4 (Part 1 of 2)

Turn the Ignition Switch ON. Does the electrical system have power?

Yes

Place Engine Stop Switch in the RUN position. Does the check engine lamp turn ON?

Yes

Test the Battery. Refer to Section 1.10 Battery Testing. Is the Battery good?

Yes

Test the J-Fuse (Firebolt) or Battery Fuse (Ulysses; Lightning). Is fuse OK?

Yes

Inspect for short circuit between J-Fuse (Firebolt) and Fuse Block or Battery Fuse and other circuits (Ulysses; Lightning). Repair circuits and replace fuse.

No

Replace Battery.

No

Test for battery voltage at ignition switch terminal "B". Is voltage present?

Yes

Test for voltage at the ignition switch terminal "1". Is voltage present?

Yes

Repair open in circuits between Ignition Switch and Fuse Block.

No

Replace Ignition Switch.

No

Repair open in (W/BK) wire in terminal "4" of connector (22A).

Yes

Repair open in (GY) wire in terminal "3" of connector (22A).

No

Repair open in (W/BK) wire in terminal "4" of connector (22A).

STOP

Go to Starter Test: Nothing Clicks (Part 2 of 2)
Starter Spins But Does Not Engage: Starter Test 5

Remove Starter. Disassemble Drive Housing assembly. Inspect for damage to Armature Gear or Idler Gear. Is damage present?

YES
Replace damaged Idler Gear and Armature.

NO
Starter Clutch failure. Replace Starter Clutch.

5825
5837

tco1589_en
Starter Stalls or Spins Too Slowly: Starter Test 6

1. Perform voltage drop tests from Battery positive to Starter terminal. Crank engine. Is voltage drop greater than 1.0 volt?
   - YES
   - NO

   - YES
     - Repair connection between Battery and Starter.
     - Use appropriate code: fc01590_en

   - NO
     - NO
     - Repair or replace Starter Solenoid (contacts).
     - Use appropriate code: fc01590_en

2. Perform voltage drop tests between Battery positive and Starter Battery terminal. Crank engine. Is voltage drop greater than 1.0 volt?
   - YES
   - NO

   - YES
     - Perform voltage drop tests between Battery negative and Starter studs or bolts. Is voltage drop greater than 1.0 volt?
     - YES
       - Repair connection between Battery and Starter.
       - Use appropriate code: fc01590_en
     - NO
       - Repair or replace Starter Solenoid (contacts).
       - Use appropriate code: fc01590_en
     - Test Starter Motor for opens, short or grounds.

3. Perform voltage drop tests between Battery and Starter. Crank engine. Is voltage drop greater than 1.0 volt?
   - YES
   - NO

   - YES
     - Perform voltage drop tests between Battery and Starter. Crank engine. Is voltage drop greater than 1.0 volt?
     - YES
       - Repair connection between Battery and Starter.
       - Use appropriate code: fc01590_en
     - NO
       - Repair or replace Starter Solenoid (contacts).
       - Use appropriate code: fc01590_en

   - NO
     - NO
     - Repair or replace Starter Solenoid (contacts).
     - Use appropriate code: fc01590_en

4. Perform voltage drop tests between Battery and Starter. Crank engine. Is voltage drop greater than 1.0 volt?
   - YES
   - NO

   - YES
     - Repair connection between Battery and Starter.
     - Use appropriate code: fc01590_en

   - NO
     - NO
     - Repair or replace Starter Solenoid (contacts).
     - Use appropriate code: fc01590_en

5. Perform Starter Current Draw Test (on vehicle). Perform Free Running Current Draw Test (on bench). Are test results within range?
   - YES
   - NO

   - YES
     - Use appropriate code: fc01590_en

   - NO
     - Test Starter Motor for opens, short or grounds.

6. Clean Ground connections.

   - Use appropriate code: fc01590_en
STARTER ACTIVATION CIRCUITS

1. Battery
2. 30 Amp battery fuse (Ulysses, Lightning); 30 Amp J-Fuse (Firebolt)
3. Key switch fuse
4. Key switch
5. Engine stop switch
6. Ignition relay (used for junction purposes only)
7. Ignition fuse
8. Key switch relay
9. Start switch
10. Start relay
11. Solenoid
12. Starter

Figure 1-5. Typical Circuitry. Refer to wiring diagrams for more information.
GENERAL

The troubleshooting tables in 1.3 STARTING SYSTEM DIAGNOSIS contain procedures to solve and correct most common problems. The 1.5 DIAGNOSTICS/TROUBLESHOOTING, Voltage Drops procedure below will help you to locate poor connections or components with excessive voltage drops.

VOLTAGE DROPS

Check the integrity of all wiring, switches, fuses and connectors between the source and destination.

The voltage drop test measures the difference in potential or the actual voltage dropped between the source and destination.

1. See ITEM A in Figure 1-5. Attach your red meter lead to the most positive part of the circuit, which in this case would be the positive post of the battery.
2. See ITEM B in Figure 1-5. Attach the black meter lead to the final destination or component in the circuit (solenoid terminal from relay).
3. Activate the starter and observe the meter reading. The meter will read the voltage dropped or the difference in potential between the source and destination. An ideal circuit’s voltage drop would be 0 volts or no voltage dropped, meaning no difference in potential.
4. See ITEM C in Figure 1-5. An open circuit should read 12 volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.

NOTE

Open circuits on the ground side will read zero.

5. Typically, a good circuit will drop less than 1.0 volt. If the voltage drop is greater, back track through the connections until the source of the potential difference is found. The benefits of doing it this way are speed and accuracy.
   a. Readings aren’t as sensitive to real battery voltage.
   b. Readings show the actual voltage dropped, not just the presence of voltage.
   c. This tests the system as it is actually being used. It is more accurate and will display hard to find poor connections.
   d. This approach can be used on lighting circuits, ignition circuits, etc. Start from most positive and go to most negative (the destination or component).

6. See ITEM D in Figure 1-5. The negative or ground circuit can be checked as well.
   a. Place the negative lead on the most negative part of the circuit (or the negative battery post). Remember, there is nothing more negative than the negative post of the battery.
   b. Place the positive lead to the ground you wish to check.
   c. Activate the circuit. This will allow you to read the potential difference or voltage dropped on the negative or ground circuit. This technique is very effective for identifying poor grounds due to powdered paint. Even the slightest connection may cause an ohmmeter to give a good reading. However, when sufficient current is passed through, the resistance caused by the powdered paint will cause a voltage drop or potential difference in the ground circuit.
### Table 1-6. Starter Does Not Run or Runs at Very Low Speeds

<table>
<thead>
<tr>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE 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 battery positive or negative cable, at either end.</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.</td>
<td>Tighten connections or repair or replace wire(s).</td>
</tr>
<tr>
<td>Start switch, clutch 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>Solenoid</td>
<td>Poor contact condition caused by burnt contact.</td>
<td>Polish contact surface or replace solenoid assembly.</td>
</tr>
<tr>
<td></td>
<td>Pull-in winding open or short-circuited.</td>
<td>Repair or replace solenoid assembly.</td>
</tr>
<tr>
<td></td>
<td>Hold-in winding open or-short-circuited.</td>
<td>Repair or replace solenoid assembly.</td>
</tr>
<tr>
<td>Starting motor</td>
<td>Brushes worn below specification.</td>
<td>Check brush spring tension. Replace field frame and holder.</td>
</tr>
<tr>
<td></td>
<td>Commutator burnt.</td>
<td>Re-face or replace.</td>
</tr>
<tr>
<td></td>
<td>Commutator high mica.</td>
<td>Correct by undercutting.</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 armature.</td>
</tr>
<tr>
<td></td>
<td>Free running current draw out of range.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Reduction gears damaged.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Insufficient brush spring tension.</td>
<td>Replace starter.</td>
</tr>
<tr>
<td></td>
<td>Disconnected lead wire between solenoid and field windings.</td>
<td>Repair or replace lead wire.</td>
</tr>
<tr>
<td></td>
<td>Ball bearing sticks.</td>
<td>Replace bearing.</td>
</tr>
</tbody>
</table>

### Table 1-7. Pinion Does Not Engage With Ring Gear While Starter is Cranked or Engine Cannot Be Cranked

<table>
<thead>
<tr>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE 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>
</tbody>
</table>
### Table 1-7. Pinion Does Not Engage With Ring Gear While Starter is Cranked or Engine Cannot Be Cranked

<table>
<thead>
<tr>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overrunning clutch</td>
<td>Overrunning clutch malfunction (rollers or compression spring).</td>
<td>Replace overrunning clutch.</td>
</tr>
<tr>
<td></td>
<td>Pinion teeth worn out.</td>
<td>Replace overrunning clutch.</td>
</tr>
<tr>
<td></td>
<td>Pinion does not run in overrunning direction.</td>
<td>Replace overrunning clutch.</td>
</tr>
<tr>
<td></td>
<td>Poor sliding condition of spline teeth.</td>
<td>Remove foreign materials, dirt or replace overrunning clutch or pinion shaft.</td>
</tr>
<tr>
<td>Gear teeth on clutch shell</td>
<td>Excessively worn teeth.</td>
<td>Replace overrunning clutch and idler gear.</td>
</tr>
</tbody>
</table>

### Table 1-8. Starter Does Not Stop Running

<table>
<thead>
<tr>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE 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>Gear teeth on clutch shell</td>
<td>Excessively worn teeth.</td>
<td>Replace clutch shell.</td>
</tr>
<tr>
<td>Solenoid</td>
<td>Return spring worn.</td>
<td>Replace spring.</td>
</tr>
<tr>
<td></td>
<td>Coil layer shorted.</td>
<td>Replace solenoid.</td>
</tr>
<tr>
<td></td>
<td>Contact plate melted and stuck.</td>
<td>Replace solenoid.</td>
</tr>
</tbody>
</table>
1. See Figure 1-6. The start relay can be tested using the motorcycle's 12-volt battery and a multimeter.
   a. Unplug connector from relay.
   b. To energize the relay connect relay terminal "85" to the negative battery terminal, and relay terminal "86" to the positive battery terminal. Some diodes contain internal diodes. If the applied voltage isn't the correct polarity, the diode could be damaged.
   c. Check for continuity between the "30" and "87" terminals. 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.

2. If the start relay is functioning properly, proceed to 1.7 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
   a. See Figure 1-7 (Ulysses), Figure 1-8 (Lightning) and Figure 1-9 (Firebolt). Unplug start relay from relay/fuse block.
   b. See Figure 1-8 and Figure 1-6. To energize the relay, connect relay terminal "85" to the negative battery terminal, and relay terminal "86" to the positive battery terminal.
   c. Check for continuity between relay terminals "3" and "5". 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.

3. If start relay is functioning properly, proceed to 1.7 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
Figure 1-8. Fuses and Relays (Lightning)
STARTER CURRENT DRAW TEST

NOTES

• Engine temperature should be stable and at room temperature.
• Battery should be fully charged.

See Figure 1-11. Check starter current draw with an induction ammeter before disconnecting battery. Proceed as follows:

1. Verify that transmission is in neutral. Disconnect spark plug wires from spark plug terminals.
2. Clamp induction ammeter over positive battery cable next to starter.
3. With ignition switch ON, turn engine over by pressing starter switch while reading the ammeter. Disregard initial high current reading which is normal when engine is first turned over.
   a. Typical starter current draw will range from 140 to 180 amperes.
   b. If starter current draw exceeds 180 amperes, the problem may be in the starter or starter drive. Remove starter for further tests. See the 1.8 TESTING STARTER ON BENCH, Free Running Current Draw Test.

NOTE

A DC current probe may be used if an induction ammeter is not available.
1. Starter
2. Induction ammeter
3. Battery

Figure 1-11. Starter Current Draw Test
FREE RUNNING CURRENT DRAW TEST

1. Remove starter from motorcycle in accordance with the procedures in the Service Manual.

2. Place starter in vise, using a clean shop towel to prevent scratches or other damage.

3. See Figure 1-12. Attach one heavy jumper cable (6 gauge minimum).
   a. Connect one end to the starter mounting flange (1).
   b. Connect the other end to the negative (-) terminal of a fully charged battery (2).

4. Connect a second heavy jumper cable (6 gauge minimum).
   a. Connect one end to the positive (+) terminal of the battery (2).
   b. Connect the other end to the battery terminal (4) on the starter solenoid. Place an inductive ammeter (3) over cable.

5. Connect a smaller jumper cable (14 gauge minimum).
   a. Connect one end to the positive (+) terminal of the battery (2).
   b. Connect the other end to the solenoid relay terminal (5).

6. Check ammeter reading.
   a. Ammeter should show 90 amps maximum.
   b. If reading is higher, disassemble starter for inspection. See the Service Manual.
   c. If starter current draw on vehicle was over 200 amps and this test was within specification, there may be a problem with engine or primary drive.

Figure 1-12. Free Running Current Draw Test

STARTER SOLENOID

Do not disassemble solenoid. Before testing, disconnect field wire from motor terminal as shown in Figure 1-13.

Each test should be performed for only 3-5 seconds to prevent damage to solenoid.

The solenoid Pull-in, Hold-in, and Return tests must be performed together in one continuous operation. Conduct all three tests one after the other in the sequence given without interruption.

SOLENOID PULL-IN TEST

1. See Figure 1-13. Using a 12-volt battery, connect three separate test leads as follows:
   a. Solenoid housing to negative battery post.
   b. Solenoid motor terminal to negative battery post.
   c. Solenoid relay terminal to positive battery post.

2. Observe starter shaft.
   a. If starter shaft extends strongly, solenoid is working properly.
   b. If starter shaft does not extend strongly, replace the solenoid.
1. Motor terminal  
2. Battery  
3. Relay terminal

Figure 1-13. Test 1: Pull-in Test

---

SOLENOID HOLD-IN TEST

1. See Figure 1-14. With test leads still connected in the manner specified in the previous 1.8 TESTING STARTER ON BENCH, Solenoid Hold-in Test, disconnect solenoid motor terminal/battery negative test lead (B) at negative battery post only; reconnect loose end of this test lead to positive battery post instead.

2. Observe starter shaft.
   a. If starter shaft remains extended, solenoid is working properly.
   b. If starter shaft retracts, replace the solenoid.

---

SOLENOID RETURN TEST

1. See Figure 1-15. With test leads still connected in the manner specified at the end of the previous 1.8 TESTING STARTER ON BENCH, Solenoid Hold-In Test, disconnect solenoid relay terminal/positive battery post test lead (C) at either end.

2. Observe starter pinion.
   a. If starter shaft retracts, solenoid is working properly.
   b. If starter shaft does not retract, replace the solenoid.

---
1. Carefully remove battery cables and jumpers.
2. Reattach starter cable to starter solenoid.
3. Reinstall starter assembly to motorcycle engine in accordance with the procedures in the Service Manual.

Figure 1-15. Test 3: Return Test
GENERAL

The charging system consists of the alternator and regulator. The charging system circuit is shown in Figure 1-18 and Figure 1-19.

Alternator

The alternator consists of two main components:
- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

Voltage Regulator

See Figure 1-16. The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating. The system is a single phase 30 amp system capable of 405 watts at 3000 rpm.

TRoubleshooting

When the charging system fails to charge or does not charge at a satisfactory rate, make the following recommended checks.

Battery

Check for a weak or dead battery. See 1.10 Battery Testing for battery testing procedures. Battery must be fully charged in order to perform a load test, or 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

Check for corroded or loose connections in the charging circuit. See Figure 1-18.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in bold text underneath the appropriate repair.
Figure 1-18. Charging System Circuit (Ulysses, Lightning)

Table 1-9. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[46]</td>
<td>Stator</td>
<td>2-place Packard</td>
<td>Under ram air scoop</td>
</tr>
<tr>
<td>[77]</td>
<td>Voltage regulator</td>
<td>2-place Packard</td>
<td>Under ram air scoop</td>
</tr>
</tbody>
</table>
Figure 1-19. Charging System Circuit (Firebolt)

Table 1-10. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[46]</td>
<td>Stator</td>
<td>2-place Packard</td>
<td>Under ram air scoop</td>
</tr>
<tr>
<td>[77]</td>
<td>Voltage regulator</td>
<td>2-place Packard</td>
<td>Under ram air scoop</td>
</tr>
</tbody>
</table>
Charging System (Part 1 of 2)

Test Battery.
Charge or replace as required.

Inspection Voltage Regulator.
See Voltage Regulator Inspection.

PASS

FAIL

Perform Milliampere Draw Test

Correct as required.

Disconnect Regulator.
Does milliampere draw drop?

PASS

FAIL

Perform Total Current Draw Test. Record measurement.

Replace grounded stator.

Isolate damaged component or wiring.

YES

NO

NOTE
Whenever a charging system component fails a test and is replaced, re-test the system to be sure the problem has been corrected.

STOP

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

FAIL

Isolate damaged wiring or excessive accessories.

PASS
Perform Current and Voltage Output Test. Record measurements and compare with Total Current Draw Test results before proceeding.

**PASS**

System tests good up to this point. Suspect:
- Accessories on for long periods when vehicle is parked and not running.
- Accessories on when vehicle is ridden very slowly for long periods.
- Battery self-discharge and/or accessory draw because vehicle was not operated for a long period.

**NOTE**
Whenever a charging system component fails a test and is replaced, re-test the system to be sure the problem has been corrected.

**FAIL**

Perform Stator Check.

**PASS**

Perform AC Output Check.

**FAIL**

Replace Stator.

**PASS**

Replace Voltage Regulator. Perform Current and Voltage Output Test.

**FAIL**

Inspect Rotor.

**PASS**

System OK.

**FAIL**

Damaged or slipping Rotor.

**PASS**

Replace Stator.

**FAIL**

Replace 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 vehicle is parked for a long time. Check for this by connecting ammeter between negative battery cable and ground.

1. See Figure 1-20. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.

2. With ignition switch turned to OFF and all lights and accessories off, observe current reading.
   a. Maximum reading should be 2.0 milliamperes,
   b. A higher reading indicates excessive current draw. Any accessories must be considered and checked for excessive drain.

**NOTE**

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

### Figure 1-20. Milliampere Draw Test (Ignition turned to OFF)

1. Battery
2. Induction ammeter
3. Battery negative cable

---

## Total Current Draw Test

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

### Figure 1-21. Check Current Draw (Ignition Switch On)

1. Load tester
2. Battery

---

## 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, analyzer instruction manual, system condition.

2. Follow the instructions in the analyzer instruction manual to perform a Charging System Test.

See Figure 1-22. The test results will include a decision on the charging system condition and the measured output voltage at idle and at 3000 RPM. The analyzer printer will provide you with a printout including one of two possible test results:

1. CHARGING SYSTEM NORMAL - No problem found.
2. CHARGING SYSTEM PROBLEM - The analyzer detected a problem and will display one of the three following results:
   a. LOW CHARGING VOLTS - The alternator is not supplying sufficient current for the system electrical loads.
   b. HIGH CHARGING VOLTS - The voltage output from the alternator exceeds the normal regulator limits.
   c. INVESTIGATE VOLT OUTPUT - The rev voltage is lower than the idle voltage.

Current and Voltage Output Test: Using Load Tester

1. Connect load tester.
   a. Connect negative and positive leads to battery terminals.
   b. Place load tester induction pickup over 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 note of measurement for use in 1.9 CHARGING SYSTEM, Testing.

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

4. After removing the load, read the load tester voltage meter.
   a. If voltage to the battery is not more than 15 VDC, voltage output is within specifications. Investigate other possible problems. See Charging System Test flow charts.
   b. If voltage is higher, voltage regulator is not functioning properly or connections are loose or dirty.

Stator Check

1. Turn ignition switch OFF.

2. See Figure 1-23. Connect an ohmmeter.
   a. Disconnect voltage regulator connector from alternator stator wiring.
   b. Insert one ohmmeter lead into a stator connector socket.
   c. Attach the other lead to a suitable ground.

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

4. See Figure 1-24. Remove ground lead. Check resistance across stator sockets 1 and 2.

5. Test for resistance with ohmmeter set on the ohms scale.
   a. Resistance across the stator sockets should be 0.1-0.3 ohms.
   b. If the resistance is higher, the stator is damaged and must be replaced.

NOTE
Verify that meter reads 0 ohms when probes are shorted together. If not, subtract lowest value from resistance value of stator.

Figure 1-22. Charging System Test Results Printout

Figure 1-23. Test for Grounded Stator (Typical)
AC Output Check

1. See Figure 1-25. Test AC output.
   a. Disconnect voltage regulator connector from alternator stator wiring.
   b. Connect an AC voltmeter across stator connector sockets 1 and 2.
   c. Run the engine at 2000 RPM. The AC output should be 40-56 volts AC (approximately 20-28 volts per 1000 RPM).

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

3. Check the output again as previously described under 1.9 CHARGING SYSTEM, Testing.
BATTERY TESTING

GENERAL

Three different procedures may be performed to provide a good indicator of battery condition: a voltage test, a conductance test, or a load test.

A battery may be tested, whether fully charged or not, via conductance test. In order to perform a load test, however, the battery must be fully charged.

VOLTOMETER TEST

The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is fully charged. Refer to Table 1-11.

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 12.8V or above, perform the 1.10 BATTERY TESTING, Load Test described in this section.

Table 1-11. Voltmeter Test For Battery Charge Conditions

<table>
<thead>
<tr>
<th>VOLTAGE (OCV)</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>

LOAD TEST

To load test the battery, proceed as follows:

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

LOAD TEST

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 battery from motorcycle.
2. Always fully charge the battery before testing or test readings will be incorrect. Load testing a discharged battery can also result in permanent battery damage.
3. After charging, allow 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 1-27. Connect tester leads to battery posts and place induction pickup over negative (black) cable.
5. Refer to Table 1-12. To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds. Load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70°F (21°C).
**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 on the motorcycle.

---

**Table 1-12. Battery Load Test**

<table>
<thead>
<tr>
<th>COLD CRANKING AMPERAGE (CCA)</th>
<th>100%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Buell models</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>SUBJECT</td>
<td>PAGE NO.</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>2.1 SPECIFICATIONS</td>
<td>2-1</td>
<td></td>
</tr>
<tr>
<td>2.2 DYNAMIC DIGITAL FUEL INJECTION (DDFI)</td>
<td>2-2</td>
<td></td>
</tr>
<tr>
<td>2.3 DIAGNOSTIC INTRODUCTION</td>
<td>2-5</td>
<td></td>
</tr>
<tr>
<td>2.4 CHECKING FOR TROUBLE CODES</td>
<td>2-6</td>
<td></td>
</tr>
<tr>
<td>2.5 CHECK ENGINE LAMP DIAGNOSTICS</td>
<td>2-9</td>
<td></td>
</tr>
<tr>
<td>2.6 BREAKOUT BOX</td>
<td>2-11</td>
<td></td>
</tr>
<tr>
<td>2.7 WIGGLE TEST</td>
<td>2-13</td>
<td></td>
</tr>
<tr>
<td>2.8 INITIAL DIAGNOSTIC CHECK</td>
<td>2-14</td>
<td></td>
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<tr>
<td>2.9 INTAKE LEAK TEST</td>
<td>2-21</td>
<td></td>
</tr>
<tr>
<td>2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON</td>
<td>2-23</td>
<td></td>
</tr>
<tr>
<td>2.11 CHECK ENGINE LAMP ON CONTINUOUSLY</td>
<td>2-27</td>
<td></td>
</tr>
<tr>
<td>2.12 ENGINE CRANKS BUT WILL NOT START</td>
<td>2-31</td>
<td></td>
</tr>
<tr>
<td>2.13 NO ECM POWER</td>
<td>2-36</td>
<td></td>
</tr>
<tr>
<td>2.14 STARTS, THEN STALLS</td>
<td>2-39</td>
<td></td>
</tr>
<tr>
<td>2.15 FUEL PRESSURE TEST</td>
<td>2-42</td>
<td></td>
</tr>
<tr>
<td>2.16 MISFIRE</td>
<td>2-50</td>
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<tr>
<td>2.17 DTC P0112 (15), P0113 (15)</td>
<td>2-54</td>
<td></td>
</tr>
<tr>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
<td>2-58</td>
<td></td>
</tr>
<tr>
<td>2.19 DTC P0122 (11), P0123 (11)</td>
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<tr>
<td>2.20 DTC P0151 (13), P0152 (11), P0154 (13)</td>
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<tr>
<td>2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32)</td>
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</tr>
<tr>
<td>2.22 DTC P0339 (56)</td>
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<tr>
<td>2.23 DTC P0502 (43), P0503 (43), P0608 (37)</td>
<td>2-77</td>
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<tr>
<td>2.24 DTC P0506 (34), P0507 (34), P0511 (34)</td>
<td>2-84</td>
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<tr>
<td>2.25 DTC P0562 (16), P0563 (16)</td>
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<tr>
<td>2.26 DTC P0603 (54), P0604 (52), P0605 (53), P0607 (55)</td>
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<td></td>
</tr>
<tr>
<td>2.27 DTC P0617 (46)</td>
<td>2-94</td>
<td></td>
</tr>
<tr>
<td>2.28 DTC P0628 (33), P0629 (33)</td>
<td>2-99</td>
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</tr>
<tr>
<td>2.29 DTC P0691 (36), P0692 (36)</td>
<td>2-104</td>
<td></td>
</tr>
<tr>
<td>2.30 DTC P1110 (22), P1111 (22), P1112 (22) (JAPANESE MODELS ONLY)</td>
<td>2-109</td>
<td></td>
</tr>
<tr>
<td>2.31 DTC P1151 (44), P1152 (44)</td>
<td>2-115</td>
<td></td>
</tr>
<tr>
<td>2.32 DTC P1154 (26), P1155 (27)</td>
<td>2-119</td>
<td></td>
</tr>
<tr>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21)</td>
<td>2-124</td>
<td></td>
</tr>
<tr>
<td>2.34 DTC P1501 (45), P1502 (45), P1503 (45)</td>
<td>2-130</td>
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<tr>
<td>2.35 DTC P1601 (47)</td>
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<td></td>
</tr>
<tr>
<td>2.36 DTC P1653 (35), P1654 (35)</td>
<td>2-139</td>
<td></td>
</tr>
<tr>
<td>2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25)</td>
<td>2-143</td>
<td></td>
</tr>
<tr>
<td>2.38 HEATED HANDLEBAR GRIPS</td>
<td>2-146</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2-1. Fuel System Specifications

<table>
<thead>
<tr>
<th>FUEL SYSTEM</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake:</td>
<td>45 mm downdraft manifold,</td>
</tr>
<tr>
<td></td>
<td>ram air</td>
</tr>
<tr>
<td>Intake:</td>
<td>49 mm downdraft manifold,</td>
</tr>
<tr>
<td></td>
<td>ram air</td>
</tr>
<tr>
<td>Fuel delivery</td>
<td>DDFI Fuel Injection</td>
</tr>
<tr>
<td>Fuel pressure</td>
<td>49-51 PSI (338-352 kPa)</td>
</tr>
<tr>
<td>Recommended fuel</td>
<td>91 Octane</td>
</tr>
</tbody>
</table>

### Table 2-2. Idle Speed Specifications

<table>
<thead>
<tr>
<th>ADJUSTMENT</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal idle speed</td>
<td>1050-1150 RPM, 1120 Nominal, hot</td>
</tr>
</tbody>
</table>

### Table 2-3. Battery Specifications

<table>
<thead>
<tr>
<th>BATTERY</th>
<th></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>
</tbody>
</table>

### Table 2-4. Spark Plug Specifications

<table>
<thead>
<tr>
<th>SPARK PLUGS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>12 mm</td>
</tr>
<tr>
<td>Type</td>
<td>10R12X</td>
</tr>
<tr>
<td>Gap</td>
<td>0.035 in. 0.9 mm</td>
</tr>
<tr>
<td>Torque</td>
<td>12-18 ft-lbs 16-24 Nm</td>
</tr>
<tr>
<td>Cable resistance (front and rear)</td>
<td>1,350-3,465 ohms</td>
</tr>
</tbody>
</table>

### Table 2-5. Alternator Specifications

<table>
<thead>
<tr>
<th>ALTERNATOR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AC voltage output</td>
<td>20-28 VAC per 1000 engine RPM</td>
</tr>
<tr>
<td>Stator coil resistance</td>
<td>0.1-0.3 ohms</td>
</tr>
</tbody>
</table>

### Table 2-6. Regulator Specifications

<table>
<thead>
<tr>
<th>REGULATOR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output @ 3600 RPM</td>
<td>14.3-14.7 VDC @ 75° F (24° C)</td>
</tr>
<tr>
<td>Amperes @ 3600 RPM</td>
<td>32 Amps</td>
</tr>
</tbody>
</table>

### Table 2-7. 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/active muffler fuse</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>10</td>
</tr>
<tr>
<td>Auxiliary fuse</td>
<td>10</td>
</tr>
</tbody>
</table>

### Table 2-8. Ignition Coil Specifications

<table>
<thead>
<tr>
<th>IGNITION COIL RESISTANCE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary winding</td>
<td>0.5-0.7 ohms</td>
</tr>
<tr>
<td>Secondary winding</td>
<td>5500-7500 ohms</td>
</tr>
</tbody>
</table>
INTRODUCTION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44750</td>
<td>DIGITAL TECHNICIAN</td>
</tr>
</tbody>
</table>

The Buell Dynamic Digital Fuel Injection (DDFI) System provides microprocessor-based electronic engine management for the 984cc and 1203cc high performance engines. The DDFI system has the following features:

- Independently mapped spark and fuel control.
- Engine and air temperature compensated fuel delivery.
- Engine load measurement through throttle position.
- Single point spark delivery (no waste spark).
- Sequential port indirect (manifold) fuel injection.
- Open/closed-loop air/fuel control.
- Automatic enrichment at start-up.
- Electric cooling fan for improved thermal management.
- Engine idle speed managed electronically with idle air control (IAC) motor.
- Full diagnostic capability compatible with the DIGITAL TECHNICIAN (Part No. HD-44750).
- Returnless fuel system (excess pressure relieved in tank by Fuel Pressure Regulator Valve).
- Interactive muffler control with muffler valve position feedback for 1203cc engines only.

The DDFI system also analyzes how the engine performs during a ride. It then stores this information internally so it will be available for the next ride.

The 1200 models utilize an interactive exhaust system which has an electronically controlled actuator that activates a butterfly valve that controls exhaust flow in the dual-chamber muffler. The Electronic Control Module (ECM) monitors engine speed and throttle position while activating the valve. See 2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21).

GENERAL

The Buell DDFI operates both as an open and closed loop system which allows it to adjust for all possible operating conditions. During open loop operation, the system utilizes programmed fuel and spark maps in the ECM which provide ease of cold starting and maximum power at wide open throttle (WOT). The adaptive fuel value which is "learned" during closed loop operation is applied during open loop operation to adjust fuel and spark maps for optimum performance.

During closed loop operation, the system relies on input from the $O_2$ sensor to provide for the optimal air fuel mixture which results in reduced emissions, good fuel economy and power. In order for the system to enter closed loop operation, the following conditions must be met:

- $O_2$ Sensor at operating temperature (Engine at normal operating temperature).
- Operation below 4000 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 provide maximum performance.

FOR MORE INFORMATION

To learn more about the Buell DDFI system, read the following topics in this section. A system diagram can be found in Figure 2-1.

Troubleshooting

- 2.3 DIAGNOSTIC INTRODUCTION
- 2.4 CHECKING FOR TROUBLE CODES
- 2.5 CHECK ENGINE LAMP DIAGNOSTICS
- 2.8 INITIAL DIAGNOSTIC CHECK
- Table 2-13
Figure 2-1. Dynamic Digital Fuel Injection (DDFI) System
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
<td>Under seat</td>
</tr>
</tbody>
</table>
SYSTEM PROBLEMS

All system problems fall into at least one of three general categories.

No Start

The engine cranks over freely, but will not start. This does not include situations where the engine will not crank, such as a security disabled starter, dead battery, etc. This condition assumes that all obvious checks (fuel in tank, etc.) have been made.

Poor Performance

The engine starts but there are performance problems. These problems may include poor fuel economy, rough idle, engine misfire, engine hesitation, severe spark knock, etc.

Check Engine Lamp

See Figure 2-2. The check engine lamp indicates the Electronic Control Module (ECM) has determined a fault condition exists. There may also be starting or performance problems.

RESOLVING PROBLEMS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44750</td>
<td>DIGITAL TECHNICIAN</td>
</tr>
</tbody>
</table>

NOTE

The most sophisticated method of resolving problems involves using a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).

To resolve system problems, five basic steps are involved. In order of occurrence, they are:

1. Check for diagnostic trouble codes (DTCs) by observing check engine lamp. See 2.4 CHECKING FOR TROUBLE CODES.

2. Retrieve trouble codes using check engine lamp diagnostics. See 2.5 CHECK ENGINE LAMP DIAGNOSTICS.

3. Diagnose system problems. This involves using special tools and the diagnostic flow charts in this section.

4. Correct problems through the replacement and/or repair of the affected components.

5. After repairs are performed, the work must be validated. This involves clearing the trouble codes and confirming proper vehicle operation as indicated by the behavior of the check engine lamp.

Figure 2-2. Check Engine Lamp (Typical)
CHECK ENGINE LAMP

The diagnose problems, start by observing the behavior of the check engine lamp.

NOTES

• All references to "Key ON" or "Ignition Switch ON" require that the Ignition Switch be in the ON position and the engine stop switch be set to RUN.

• If the check engine lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four second period, then a problem exists in the check engine lamp circuit. See 2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON or 2.11 CHECK ENGINE LAMP ON CONTINUOUSLY for more information.

1. When the Ignition Switch is turned ON after being OFF for 2 seconds or more, the check engine lamp will illuminate for approximately four seconds and then turn off.

2. See Figure 2-5. After check engine lamp turns off after being illuminated for the first four second period, one of three situations may occur:
   a. The check engine lamp remains off. This indicates there are no current fault conditions or stored functional trouble codes currently detected by the Electronic Control Module (ECM).
   b. The check engine lamp stays off for only four seconds and then comes back on for an eight second period. This indicates a functional error code is stored, but no current trouble code exists.
   c. If the check engine lamp remains on beyond the eight second period, then a current trouble code exists.

3. See 2.4 CHECKING FOR TROUBLE CODES, Code Types for a complete description of trouble code formats.
There are two types of trouble codes: current and historic. Certain codes are also called functional codes. Historic codes can be read using the check engine lamp diagnostics.

All trouble codes reside in the memory of the ECM unit the code is cleared by DIGITAL TECHNICIAN (Part No. HD-44750) or a total of 50 trips has elapsed. A trip consists of a start and run cycle lasting at least 30 seconds. After the 50 trip retention period, the trouble code is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.

**NOTE**

Trouble codes relating to the fuel injectors or the ignition coils can only be fully diagnosed during actuation. For example, a problem with the ignition coils will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coils are activated by vehicle start sequence. In this manner, there may sometimes be a false indication of the current trouble code.

**Current**

Current trouble codes are those which are presently disrupt motorcycle operation. See the appropriate flow charts for solutions.

**Historic**

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic fault rather than a current fault.

Historic trouble codes are stored for a length of time to assist in the diagnosis of intermittent faults. The check engine lamp will not turn on during normal operation if only historic codes are present.

It is important to note that historic trouble codes may also be present whenever the system indicates the existence of a current fault. See 2.4 CHECKING FOR TROUBLE CODES if multiple trouble codes are found.

**RETRIEVING TROUBLE CODES**

The fuel injection system provides two levels of diagnostics.

- The most sophisticated mode employs using a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The other mode requires using the check engine lamp. See 2.5 CHECK ENGINE LAMP DIAGNOSTICS for more information.

**MULTIPLE TROUBLE CODES**

The throttle position and bank angle sensors are connected to separate lines (5V REF).

Also, the ECM, fuel pump, fuel injectors and ignition coils all receive +12 volts from the ignition relay. If this line should go to ground the ignition fuse will open.

Always start with the trouble code having the highest priority. Refer to Table 2-13.

**CHECK ENGINE LAMP FLASHES**

In addition to alerting the rider to trouble codes, the check engine lamp will flash during operation to warn of potentially damaging temperature. While this condition is in effect, the ECM will reduce engine power to assist in cooling the engine...
to a safe operating temperature. The check engine lamp will flash until the engine has cooled to a safe operating temper-
ature. This will not set a trouble code.
2.5 CHECK ENGINE LAMP DIAGNOSTICS

RETRIEVING TROUBLE CODES

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44750</td>
<td>DIGITAL TECHNICIAN</td>
</tr>
</tbody>
</table>

Trouble codes may be retrieved without the use of the DIGITAL TECHNICIAN (Part No. HD-44750).

1. Remove the protective cover from data link connector [91A]. The data link connector's location is different for each model. It is located under the fairing (Firebolt), under the seat (Lightning) or behind the left airflow guide (Ulysses).

2. To activate the diagnostic feature of the check engine lamp, proceed as follows:
   a. See Figure 2-6. Install diagnostic test wire from parts shown.
   b. See Figure 2-7. Install diagnostic test wire across terminal “1” and terminal “2” on the data link connector [91A].
   c. Turn the Ignition Switch ON and wait approximately eight seconds for the check engine lamp to start flashing.

3. See Figure 2-8. All trouble codes are sent out as a series of flashes. To retrieve the first digit of the trouble code simply observe the number of times the check engine lamp flashes.
   a. The transmission of a trouble code is always preceded by six rapid flashes (about 3 per second).
   b. This “intermission” is followed by a 2 second pause in which the check engine lamp is off.
   c. The check engine lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the check engine lamp is illuminated and the length of time in which it is off are each about 1 second in duration.

4. The second digit follows:
   a. Following transmission of the first digit, there is another 2 second pause in which the check engine lamp is off.
   b. The check engine lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the check engine lamp flashes to retrieve the second digit.

5. If more than one trouble code is sent:
   a. Following transmission of the second digit of the first code, there is a third 2 second pause in which the check engine lamp is off.
   b. After the pause comes the intermission, which is followed by transmission of the next recorded trouble code.
   c. All subsequent codes are sent in the same manner each separated from the next by the intermission.

6. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.

   **NOTE**
   
   If the check engine lamp flashes at a rate faster than normal, then you are observing the "intermission" only, which means that no trouble codes are present.

7. When examining trouble codes, write down all codes on a piece of paper.
   a. If trouble codes are present, refer to Table 2-13. Follow the applicable flow charts for each code.
   b. If trouble codes are NOT present, but starting or driveability problems are evident, see charts under 2.8 INITIAL DIAGNOSTIC CHECK.

8. Turn the Ignition Switch OFF.

9. Remove diagnostic test wire and install protective cover over data link connector. Return data link connector to original position.

   **NOTE**
   
   The engine may be started and run when the trouble codes are received using a jumper wire on terminals “1” and “2” of the data link connector. However, if the jumper wire is removed with the engine running, the check engine lamp will continue to flash trouble codes. To stop check engine lamp from flashing codes, turn engine stop switch OFF.

---

![Figure 2-6. Diagnostic Test Wire](diagram)

1. Part Number 72191-94 (2)
2. 2.0 in (51 mm) 18 Gauge Wire

---

2008 Buell XB Diagnostics: Engine Management 2-9
1. Terminal 1: Receive Data Line (LGN/R)
2. Terminal 2: Ground (BK/W)
3. Terminal 3: Transmit Data Line (V/R)
4. Terminal 4: Power (GY)
5. Protective Cap

Figure 2-7. Data Link Connector Pin Identification

---

**CLEARING CODES**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44750</td>
<td>DIGITAL TECHNICIAN</td>
</tr>
</tbody>
</table>

After correcting system problems, clear trouble codes. If the DIGITAL TECHNICIAN (Part No. HD-44750) is not available, perform 50 start and run cycles. To execute one run cycle:

1. Start the vehicle.
2. Let it run for at least 30 seconds.
3. Turn the engine off.

---

Figure 2-8. Check Engine Lamp Diagnostics
GENERAL

<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>DVOM</td>
</tr>
</tbody>
</table>

The BREAKOUT BOX (Part No. B-48115) splices into the main harness. Used in conjunction with a DVOM (Part No. HD-39978), it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

1. Depress latches on each side of connectors [10] (black) and [11] (gray) and detach connectors from the Electronic Control Module (ECM).

2. See Figure 2-9, Figure 2-10 and Figure 2-11. Attach Breakout Box to black connector [10].
   a. Attach black connector from Breakout Box to corresponding black ECM connector.
   b. Attach black connector from the wiring harness to black connector on Breakout Box.

   a. Attach gray connector from Breakout Box to corresponding gray ECM connector.
   b. Attach gray connector from the wiring harness to gray connector on Breakout Box.

REMOVAL

1. See Figure 2-9, Figure 2-10 and Figure 2-11. Depress latches on each side of connectors [10] (black) and [11] (gray).
2. Detach Breakout Box connectors from ECM connectors.
3. Detach Breakout Box connectors from wiring harness.
4. Reconnect harness to ECM.
# WIGGLE TEST

## GENERAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44750</td>
<td>DIGITAL TECHNICIAN</td>
</tr>
</tbody>
</table>

**NOTE**

DIGITAL TECHNICIAN (Part No. HD-44750) can be used to perform wiggle test.

The wiggle test checks for the presence of intermittents in a wiring harness.

## PROCEDURE

<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>DVOM</td>
</tr>
</tbody>
</table>

1. See Figure 2-12. Connect DVOM (Part No. HD-39978) to wiring harness between the suspect connections. When diagnosing Electronic Control Module (ECM) connections, a BREAKOUT BOX (Part No. B-48115) may be used to simplify the procedure. See 2.6 BREAKOUT BOX.

2. Set DVOM to read voltage changes.

3. Start motorcycle engine and run at idle.

4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

![Fluke 78 Multimeter (DVOM) (Part No. HD-39978)](image)
To locate faulty circuits or other system problems, follow the diagnostic flow charts in this section. For a systematic approach, always begin with 2.8 INITIAL DIAGNOSTIC CHECK, Initial Diagnostics. Read the general informational and then work your way through the flow chart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Cable

When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a BREAKOUT BOX (Part No. B-48115) and a DVOM (Part No. HD-39978) are required. See 2.6 BREAKOUT BOX.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

Dealership technicians filing out warranty claims should use the job/time code values in Digital Technician.

Table 2-10. Engine Starts Hard

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine temperature circuit</td>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>2.15 FUEL PRESSURE TEST</td>
</tr>
<tr>
<td>Spark plugs and/or wires</td>
<td>2.16 MISFIRE</td>
</tr>
<tr>
<td>Battery discharged</td>
<td>1.9 CHARGING SYSTEM, Troubleshooting</td>
</tr>
<tr>
<td>Crankshaft position sensor</td>
<td>2.22 DTC P0339 (56)</td>
</tr>
<tr>
<td>Manifold leak</td>
<td>2.9 INTAKE LEAK TEST</td>
</tr>
<tr>
<td>Ignition coil</td>
<td>2.16 MISFIRE</td>
</tr>
<tr>
<td>Leaky injectors</td>
<td>Test fuel injectors. 2.18 DTC P0117 (14), P0118 (14).</td>
</tr>
<tr>
<td>Valve sticking</td>
<td>Perform compression test. See appropriate Buell Service Manual.</td>
</tr>
</tbody>
</table>
### Table 2-11. Engine Performance Problems

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine temperature circuit</td>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
</tr>
<tr>
<td>Crankshaft position sensor circuit</td>
<td>2.22 DTC P0339 (56)</td>
</tr>
<tr>
<td>Spark plugs and/or wires</td>
<td>2.16 MISFIRE</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>2.15 FUEL PRESSURE TEST</td>
</tr>
<tr>
<td>Manifold leak</td>
<td>2.9 INTAKE LEAK TEST</td>
</tr>
<tr>
<td>NOTE - When manifold leak is large enough, IAC will close to almost 0 and code P0506 will set.</td>
<td>A low IAC may also indicate an air intake leak.</td>
</tr>
<tr>
<td>Throttle plates not opening fully</td>
<td>Perform throttle cable adjustment. See appropriate Buell Service Manual</td>
</tr>
<tr>
<td>EVAP hose (California models only) disconnected from induction module</td>
<td>Connect.</td>
</tr>
<tr>
<td>Water or dirt in fuel system</td>
<td>Drain and refill with fresh fuel.</td>
</tr>
<tr>
<td>Cooling fan inoperative</td>
<td>2.29 DTC P0691 (36), P0692 (36)</td>
</tr>
<tr>
<td>Active muffler control inoperative</td>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21).</td>
</tr>
</tbody>
</table>

### Table 2-12. Engine Exhaust Emits Black Smoke or Fouls Plugs

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine temperature circuit</td>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
</tr>
<tr>
<td>Clogged air filter</td>
<td>2.17 DTC P0112 (15), P0113 (15)</td>
</tr>
<tr>
<td>Leaky injectors</td>
<td>Test fuel injectors. 2.23 DTC P0502 (43), P0503 (43), P0608 (37)</td>
</tr>
<tr>
<td>Improper fuel pressure</td>
<td>2.15 FUEL PRESSURE TEST</td>
</tr>
</tbody>
</table>

### Table 2-13. Trouble Codes and Fault Conditions

<table>
<thead>
<tr>
<th>RANKING</th>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>FAULT CONDITION</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P0604</td>
<td>52</td>
<td>ECM RAM Failure</td>
<td>2.26 DTC P0603 (54), P0604 (52), P0605 (53), P0607 (55)</td>
</tr>
<tr>
<td>2</td>
<td>P0605</td>
<td>53</td>
<td>ECM ROM Failure</td>
<td>2.26 DTC P0603 (54), P0604 (52), P0605 (53), P0607 (55)</td>
</tr>
<tr>
<td>3</td>
<td>P0603</td>
<td>54</td>
<td>ECM EEPROM Failure</td>
<td>2.26 DTC P0603 (54), P0604 (52), P0605 (53), P0607 (55)</td>
</tr>
<tr>
<td>4</td>
<td>P0607</td>
<td>55</td>
<td>ECM Microprocessor Failure</td>
<td>2.26 DTC P0603 (54), P0604 (52), P0605 (53), P0607 (55)</td>
</tr>
<tr>
<td>5</td>
<td>P0339</td>
<td>56</td>
<td>Crankshaft Position Sensor Circuit Intermittent</td>
<td>2.22 DTC P0339 (56)</td>
</tr>
<tr>
<td>6</td>
<td>P0123</td>
<td>11</td>
<td>Throttle Position Sensor Circuit High</td>
<td>2.19 DTC P0122 (11), P0123 (11)</td>
</tr>
<tr>
<td>7</td>
<td>P0122</td>
<td>11</td>
<td>Throttle Position Sensor Circuit Low</td>
<td>2.19 DTC P0122 (11), P0123 (11)</td>
</tr>
<tr>
<td>8</td>
<td>P1502</td>
<td>45</td>
<td>Side Stand Sensor High/Open</td>
<td>2.34 DTC P1501 (45), P1502 (45), P1503 (45)</td>
</tr>
<tr>
<td>9</td>
<td>P1501</td>
<td>45</td>
<td>Side Stand Sensor Low</td>
<td>2.34 DTC P1501 (45), P1502 (45), P1503 (45)</td>
</tr>
<tr>
<td>10</td>
<td>P1503</td>
<td>45</td>
<td>Side Stand down at vehicle speed</td>
<td>2.34 DTC P1501 (45), P1502 (45), P1503 (45)</td>
</tr>
<tr>
<td>11</td>
<td>P1152</td>
<td>44</td>
<td>Bank Angle Sensor Shorted High</td>
<td>2.31 DTC P1151 (44), P1152 (44)</td>
</tr>
<tr>
<td>RANKING</td>
<td>DTC</td>
<td>CHECK ENGINE LAMP CODE</td>
<td>FAULT CONDITION</td>
<td>SOLUTION</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------------------------</td>
<td>----------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>12</td>
<td>P1151</td>
<td>44</td>
<td>Bank Angle Sensor Shorted Low</td>
<td>2.31 DTC P1151 (44), P1152 (44)</td>
</tr>
<tr>
<td>13</td>
<td>P1154</td>
<td>26</td>
<td>Clutch Position Sensor Circuit Low</td>
<td>2.32 DTC P1154 (26), P1155 (27)</td>
</tr>
<tr>
<td>14</td>
<td>P1155</td>
<td>27</td>
<td>Neutral Switch Input Circuit Low</td>
<td>2.32 DTC P1154 (26), P1155 (27)</td>
</tr>
<tr>
<td>15</td>
<td>P0118</td>
<td>14</td>
<td>Engine Temperature Sensor High/Open</td>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
</tr>
<tr>
<td>16</td>
<td>P0117</td>
<td>14</td>
<td>Engine Temperature Sensor Voltage Low</td>
<td>2.18 DTC P0117 (14), P0118 (14)</td>
</tr>
<tr>
<td>17</td>
<td>P0113</td>
<td>15</td>
<td>Intake Air Temperature Sensor High/Open</td>
<td>2.17 DTC P0112 (15), P0113 (15)</td>
</tr>
<tr>
<td>18</td>
<td>P0112</td>
<td>15</td>
<td>Intake Air Temperature Sensor Voltage Low</td>
<td>2.17 DTC P0112 (15), P0113 (15)</td>
</tr>
<tr>
<td>19</td>
<td>P0629</td>
<td>33</td>
<td>Fuel Pump Circuit High</td>
<td>2.28 DTC P0628 (33), P0629 (33)</td>
</tr>
<tr>
<td>20</td>
<td>P0628</td>
<td>33</td>
<td>Fuel Pump Circuit Low</td>
<td>2.28 DTC P0628 (33), P0629 (33)</td>
</tr>
<tr>
<td>21</td>
<td>P2301</td>
<td>24</td>
<td>Front Ignition Coil Control Circuit High</td>
<td>2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25)</td>
</tr>
<tr>
<td>22</td>
<td>P2300</td>
<td>24</td>
<td>Front Ignition Coil Control Circuit Low</td>
<td>2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25)</td>
</tr>
<tr>
<td>23</td>
<td>P2304</td>
<td>25</td>
<td>Rear Ignition Coil Control Circuit High</td>
<td>2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25)</td>
</tr>
<tr>
<td>24</td>
<td>P2303</td>
<td>25</td>
<td>Rear Ignition Coil Control Circuit Low</td>
<td>2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25)</td>
</tr>
<tr>
<td>25</td>
<td>P0262</td>
<td>23</td>
<td>Front Fuel Injector Circuit High</td>
<td>2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32)</td>
</tr>
<tr>
<td>26</td>
<td>P0261</td>
<td>23</td>
<td>Front Fuel Injector Circuit Low</td>
<td>2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32)</td>
</tr>
<tr>
<td>27</td>
<td>P0265</td>
<td>32</td>
<td>Rear Fuel Injector Circuit High</td>
<td>2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32)</td>
</tr>
<tr>
<td>28</td>
<td>P0264</td>
<td>32</td>
<td>Rear Fuel Injector Circuit Low</td>
<td>2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32)</td>
</tr>
<tr>
<td>29</td>
<td>P0563</td>
<td>16</td>
<td>Battery Voltage High</td>
<td>2.25 DTC P0562 (16), P0563 (16)</td>
</tr>
<tr>
<td>30</td>
<td>P0562</td>
<td>16</td>
<td>Battery Voltage Low</td>
<td>2.25 DTC P0562 (16), P0563 (16)</td>
</tr>
<tr>
<td>31</td>
<td>P0502</td>
<td>43</td>
<td>Vehicle Speed Sensor High</td>
<td>2.23 DTC P0502 (43), P0503 (43), P0608 (37)</td>
</tr>
<tr>
<td>32</td>
<td>P0503</td>
<td>43</td>
<td>Vehicle Speed Sensor Intermittent/Erratic High</td>
<td>2.23 DTC P0502 (43), P0503 (43), P0608 (37)</td>
</tr>
<tr>
<td>33</td>
<td>P1470</td>
<td>21</td>
<td>Exhaust Valve Actuator Stuck Open</td>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21)</td>
</tr>
<tr>
<td>34</td>
<td>P1478</td>
<td>21</td>
<td>Exhaust Valve Actuator High</td>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21)</td>
</tr>
<tr>
<td>35</td>
<td>P1471</td>
<td>21</td>
<td>Exhaust Valve Actuator Stuck Closed</td>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21)</td>
</tr>
<tr>
<td>36</td>
<td>P1477</td>
<td>21</td>
<td>Exhaust Actuator Low/Open</td>
<td>2.33 DTC P1470 (21), P1471 (21), P1477 (21), P1478 (21)</td>
</tr>
<tr>
<td>37</td>
<td>P0152</td>
<td>13</td>
<td>Oxygen Sensor Circuit High/Engine Rich</td>
<td>2.20 DTC P0151 (13), P0152 (11), P0154 (13)</td>
</tr>
<tr>
<td>38</td>
<td>P0154</td>
<td>13</td>
<td>Oxygen Sensor Open/Inactive</td>
<td>2.20 DTC P0151 (13), P0152 (11), P0154 (13)</td>
</tr>
<tr>
<td>39</td>
<td>P0151</td>
<td>13</td>
<td>Oxygen Sensor Circuit Low/Engine Lean</td>
<td>2.20 DTC P0151 (13), P0152 (11), P0154 (13)</td>
</tr>
<tr>
<td>40</td>
<td>P0511</td>
<td>34</td>
<td>Idle Air Control Circuit</td>
<td>2.24 DTC P0506 (34), P0507 (34), P0511 (34)</td>
</tr>
</tbody>
</table>
Table 2-13. Trouble Codes and Fault Conditions

<table>
<thead>
<tr>
<th>RANKING</th>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>FAULT CONDITION</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>P0506</td>
<td>34</td>
<td>Idle Air Control System - RPM Higher Than Expected</td>
<td>P0506 (34), P0507 (34), P0511 (34)</td>
</tr>
<tr>
<td>42</td>
<td>P0507</td>
<td>34</td>
<td>Idle Air Control System - RPM Lower Than Expected</td>
<td>P0506 (34), P0507 (34), P0511 (34)</td>
</tr>
<tr>
<td>43</td>
<td>P0692</td>
<td>36</td>
<td>Fan Control Circuit High</td>
<td>P0691 (36), P0692 (36)</td>
</tr>
<tr>
<td>44</td>
<td>P0691</td>
<td>36</td>
<td>Fan Control Circuit Low</td>
<td>P0691 (36), P0692 (36)</td>
</tr>
<tr>
<td>45</td>
<td>P0617</td>
<td>46</td>
<td>Starter Relay Circuit High</td>
<td>P0617 (46)</td>
</tr>
<tr>
<td>46</td>
<td>P1112</td>
<td>22</td>
<td>Active Intake Control Throttle Position Sensor Feedback Failure</td>
<td>P1110 (22), P1111 (22), P1112 (22) (JAPANESE MODELS ONLY)</td>
</tr>
<tr>
<td>47</td>
<td>P1111</td>
<td>22</td>
<td>Active Intake Control Circuit Short High</td>
<td>P1110 (22), P1111 (22), P1112 (22) (JAPANESE MODELS ONLY)</td>
</tr>
<tr>
<td>48</td>
<td>P1110</td>
<td>22</td>
<td>Active Intake Control Circuit Short Low/Open</td>
<td>P1110 (22), P1111 (22), P1112 (22) (JAPANESE MODELS ONLY)</td>
</tr>
<tr>
<td>49</td>
<td>P1601</td>
<td>47</td>
<td>Auxiliary Relay Driver Circuit</td>
<td>P1601 (47)</td>
</tr>
<tr>
<td>50</td>
<td>P0608</td>
<td>37</td>
<td>Vehicle Speed Sensor Control Module Fail</td>
<td>P1653 (35), P1654 (35)</td>
</tr>
<tr>
<td>51</td>
<td>P1654</td>
<td>35</td>
<td>Tachometer Output High</td>
<td>P1653 (35), P1654 (35)</td>
</tr>
<tr>
<td>52</td>
<td>P1653</td>
<td>35</td>
<td>Tachometer Output Low</td>
<td>P1653 (35), P1654 (35)</td>
</tr>
</tbody>
</table>

Figure 2-13. Diagnostic Check
## Table 2-14. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt, Ulysses, Lightning</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing, Under seat</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt, Ulysses, Lightning</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing, Under seat</td>
</tr>
<tr>
<td>[91A]</td>
<td>Data link connector</td>
<td>Firebolt, Ulysses, Lightning</td>
<td>4-place Deutsch</td>
<td>Under fairing, Behind left airflow guide, Under seat</td>
</tr>
</tbody>
</table>
Turn Ignition Switch ON. Set Engine Stop Switch to RUN. Do not start engine. Does check engine lamp illuminate?

YES

Does check engine lamp turn OFF after four seconds?

YES

Does engine start?

NO

See 2.11 CHECK ENGINE LAMP ON CONTINUOUSLY.

NO

See 2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON.

YES

Does check engine lamp display ignition module data? See 2.4 CHECKING FOR TROUBLE CODES.

YES

Are any trouble codes displayed?

NO

Refer to applicable trouble code flow chart. Start with highest priority trouble code. All DTCs are listed in Table 2-13.

NO

Refer to diagnostic tips in related trouble code chart (even if no DTC codes are set).

STOP

Go to Diagnostic Check (Part 2 of 2).
Diagnostic Check (Part 2 of 2)

Continued from Diagnostic Check (Part 1 of 2).

Remove Electronic Control Module (ECM) connectors [10B] (Black) and [11B] (Gray). Check for continuity to ground at data link connector [91A] terminals "1", "3" and "4". Continuity to ground?

- YES
- NO

Test the four data link connector terminals against their ECM connector terminals for continuity.

<table>
<thead>
<tr>
<th>DATA LINK TERMINAL</th>
<th>DATA LINK TERMINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Wire Color</td>
</tr>
<tr>
<td>1</td>
<td>(LGN/R)</td>
</tr>
<tr>
<td>2</td>
<td>(BK/W)</td>
</tr>
<tr>
<td>3</td>
<td>(V/R)</td>
</tr>
<tr>
<td>4</td>
<td>(GY)</td>
</tr>
</tbody>
</table>

Continuity present in all four circumstances?

- YES
- NO

- Repair short to ground.
- Replace ECM.
- Inspect terminals for damage or repair opens as necessary.

NOTE: After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
INTAKE LEAK TEST

GENERAL

NOTES

• To prevent false readings, keep airbox cover installed when performing test.
• Do not direct propane into air scoop, false readings will result.

LEAK TESTER

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41417</td>
<td>PROPANE ENRICHMENT KIT</td>
</tr>
</tbody>
</table>

Parts List

• Standard 14 oz. propane cylinder.
• PROPANE ENRICHMENT KIT (Part No. HD-41417).
• 12 in. (304 mm) long section of 1/4 in. (6 mm) diameter copper tubing.

Tester Assembly

1. Cut rubber hose from kit to 18 in. (457 mm) in length.
2. See Figure 2-14. Flatten one end of copper tube to form a nozzle.
3. Insert round side of copper tube into end of 18 in. (457 mm) tubing. See Figure 2-15.

Do not allow open flame or sparks near propane. Propane is extremely flammable, which could cause death or serious injury. (00521b)

1. Start engine.
2. Warm engine to operating temperature.
3. See Figure 2-15. Turn knob (5) counterclockwise to open propane bottle.
4. See Figure 2-16. Aim nozzle toward possible sources of leak such as Fuel Injectors and intake tract.
5. See Figure 2-15. Push valve (4) to release propane. Tone of engine will change when propane enters source of leak.
6. Note which components fail the intake leak test, for further servicing.
Figure 2-16. Checking for Leaks
2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON

GENERAL

If the engine stop switch is set to RUN with the engine off, and the ignition switch is turned ON the check engine lamp should illuminate for four seconds.

Battery voltage is supplied to the check engine lamp bulb. The check engine lamp bulb is grounded by the Electronic Control Module (ECM) through the (BK/Y) wire. A lack of power to the ECM will cause the check engine lamp to be inoperative and also create a no start situation.

Figure 2-18. Electronic Control Module (Ulysses)

DIAGNOSTICS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
</tbody>
</table>

Diagnostic Tips

Check for the following conditions:

- Check for open (BK/Y) wire.
- Check for open fuse.
- Check for failed bulb

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black pin probe and patch cord.
2. See Figure 2-18, Figure 2-19, Figure 2-20. Inspect connector [10] (black) for contamination or corrosion. If connection is good, replace ECM. See 2.13 NO ECM POWER.
3. Check continuity between instrument module connector [39] terminal "7" and ECM connector [10] (black), terminal "23".

Figure 2-17. Check Engine Lamp (Typical)

Figure 2-19. Electronic Control Module (Lightning)
Table 2-15. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen</td>
</tr>
</tbody>
</table>
Figure 2-22. Check Engine Lamp Circuit (Firebolt)

Table 2-16. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
</tbody>
</table>
Check Engine Lamp Not Illuminated at Key On

Turn Ignition Switch ON. Set Engine Stop Switch to RUN. Does the engine start?

Set Engine Stop Switch to OFF. Disconnect Electronic Control Module (ECM) connector [10] (Black) and connect Breakout Box. Turn Ignition Switch ON. Jumper Breakout Box (Black) terminal “23” to Ground. Check engine lamp should be ON. Is it?

1. YES
2. NO

YES

Replace ECM.

NO

Connect jumper wire from terminal “7” at connector [39] to ground. Is check engine lamp ON?

YES

Replace ECM. See 2.12 ENGINE CRANKS BUT WILL NOT START for no start condition and then return to 2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON to resolve no engine check lamp.

NO

Did check engine lamp and no start conditions occur simultaneously?

YES

No ECM power. Refer to NO ECM POWER.

NO

See 2.12 ENGINE CRANKS BUT WILL NOT START for no start condition and then return to 2.10 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON to resolve no engine check lamp.

Disassemble Instrument Module. Inspect check engine lamp bulb. Bulb failed?

YES

Replace bulb.

NO

Replace Instrument Module. See INSTRUMENT MODULE in the appropriate Buell Service Manual.

Repair open or short to voltage on (BK/Y) wire between connector [39] and connector [108] (Black).

NOTE:
After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
GENERAL

See Figure 2-23. If the engine stop switch is set to RUN with the engine off, and the ignition switch is turned ON, the check engine lamp should illuminate for four seconds.

Following the initial period of illumination, the lamp should turn off for four seconds. It may then come back on for an eight second period (for a stored error) or remain on continuously (current error).

DIAGNOSTICS

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See Figure 2-25. If the check engine lamp turns off when the black Electronic Control Module (ECM) connector [10] is unplugged, the (BK/Y) wire is not shorted to ground.
Figure 2-26. Electronic Control Module (Firebolt)

![Diagram of Electronic Control Module (Firebolt)](image)

Figure 2-27. Check Engine Lamp Circuit (Ulysses, Lightning)

![Diagram of Check Engine Lamp Circuit](image)

Table 2-17. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen</td>
</tr>
</tbody>
</table>
Figure 2-28. Check Engine Lamp Circuit (Firebolt)

Table 2-18. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
</tbody>
</table>
Check Engine Lamp On Continuously

1. Turn Ignition Switch OFF. Disconnect Electronic Control Module (ECM) connector [10] (Black). Turn Ignition Switch ON. Check engine lamp should be OFF. Is it?

   YES
   
   With Ignition Switch OFF, reconnect ECM connector [10] (Black). With Ignition Switch ON, verify that there is NOT a 4 second check engine lamp OFF period. Is there a check engine lamp OFF period?

   YES
   
   Check engine lamp function OK. Check for trouble codes. See CHECKING FOR TROUBLE CODES.

   NO
   
   Replace ECM.

   NO
   
   Disconnect Instrument Module connector [39]. Remove (BK/ Y) wire from connector [39A]. Reconnect [39]. Check engine lamp ON?

   YES
   
   Repair short to ground on (BK/Y) wire between connector [39] and connector [10] (Black).

   NO
   
   Replace Instrument Module.

NOTE:
After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
ENGINE CRANKS BUT WILL NOT START  2.12

GENERAL

If the starter will not crank engine, the problem is not ignition related. See 2.14 STARTS, THEN STALLS.

NOTE
The engine may be started and run when the trouble codes are received using a jumper wire on terminals “1” and “2” of the data link connector. However, if the jumper wire is removed with the engine running, the check engine lamp will continue to flash trouble codes. To stop check engine lamp from flashing codes, turn engine stop switch OFF.

DIAGNOSTICS

<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-26792</td>
<td>SPARK TESTER</td>
</tr>
<tr>
<td>HD-34730-2C</td>
<td>FUEL INJECTOR TEST LAMP</td>
</tr>
</tbody>
</table>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) between harness and Electronic Control Module (ECM). See 2.6 BREAKOUT BOX.

2. Check battery condition. Perform a voltage test and recharge if below 12.70 volts. Check battery connections and perform load test. Replace the battery if necessary.

3. Remove spark plug cable from spark plug.
   a. Visually check condition of plug.
   b. See Figure 2-29. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt.
   c. While cranking starter, look for spark. Repeat procedure on other spark plug cable.

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)


5. Access fuel injectors.
   b. Remove airbox to access fuel injectors. See appropriate Buell Service Manual.

6. See Figure 2-30. Plug FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box. Note that cranking the engine with test lamp in place of an ignition coil can sometimes cause code P2300 or P2304. This condition is normal and does not by itself indicate a malfunction. Codes must be cleared if this condition occurs.

7. If resistance greater than 1 ohm is found between ECM connector [10] terminal “25” OR “34” and terminal “9”, but not both, the open must be repaired but this repair will not correct the concern.

If resistance greater than 1 ohm is found between ECM connector [10] terminal “31” OR “32” and terminal “9”, but not both, the open must be repaired but this repair will not correct the concern.
Table 2-19. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition coil</td>
<td>All</td>
<td>3-place Delphi</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[84]</td>
<td>Front injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[133]</td>
<td>Side stand sensor</td>
<td>All</td>
<td>3-place Amp</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>Firebolt</td>
<td>6-place Sumitomo</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2-31. Ignition Circuit
Is fresh gasoline in tank?

**YES**
- Check for trouble codes. See CHECKING FOR TROUBLE CODES. Codes found?
  - **YES**
    - Refer to applicable trouble code chart. Start with highest priority code.
  - **NO**
    - Connect Breakout Box. Measure voltage between connector 11 (Gray) terminal "17" (+) and terminal "19" (-). Voltage should be 0.25-2.7 volt (Run Mode). Is it?
      - **YES**
        - Install Fuel Pressure Gauge. See 2.15 FUEL PRESSURE TEST. While cranking engine (for more than two seconds to ensure proper system operation), verify that pressure rises to 49-51 PSI (338-352 kPa). Adequate pressure?
          - **YES**
            - Incorrect pressure. See 2.15 FUEL PRESSURE TEST.
          - **NO**
            - No Fuel Pump response or check engine lamp. See 2.13 NO ECM POWER.
      - **NO**
        - Short Fuel Pump response, check engine lamp OK. See 2.31 DTC P1151 (44), P1152 (44).
        - No Fuel Pump response or check engine lamp. See 2.13 NO ECM POWER.
          - **YES**
            - Replace Battery.
          - **NO**
            - Recharge Battery.

**NO**
- Fill tank with fresh gasoline.
- Place transmission in neutral. Turn Ignition Switch ON and set Engine Stop Switch to RUN. Did fuel pump run 2-3 seconds and did the check engine lamp illuminate?
  - **YES**
    - Install Fuel Pressure Gauge. See 2.15 FUEL PRESSURE TEST. While cranking engine (for more than two seconds to ensure proper system operation), verify that pressure rises to 49-51 PSI (338-352 kPa). Adequate pressure?
      - **YES**
        - Incorrect pressure. See 2.15 FUEL PRESSURE TEST.
      - **NO**
        - No Fuel Pump response or check engine lamp. See 2.13 NO ECM POWER.
  - **NO**
    - Check battery connections. Check battery voltage. Is voltage above 12.7 volts?
      - **YES**
        - Does battery pass load test?
          - **YES**
            - Place transmission in neutral. Turn Ignition Switch ON and set Engine Stop Switch to RUN. Did fuel pump run 2-3 seconds and did the check engine lamp illuminate?
          - **NO**
            - Check battery connections. Check battery voltage. Is voltage above 12.7 volts?
      - **NO**
        - Recharge Battery.

Go to Engine Cranks but Will Not Start Test (Part 2 of 3).
Engine Cranks But Will Not Start (Part 2 of 3)

Continued from Engine Cranks but Will Not Start Test (Part 1 of 3).

Check spark plug condition. Replace if fouled.
Check spark at both plugs while cranking. Is spark present?

1. Connect Breakout Box to the Electronic Control Module (ECM) and use test adapters for following inspection.

2. Check engine compression. See appropriate BUELL SERVICE MANUAL.


4. Using DVOM, check for battery voltage at ignition coil [83] terminal "2". Power present after Ignition Switch is ON?

5. Open in (GY) wire between splice for fuel pump wire and Ignition Coil. Repair open.

6. **Front Coil:** Insert test lamp between ECM terminal "9" (Black) and "25" (Black), then between terminals "9" and "34" of Breakout Box. Does test lamp flash when engine is cranked?

7. **Rear Coil:** Insert test lamp between ECM terminal "9" (Black) and "31" (Black), then between terminals "9" and "32" of Breakout Box. Does test lamp flash when engine is cranked?

   - **YES:**
     - Check ignition coil connections. Are connections OK?
     - Test Spark Plug. Cable resistance. See 2.16 MISFIRE Test. Resistance OK?
     - Inspect Spark Plugs. Are plugs good?
     - Replace Ignition Coil.
     - Replace Spark Plug Cables.
     - Replace Spark Plugs.

   - **NO:**
     - Repair.

   **STOP**

Go to Engine Cranks but Will Not Start Test (Part 3 of 3).
Engine Cranks But Will Not Start (Part 3 of 3)

Continued from Engine Cranks but Will Not Start Test (Part 2 of 3).

Disconnect Electronic Control Module (ECM) from Breakout Box. Using a DVOM, check resistance between Breakout Box terminals “18” (Gray) and “26” (Gray).

Below 700 Ohms.

Disconnect Crankshaft Position Sensor. Check for continuity between Breakout Box terminals “18” (Gray) and “26” (Gray). Is resistance greater than 1.0 ohm?

YES

Replace Crankshaft Position Sensor.

NO

Repair short between circuits.

Above 1500 Ohms.

Disconnect Crankshaft Position Sensor. Check for continuity between connector [79B] terminal “1” and ground. Check for continuity between connector [79B] terminal “2” and ground. Is resistance greater than 1.0 ohm?

YES

Replace Crankshaft Position Sensor.

NO

Locate and repair short to Ground.

Above 1500 Ohms.

Disconnect Crankshaft Position Sensor. Check for continuity between Breakout Box terminal “18” (Gray) to crankshaft position sensor connector [79B] terminal “1”. Check for continuity between Breakout Box terminal “26” (Gray) to crankshaft position sensor connector [79B] terminal “2”. Is resistance greater than 1.0 ohm?

YES

Replace Crankshaft Position Sensor.

NO

Locate and repair open circuit.

Connect DVOM to crankshaft position sensor terminals “1” and “2”. Measure AC voltage output of the sensor while cranking engine. Is voltage at least 1.0 VAC?

YES

Replace Crankshaft Position Sensor.

NO

Replace ECM.

NOTE:
After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
GENERAL
A relay controlled by the engine stop switch supplies power to the ECM. The relay requires a ground to operate. If the ground is not established, the ECM will not receive power. If the ECM does not appear to be receiving power, check the ground sources. An open ignition fuse or ECM fuse can also disable the ECM.

DIAGNOSTICS

<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>

Diagnostic Notes
Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

Figure 2-32. ECM Power Circuit (Ulysses, Lightning)

Table 2-20. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>To the right of windscream</td>
</tr>
</tbody>
</table>
### Table 2-21. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>To the right of windscreen</td>
</tr>
</tbody>
</table>
With Ignition Switch ON, Transmission in neutral and Engine Stop Switch in RUN position, check the Battery Fuse, Ignition Fuse and Key Switch Fuse. Are fuses OK?

YES

NO

1. Attach Breakout Box (B-48115) to the Electronic Control Module (ECM). Check for battery voltage between Breakout Box [10] terminals “8” (Black) and “9” (Black). Is voltage present?

YES

NO

Replace fuse(s) as needed.

NOTE: After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BEUL SERVICE MANUAL.

Check for battery voltage on ignition relay terminal “87” (GY). Is voltage present?

YES

NO

Check for continuity to ground on Breakout Box terminal “8” (Black). Is continuity present?

YES

NO

Replace ECM.

Check for battery voltage on ignition relay terminal “85” (BK). Is voltage present?

YES

NO

Repair open between ECM and Ignition Relay.

Check for continuity to ground on ignition relay terminal “30” (GY/O). Is continuity present?

YES

NO

Locate and repair open on (BK) wire to ground from ignition relay.

Check for battery voltage on ignition relay terminal “86” (W/BK). Is voltage present?

YES

NO

Repair open on (GY/O) wire between Ignition Relay and Ignition Fuse.

Check for battery voltage on right handlebar switch connector [22A] terminal “3” (W/BK) wire. Is voltage present?

YES

NO

Replace Ignition Relay.

Check for battery voltage on right handlebar switch connector [22A] terminal “4” (R/BK) wire. Is voltage present?

YES

NO

Repair open on (W/BK) wire between connector [22] and Ignition Relay.

Replace right handlebar switch assembly.

Repair open on (R/BK) wire between right handlebar switch connector [22] and Ignition Switch.
STARTS, THEN STALLS

GENERAL

This symptom may be created by the following:

- fuel system.
- idle air control system.
- starting engine with side stand extended and transmission in gear.

![Figure 2-34. Ignition Circuit](image-url)

Table 2-22. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Table 2-22. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition coil</td>
<td>All</td>
<td>3-place Delphi</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[84]</td>
<td>Front injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>All</td>
<td>1-place</td>
<td>Under sprocket cover</td>
</tr>
<tr>
<td>[133]</td>
<td>Side stand sensor</td>
<td>All</td>
<td>3-place Amp</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>Firebolt</td>
<td>6-place Sumitomo</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Engine Starts Then Stalls

Fresh gasoline in tank?
- YES
  - Check for trouble codes. See 2.4 CHECKING FOR TROUBLE CODES. Codes found?
    - YES
      - Refer to applicable trouble code chart. Start with highest priority code.
    - NO
      - Add gasoline.
  - NO

With Ignition Switch ON, the Engine Stop Switch in the RUN position, side stand up (HDI vehicles only), transmission in neutral (lamp ON), does the engine start and stay running?
- YES
  - System operation normal.
  - Tap lightly on Fuel Injectors. Problem still exist?
    - YES
      - Replace Fuel Injectors. Problem still exist?
        - YES
          - Replace Electronic Control Module (ECM).
        - NO
          - System OK.
    - NO
      - System OK.
  - NO
    - Repair or replace Clutch or Neutral switches or circuitry.
    - Will engine start with throttle opened partially and stall when throttle is closed?
      - YES
        - See flow chart under 2.34 DTC P1154 (26), P1155 (27). Clutch Switch or Neutral Switch problem?
      - NO
        - See 2.34 DTC P1501 (45), P1502 (45), P1503 (45).
    - NO
      - See flow chart under 2.34 DTC P0506 (34), P0507 (34), P0511 (34).

Turn Ignition Switch OFF. Place transmission in gear and disengage clutch. Turn Ignition Switch ON and attempt to start engine. Does engine start and stay running?
- YES
  - Turn Ignition Switch OFF. Lower the Side Stand (HDI vehicles only). Place transmission in neutral and release clutch. Turn Ignition Switch ON and attempt to start engine. Does engine start and stay running?
    - YES
      - See 2.4 DTC P0503 (34), P0506 (34), P0507 (34), P0511 (34).
    - NO
      - Check fuel pressure while cranking engine. See 2.15 FUEL PRESSURE TEST. Is fuel pressure OK?
  - NO
    - Side Stand Sensor problem. See flow chart under 2.34 DTC P1501 (45), P1502 (45), P1503 (45).
    - System operation normal.

System operation normal.

NOTE:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

When replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
2.15 FUEL PRESSURE TEST

INSPECTION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-45522</td>
<td>FUEL PRESSURE GAUGE ADAPTER</td>
</tr>
<tr>
<td>HD-41182</td>
<td>FUEL PRESSURE GAUGE</td>
</tr>
</tbody>
</table>

**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. Remove airbox. See the appropriate Buell Service Manual.

2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 2-35. Disconnect the 4-place fuel pump connector [86]. The connector is located inside the left rear portion of the fuel tank/frame.
   b. With the motorcycle in neutral, start the engine and allow vehicle to run.
   c. When the engine stalls, press the starter button for 3 seconds to remove any remaining fuel from fuel line.

3. Figure 2-38 Depress button (2) of fuel line connector and disconnect the fuel line (3) from throttle body inlet (1).

4. See Figure 2-39. Attach FUEL PRESSURE GAUGE ADAPTER (Part No. B-45522) (2) to throttle body inlet (1).

5. Connect the fuel line (3) to fuel pressure gauge adapter.

   **NOTE**
   See Figure 2-40. Verify that fuel valve (2) and air bleed petcock (5) on the gauge are closed.

6. Attach FUEL PRESSURE GAUGE (Part No. HD-41182) (4) to fuel pressure gauge adapter (1).

7. See Figure 2-35, Attach fuel pump connector [86] to main wiring harness.

8. See Figure 2-40. Pressurize the fuel system.
   a. Start and idle engine to pressurize the fuel system.
   b. Open fuel valve (2) on fuel pressure gauge to allow fuel to flow down the gauge hose.
   c. Position the air bleed tube (3) into proper container.
   d. Open and close the air bleed petcock (5) to purge the fuel pressure gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube.
   e. Close the air bleed petcock.

9. Open throttle and increase engine speed to 2500-3000 RPM. Note the reading on the pressure gauge.
   a. If pressure is 49-51 PSI (338-352 kPa) then system is operating within limits.
   b. If pressure is not within limits, see flow chart after disconnecting pressure gauge.

**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)

10. See Figure 2-40. Turn engine off. Detach pressure gauge (4) from adapter (1).
    a. Open the air bleed petcock (5) to relieve fuel system pressure and purge the pressure gauge of gasoline.
    b. Remove adapter from vehicle.

11. Detach adapter from vehicle.

12. Connect fuel line to throttle body inlet.

Figure 2-35. Fuel Pump Connector [86] (Ulysses - swingarm removed for illustration)
Figure 2-36. Fuel Pump Connector [86] (Lightning - swingarm removed for illustration)

1. Throttle body inlet
2. Button
3. Fuel line

Figure 2-38. Fuel Line

Figure 2-37. Fuel Pump Connector [86] (Firebolt - swingarm removed for illustration)

1. Throttle body inlet
2. Fuel pressure gauge adapter
3. Fuel line

Figure 2-39. Fuel Pressure Gauge Adapter
1. Fuel pressure gauge adapter (B-45522)
2. Fuel valve (closed position)
3. Air bleed tube
4. Fuel pressure gauge (HD-41182)
5. Air bleed petcock

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple socket probe and patch cord.
2. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX
3. If resistance greater than 1 ohm is found between ECM connector [10] terminal "27" OR "28" and Fuel Pump connector [86A] terminal "4", but not both, the open must be repaired but this repair will not correct the concern.

Figure 2-40. Fuel Pressure Gauge (Part No. HD-41182)

Figure 2-41. Fuel Pump Circuit (Ulysses, Lightning)
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscren</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel pump</td>
<td>4-place Multilock</td>
<td>Left side of frame</td>
</tr>
</tbody>
</table>
Figure 2-42. Fuel Pump Circuit (Firebolt)
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel pump</td>
<td>4-place Multilock</td>
<td>Left side of frame</td>
</tr>
</tbody>
</table>
Run fuel pressure test as described under 2.15 FUEL PRESSURE TEST. Does fuel pressure remain steady at 49-51 PSI (338-352 kPa)?

- **High Pressure.**
  - Check for faulty Fuel Pump and replace. See FUEL PUMP in the appropriate Buell Service Manual.

- **Low Pressure.**
  - Check voltage drop between battery positive (+) and fuel pump connector [86B] terminal during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
    - **YES**
      - Move negative (-) probe to Ignition Relay terminal “30” or “3” (GY/O) wire. Measure voltage during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
        - **YES**
          - Locate and repair poor connection between Battery and Ignition Relay.
        - **NO**
          - Replace Ignition Relay.
    - **NO**
      - Check for restricted Fuel Pump Inlet Screen. Is screen restricted?
        - **YES**
          - Flush out fuel cell. See FUEL PUMP in the appropriate Buell Service Manual.
        - **NO**
          - Check for faulty Fuel Pump and replace. See FUEL PUMP in the appropriate Buell Service Manual.

- **No Pressure.**
  - Go to Fuel Pressure Test (Part 2 of 2).

- **Low Pressure.**
  - No trouble found. Review symptoms.

- **No Pressure.**
  - Review symptoms.

**High Pressure.**

- Check for faulty Fuel Pump and replace. See FUEL PUMP in the appropriate Buell Service Manual.

**Low Pressure.**

- Check voltage drop between battery positive (+) and fuel pump connector [86B] terminal during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
  - **YES**
    - Move negative (-) probe to Ignition Relay terminal “30” or “3” (GY/O) wire. Measure voltage during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
      - **YES**
        - Locate and repair poor connection between Ignition Relay and Fuel Pump.
      - **NO**
        - Locate and repair poor connection between Battery and Ignition Relay.
  - **NO**
    - Replace Ignition Relay.

**No Pressure.**

- Review symptoms.

**High Pressure.**

- Check for faulty Fuel Pump and replace. See FUEL PUMP in the appropriate Buell Service Manual.

**Low Pressure.**

- Check voltage drop between battery positive (+) and fuel pump connector [86B] terminal during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
  - **YES**
    - Move negative (-) probe to Ignition Relay terminal “30” or “3” (GY/O) wire. Measure voltage during first two seconds after Ignition Switch is ON. Is voltage greater than 1.0V?
      - **YES**
        - Locate and repair poor connection between Ignition Relay and Fuel Pump.
      - **NO**
        - Replace Ignition Relay.
  - **NO**
    - Review symptoms.

**No Pressure.**

- Review symptoms.

**High Pressure.**

- Check for faulty Fuel Pump and replace. See FUEL PUMP in the appropriate Buell Service Manual.
Continued from Fuel Pressure Test (Part 1 of 2).

Check for battery voltage at terminal “3” (O/GY) on fuel pump connector [86A].

Is battery voltage present?

1. Connect test lamp to battery positive (+) terminal. Probe fuel pump connector [86B] terminal “4” (BN/Y) during the first two seconds after ignition switch is turned ON. Does test lamp light?

   YES
   - Inspect fuel pump wiring. Is wiring OK?
   - Repair fuel pump wiring.

   NO
   - Locate and repair open in (O/GY) wire.

2. Connect Breakout Box (B-48115) to Electronic Control Module (ECM). Check continuity between fuel pump connector [86B] terminal “4” and ECM connector [10] (Black) terminals “27” and “28”. Is continuity present?

   YES
   - Replace ECM.
   - Locate and repair open on (BN/Y) wire.

   NO
   - Repair fuel pump wiring.

NOTE:
After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
MISFIRE

GENERAL

Misfire at Idle or Under Load
Misfire conditions may be caused by:

- Battery condition and connections.
- Fuel system problems. See tables under 2.8 INITIAL DIAGNOSTIC CHECK.

DIAGNOSTICS

<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>HD-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
</tbody>
</table>

Diagnostic Notes
Each reference number below correlates to a circled number on the flow chart(s).

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)

1. See Figure 2-43. A SPARK TESTER (Part No. HD-26792) must be used to verify adequate secondary voltage (25,000 volts) at the spark plug.
   a. Turn ignition switch OFF.
   b. Remove spark plug cable from spark plug. Visually check plug condition.
   c. Attach cable to spark tester. Clip tester to cylinder head bolt.
   d. While cranking engine, watch for spark to jump tester gap on leads.
   e. Reinstall and repeat procedure on other spark plug cable.

2. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil.
   b. Using an ohmmeter, touch probes to terminals on each end of plug wire.
   c. Compare resistance values to Table 2-25. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

3. If carbon tracking is evident, replace ignition coil and inspect spark plug wires. Wires must be clean and tight. Excessive wire resistance or faulty connections can cause ignition coil damage. See 2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25).

4. This test can also be performed by substituting a known good ignition coil for one causing the no spark condition. The ignition coil does not require full installation to be functional. Verify faulty ignition coil by performing resistance test. See 2.37 DTC P2300 (24), P2301 (24), P2303 (25), P2304 (25).

5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.

Table 2-25. Spark Plug Cables

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>FRONT &amp; REAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>5.75 in. (146 mm)</td>
</tr>
<tr>
<td>Resistance</td>
<td>1,430-3,360 ohms</td>
</tr>
</tbody>
</table>
Figure 2-44. Ignition Circuit

Table 2-26. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[10]</td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition coil</td>
<td>All</td>
<td>3-place Delphi</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[84]</td>
<td>Front injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath airbox base</td>
</tr>
<tr>
<td>[133]</td>
<td>Side stand sensor</td>
<td>All</td>
<td>3-place Amp</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>Firebolt</td>
<td>6-place Sumitomo</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Is fuel contaminated?

1. Use Spark Tester to check Spark Plug Cables. See 2.12 ENGINE CRANKS BUT WILL NOT START. Did spark jump gap on both leads?

   YES

   Drain and flush fuel tank. Refill with fresh fuel.

   YES

   Use Spark Tester to check Spark Plug Cables. See 2.12 ENGINE CRANKS BUT WILL NOT START. Did spark jump gap on both leads?

   NO

   NO

   Check resistance of each Spark Plug Cable that did not fire the Spark Tester. Also, check for faulty spark plug wire connections and wire boots for carbon tracking. Are wires OK?

   NO

   Check for:
   • Faulty, worn or cracked Spark Plug(s)
   • Spark Plug fouling due to engine mechanical fault
   • Faulty or poor connection at Spark Plug

   YES

   Ignition Coils should be free of carbon tracking. Are they?

   NO

   Replace faulty Spark Plug Wires.

   NO

   Switch Ignition Coil with unit known to be good. Perform spark test. Did spark jump gap during engine cranking?

   NO

   Replace Ignition Coil.

   YES

   Original Ignition Coil is faulty. Replace.

   STOP

Go to Misfire at Idle or Under Load (Part 2 of 2).
## Misfire at Idle or Under Load (Part 2 of 2)

**Below 700 Ohms.**
- Disconnect Crankshaft Position Sensor. Check for continuity between Breakout Box terminals “18” (Gray) and “26” (Gray).
- Is resistance greater than 1.0 ohm?
  - **YES:** Replace Crankshaft Position Sensor.
  - **NO:** Repair short between circuits.

**Above 1500 Ohms.**
- Disconnect Crankshaft Position Sensor. Check for continuity between Breakout Box terminal “18” (Gray) and “26” (Gray).
- Is resistance greater than 1.0 ohm?
  - **YES:** Repair short between circuits.
  - **NO:** Connect DVOM to crankshaft position sensor terminals “1” and “2”. Measure AC voltage output of the sensor while cranking engine. Is voltage greater than 1.0V?
    - **YES:** Replace Crankshaft Position Sensor.
    - **NO:** Replace ECM.

**Above 1500 Ohms.**
- Disconnect Crankshaft Position Sensor. Check for continuity between Breakout Box terminal “18” (Gray) to crankshaft position sensor connector [79B] terminal “1”.
- Is resistance greater than 1.0 ohm?
  - **YES:** Locate and repair open circuit.
  - **NO:** Replace Crankshaft Position Sensor.

**NOTE:**
After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
GENERAL

Intake Air Temperature (IAT) Sensor

See Figure 2-46. The Electronic Control Module (ECM) supplies and monitors a signal at terminal "14" of [11] to one side of the IAT sensor. The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM terminal "27" of [11].

Refer to Table 2-28. The IAT sensor is a thermistor device, meaning that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the supplied voltage to terminal "14".

Table 2-28. Intake Air Temperature Sensor Specifications

<table>
<thead>
<tr>
<th>VOLTS</th>
<th>RESISTANCE</th>
<th>TEMP °C</th>
<th>TEMP °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.49</td>
<td>1086</td>
<td>125</td>
<td>257</td>
</tr>
<tr>
<td>0.68</td>
<td>1561</td>
<td>113</td>
<td>235</td>
</tr>
<tr>
<td>0.86</td>
<td>2077</td>
<td>100</td>
<td>212</td>
</tr>
<tr>
<td>1.13</td>
<td>2920</td>
<td>90</td>
<td>194</td>
</tr>
<tr>
<td>1.40</td>
<td>3889</td>
<td>80</td>
<td>176</td>
</tr>
<tr>
<td>2.25</td>
<td>8149</td>
<td>60</td>
<td>140</td>
</tr>
<tr>
<td>3.09</td>
<td>16,178</td>
<td>40</td>
<td>104</td>
</tr>
<tr>
<td>3.52</td>
<td>23,670</td>
<td>30</td>
<td>86</td>
</tr>
<tr>
<td>3.94</td>
<td>31,170</td>
<td>20</td>
<td>68</td>
</tr>
<tr>
<td>4.24</td>
<td>55,359</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>4.53</td>
<td>96,383</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>4.68</td>
<td>146,250</td>
<td>-10</td>
<td>14</td>
</tr>
<tr>
<td>4.83</td>
<td>284,118</td>
<td>-20</td>
<td>-4</td>
</tr>
</tbody>
</table>

NOTE

All voltage and resistance values are approximate (±20%).

DIAGNOSTICS

Diagnostic Tips

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check for the following conditions:

- Poor connection. Inspect ECM harness connector for backed out terminals, improper mating, broken locks improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

- Perform 2.7 WIGGLE TEST to locate intermittents. If connectors and harness check out OK, check intake air temperature reading while moving related connectors and wiring harness. If the failure is induced, the IAT sensor display will change.

- Shifted sensor. The temperature-to-resistance values table may be used to test the IAT sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to EFI harness only (leave ECM disconnected). See 2.6 BREAKOUT BOX.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple socket probes and patch cord.

3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.

Figure 2-46. Intake Air Temperature Sensor Circuit

Table 2-29. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses,</td>
<td>Lightning</td>
<td>Under seat</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature (IAT)</td>
<td>All</td>
<td>2-place Amp</td>
<td>In air cleaner baseplate</td>
</tr>
</tbody>
</table>

Connect ECM to Breakout Box. Check for Intermittents, see 2.7 WIGGLE TEST. Intermittents present?

Yes

While wiggling harness to locate source of intermittents, perform the steps in DTC P0112 (15), P0113 (15) (Part 2 of 2) marked by Bold Asterisks. Repair as necessary.

No

Go To Intake Air Temperature Sensor DTC P0112 (15); P0113 (15) (Part 2 of 2)

With IAT Sensor disconnected, disconnect Breakout Box connector [11] (Gray). Measure resistance between Breakout Box terminal “14” (Gray) and ground. Is resistance less than 1 megohm?

Yes

Replace IAT Sensor. See INTAKE AIR TEMPERATURE SENSOR in appropriate Buell Service Manual, clear codes and road test. Did check engine lamp turn ON and set only DTC P0112 (15) or P0113 (15)?

No

Less than 4.7 volts

With IAT Sensor disconnected, disconnect Breakout Box connector [11] (Gray). Measure voltage between Breakout Box terminal “14” (Gray) and terminal “27” (-) (Gray). Is the voltage approximately 5.0 volts?

Yes

Repair short to ground on (LGN/Y) wire.

No

Repair ECM.

Unplug ECM leaving Breakout Box connected at vehicle harness. Measure voltage between Breakout Box terminal “14” (Gray) and ground. Is the voltage 0 volts?

Yes

Replace ECM.

No

Examine IAT Sensor signal wire (LGN/Y) for short to 12 volts and repair.

At some point in the flow chart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
**Intake Air Temperature: DTC P0112 (15); DTC P0113 (15) (Part 2 of 2)**

At some point in the flow chart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

---

### Step 2
**Continued from Intake Air Temperature Sensor, DTC P0112 (15) and P0113 (15) (Part 1 of 2).**

Disconnect IAT Sensor connector [89]. Measure resistance between connector [89A] terminals “1” and “2”. With engine at room temperature 60-90°F (15.6-32.2°C), is resistance between 6816-3314 ohms?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Using a DVOM, measure the resistance between ECM connector [11] (Gray) terminals “14” and “27” on Breakout Box. Is it greater than 1.0 megohm?</td>
<td>Examine (BK/W) wire in harness for open circuit and repair.</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Using a DVOM, measure the resistance between ECM connector [11] (Gray) terminal “14” on Breakout Box and ground. Is it greater than 1.0 megohm?</td>
<td>Examine (LGN/Y) wire and (BK/W) wire in harness for short between these two circuits and repair.</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>To locate sources of intermittents, wiggle harness while performing steps marked above by Bold Asterisk. Repair as necessary.</td>
<td>Examine harness for short to ground and repair.</td>
</tr>
</tbody>
</table>

---

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
GENERAL

Engine Temperature (ET) Sensor

**NOTE**

Do not pull on ET sensor wiring. Excess strain to sensor wiring will cause sensor damage.

See Figure 2-47. The Electronic Control Module (ECM) supplies and monitors a 0-5 volt signal to one side of the ET sensor. The other side of the ET sensor is connected to ground through the engine.

Refer to Table 2-31. The ET sensor is a thermistor device which means that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage sent to the temperature sensor input on the ECM.

- At high temperatures, the resistance of the sensor is very low. This effectively lowers the signal voltage.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to the supplied voltage of 5 volts.

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

<table>
<thead>
<tr>
<th>VOLTS</th>
<th>RESISTANCE</th>
<th>TEMP °C</th>
<th>TEMP °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0</td>
<td>300</td>
<td>572</td>
</tr>
<tr>
<td>0.21</td>
<td>145</td>
<td>255</td>
<td>491</td>
</tr>
<tr>
<td>0.42</td>
<td>303</td>
<td>210</td>
<td>410</td>
</tr>
<tr>
<td>0.62</td>
<td>463</td>
<td>190</td>
<td>374</td>
</tr>
<tr>
<td>0.81</td>
<td>638</td>
<td>170</td>
<td>338</td>
</tr>
<tr>
<td>1.20</td>
<td>1042</td>
<td>150</td>
<td>302</td>
</tr>
<tr>
<td>1.59</td>
<td>1539</td>
<td>130</td>
<td>266</td>
</tr>
<tr>
<td>3.01</td>
<td>4991</td>
<td>85</td>
<td>185</td>
</tr>
<tr>
<td>4.43</td>
<td>25,647</td>
<td>40</td>
<td>104</td>
</tr>
<tr>
<td>4.63</td>
<td>41,205</td>
<td>25</td>
<td>77</td>
</tr>
<tr>
<td>4.83</td>
<td>93,759</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>4.88</td>
<td>134,200</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>4.93</td>
<td>232,414</td>
<td>-10</td>
<td>14</td>
</tr>
</tbody>
</table>

**NOTE**

All voltage and resistance values are approximate (±20%).

**DIAGNOSTICS**

<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-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
</tbody>
</table>

**Diagnostic Tips**

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check for the following conditions:

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

- **Shifted Sensor**: The temperature-to-resistance values table may be used to test the ET sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.

**Diagnostic Notes**

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple socket probes and patch cord.
Figure 2-48. Engine Temperature Sensor Circuit

Table 2-32. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Temperature (ET)</td>
<td>All</td>
<td>1-place bullet</td>
<td>Beneath air cleaner base-plate</td>
</tr>
</tbody>
</table>
**Engine Temperature Sensor: DTC P0117 (14); DTC P0118 (14) (Part 1 of 2)**

---

**Diagram:**


   **YES**

   2. Attach Breakout Box (B-48115) to the Electronic Control Module (ECM). Using a DVOM (Part No. HD-39978), measure the resistance between ET Sensor connector and ECM connector [11] terminal “11”. Is it less than 1.0 ohm?

     **YES**

     3. Using a DVOM, measure the resistance between Breakout Box terminal “11” of [11] and Ground. Is it greater than 1.0 megohm?

        **YES**

        Examine (PK/Y) wire in harness for open circuit and repair.

        **NO**

        Examine harness for short to ground and repair.

     **NO**

     Go To Engine Temperature Sensor Test DTC P0117 (14); P0118 (14) (Part 2 of 2)

   **NO**

   Replace ET Sensor. See the appropriate Buell Service Manual.

---

**At some point in the flow chart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

---

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

---

*fc00395_en*
Engine Temperature Sensor: DTC P0117 (14); DTC P0118 (14) (Part 2 of 2)

At some point in the flow chart you may be instructed to jump directly to the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

YES

NO

While wiggling harness to locate source of intermittents, perform the steps in DTC P0117 (14), P0118 (14) test (Part 1 of 2) marked by Bold Asterisks. Repair as necessary.

Disconnect ET sensor connector. Turn Ignition Switch ON. Using a DVOM, measure the voltage between Breakout Box connector [11] (Gray) terminal "11" and ground. Is voltage approximately 5.0 volts?

YES

NO

Less than 4.7 volts.

Greater than 5.3 volts.

Replace ET Sensor. (See ENGINE TEMPERATURE SENSOR in Buell Service Manual), clear codes and road test. Did check engine lamp turn on and set P0117 (14), P0118 (14)?


YES

NO

Less than 1 ohm.

Replace ECM.

Repair short to ground on (PK/Y) wire.

Replace ECM.

Examine ET sensor signal wire (PK/Y) for short to 12 volts and repair.

NOTES:

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.

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GENERAL

Throttle Position Sensor (TPS)

See Figure 2-49. The TPS is supplied 5.0 volts from the ECM (5v REF) and sends a signal back to the ECM (TPS) which varies according to throttle position. The output signal from the TPS varies from:

- Approximately 0.33 volts at idle (closed throttle).
- Approximately 3.86 volts at wide open throttle.

A Code 11 will set if the TPS signal voltage does not fall within the acceptable range.

NOTE

If the TPS is removed and/or replaced, the TPS zero set procedure must be performed. For replacement of TPS, refer to THROTTLE POSITION SENSOR in the Service Manual.

Table 2-33. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0122</td>
<td>11</td>
<td>Throttle position sensor circuit low</td>
</tr>
<tr>
<td>P0123</td>
<td>11</td>
<td>Throttle position sensor circuit high</td>
</tr>
</tbody>
</table>

Diagnostic Tips

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check for the following conditions:

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

- Perform **2.6 BREAKOUT BOX** to locate intermittents. If connections and harness check out OK, monitor TPS voltage using DVOM while moving related connectors ad wiring harness. If the failure is induced, the DVOM display will change.

- **TPS scaling**: Observe the TPS voltage display while operating the throttle with engine stopped and ignition switch ON. Display should vary from closed throttle TPS voltage (when throttle is closed) to greater than 4.0 volts (when throttle is held wide open). As the throttle is slowly moved, the voltage should change gradually without spikes or low voltage being observed.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).
1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple socket probes and patch cord.

---

Figure 2-51. Throttle Position Sensor Circuit

Table 2-34. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position Sensor (TPS)</td>
<td>All</td>
<td>3-place Amp</td>
<td>Beneath air cleaner base-plate</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>Firebolt</td>
<td>6-place Sumitomo</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Throttle Position Sensor: DTC P0122 (11); DTC P0123 (11) (Part 1 of 2)

1. Attach Electronic Control Module (ECM) to Breakout Box (B-48115). Plug DVOM (Part No. HD-39978) into Pin 4 (+) and Pin 27 (-) of Breakout Box connector [11] (Gray). With Ignition Switch ON, gradually open throttle while observing voltage. Does voltage steadily increase with no spikes or low voltages observed from 0.3-1.5 volts at idle (closed throttle) to 3.9-4.9 volts at wide open throttle?

   YES

   Check engine lamp continuously ON and DTC P0122 (11), P0123 (11) only set?

   NO

   YES

   Replace ECM.

   NO

   NO

   Check for intermittents. See 2.7 WIGGLE TEST. Intermittents present?

   YES

   To identify source of intermittents, start at box marked by Bold Asterisk on right side of flow chart. Follow steps while wiggling harness and monitoring DVOM.

   NO

   Replace TPS. (See THROTTLE POSITION SENSOR in Buell Service Manual.) Clear codes and road test. Did check engine lamp come on and set DTC P0122 (11), P0123 (11)?

   YES

   Install original TPS and replace ECM. Road test again to verify.

   NO

   System now OK.

   Reconnect TPS connector [88]. Measure TPS voltage at wide open throttle. Is voltage greater than 5.0 volts?

   YES

   Locate and repair short between (V/Y) wire and battery voltage.

   NO

   Locate and repair short between (R/W) wire and battery voltage.

   NO

   Locate and repair short between (V/Y) wire and (R/W) wire.

   * At some point in the flow chart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

   STOP

   NO

   WAS VOLTAGE GREATER THAN 4.9 VOLTS?

   YES

   Disconnect TPS sensor connector [88] and ECM connector [11] (Gray). Measure voltage at Pin 4 (+) and Pin 19 (-). Does voltage measure 5.0 volts?

   NO

   Reconnect TPS connector [88]. Measure TPS voltage at wide open throttle. Is voltage greater than 5.0 volts?

   YES

   Locate and repair short between (V/Y) wire and battery voltage.

   NO

   Locate and repair short between (R/W) wire and battery voltage.

   * Go to Throttle Position Sensor Test DTC P0122 (11); P0123 (11) (Part 2 of 2).

   NOTES:

   Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

   After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
Clear codes and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
GENERAL

Oxygen (O₂) Sensor

See Figure 2-52. The oxygen sensor provides a signal to the Electronic Control Module (ECM) which indicates whether the engine is running rich or lean.

- A low voltage signal (<0.41 V) indicates the engine is running lean.
- A high voltage signal (>0.56V) indicates the engine is running rich.

When the air/fuel mixture is ideal, approximately 14.7 parts air to 1 part fuel, the voltage will be approximately 0.48 V.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0151</td>
<td>13</td>
<td>Oxygen (O₂) sensor circuit low/engine lean</td>
</tr>
<tr>
<td>P0152</td>
<td>13</td>
<td>Oxygen (O₂) sensor circuit high/engine rich</td>
</tr>
<tr>
<td>P0154</td>
<td>13</td>
<td>Oxygen (O₂) sensor open/inactive</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

The DVOM (Part No. HD-39978) displays the signal from the oxygen sensor in volts. This voltage will have an average value tending towards lean, rich or ideal value depending on operating temperature of the engine, engine speed and throttle position. An open/short to voltage or short to ground in the (V/GY) wire will cause the engine to run rich (short to ground) or lean (short to voltage) until fault is detected, vehicle will run in open loop. The engine must be running below 5000 RPM for the ECM to detect an oxygen failure.

Check for the following conditions:

- **Poor Connection:** Inspect ECM harness connector, fuel injector connectors and oxygen sensor connector wiring for backed out terminals, improper mating, broken locks improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

- **Dirty/Stuck Open Injectors:** The motorcycle may run lean (dirty/clogged injectors) or rich (stuck open injectors) if there is an injector problem. This could also cause poor fuel economy and performance.

- **Loose Oxygen Sensor:** See Figure 2-53. If the oxygen sensor is loose engine performance may be affected. This could also show up as a slow changing oxygen sensor voltage.

- **Loose/Leaking Exhaust:** This can cause poor ground connection for sensor or allow fresh air into the exhaust system. If fresh air enters exhaust system, the oxygen sensor will read a lean condition, causing the system to go rich.
Diagnostic Notes
Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

![Oxygen Sensor Circuit](image)

**Figure 2-54. Oxygen Sensor Circuit**

**Table 2-36. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[137]</td>
<td>Oxygen (O₂) sensor</td>
<td>All</td>
<td>1-place Packard</td>
<td>Above rear cylinder head</td>
</tr>
</tbody>
</table>
Disconnect Oxygen (O₂) Sensor from harness. Connect DVOM (Part No. HD39978) to Breakout Box [11] (Gray) terminal "32" (+) and ground (-).

Turn Ignition Switch ON. Observe circuit voltage. Is it approximately 5 volts?

YES

STOP

NO

Install Breakout Box (B-48115) leaving harness side connector [11] (Gray) disconnected from the Breakout Box. Measure continuity to ground on terminal "32" of connector [11] (Gray) on breakout box. Is continuity present?

YES

YES

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

Replace ECM.

NO

NO

NO

Greater than 1 volt.

Install Breakout Box (B-48115) leaving harness side connector [11] (Gray) disconnected from the Breakout Box. Measure voltage to ground on terminal 32 of connector [11] (Gray) on breakout box. Is voltage present?

YES

Inspect (V/GY) wire for shorts to voltage and repair.

Replace ECM.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, the TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
Oxygen Sensor: DTC P0151 (13); DTC P0152 (13); DTC P0154 (13) (Part 2 of 2)

Turn ignition OFF and reconnect Oxygen 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 volt?

- **YES**
  - Check for intermittents. See 2.7 WIGGLE TEST. Intermittents present?
    - **YES**
      - Repair as necessary.
    - **NO**
      - Perform FUEL PRESSURE TEST. Pressure too low?
        - **YES**
          - Repair low pressure problem. See 2.15 FUEL PRESSURE TEST.
        - **NO**
          - Check for restricted fuel filter or fuel line. Restriction present?
            - **YES**
              - Replace fuel pump. See FUEL PUMP in appropriate Buell Service Manual.
            - **NO**
              - Check for injectors stuck open. See 2.21 DTC P0261 (23), P0262 (23), P0264 (32), P0265 (32). Retest.
    - **NO**
      - Check for air leaks at induction module. Air leak present?
        - **YES**
          - Repairs may be dirty. See Fuel Injectors under THROTTLE BODY in appropriate Buell Service Manual.
        - **NO**
          - Install original Oxygen Sensor and replace ECM. Road test again to verify.

- **NO**
  - 0.0-0.4 volt.
  - 0.6-1.0 volt.
  - Slow or no change.
  - Check continuity between terminal “32” [11B] (Gray) and [137B] (V/GY). Continuity present?
    - **YES**
      - Replace O2 sensor. See OXYGEN SENSOR in appropriate Buell Service Manual.
    - **NO**
      - Repair open on (V/GY) wire.

**NOTES:**

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
GENERAL

Front and Rear Fuel Injectors

See Figure 2-55. The fuel injectors are solenoids that allow pressurized fuel into the engine intake tract. The fuel injectors are timed to the engine cycle and are triggered sequentially.

NOTE
Front and rear fuel injectors are not interchangeable due to specific spray patterns designed for the engine.

The power for the fuel injectors comes from the ignition relay. The ignition relay also provides power for fuel pump, Electronic Control Module (ECM) and the ignition coil. The ECM provides the path to ground to trigger the fuel injectors.

NOTE
Ignition relay failure or wiring harness problems will cause 12 volt power to be lost to both fuel injectors, ignition coil, ECM and fuel pump.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0261</td>
<td>23</td>
<td>Front fuel injector circuit low</td>
</tr>
<tr>
<td>P0262</td>
<td>23</td>
<td>Front fuel injector circuit high</td>
</tr>
<tr>
<td>P0264</td>
<td>32</td>
<td>Rear fuel injector circuit low</td>
</tr>
<tr>
<td>P0265</td>
<td>32</td>
<td>Rear fuel injector circuit high</td>
</tr>
</tbody>
</table>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

**WARNING**

Gasoline can drain from the fuel line when disconnected from carburetor. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00257a)

2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes and patch cord.
3. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
4. Use FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C).
Figure 2-56. Fuel Injector Circuit

Table 2-38. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place Mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[84]</td>
<td>Front injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath air cleaner base plate</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear injector</td>
<td>All</td>
<td>2-place Packard</td>
<td>Beneath air cleaner base plate</td>
</tr>
</tbody>
</table>
Front and Rear Fuel Injector: DTC P0261 (23); DTC P0262 (23); DTC P0264 (32); DTC P0265 (32) (Part 1 of 2)

1. Is connector connected at the Fuel Injector?
   - YES
     - Disconnect and attach Fuel Injector Test Lamp. Crank engine. Does the Fuel Injector Test Lamp flash?
       - YES
         - Measure resistance of the suspect Fuel Injector. Is resistance across terminals 12.25 ohms?
           - YES
             - Check for loose or corroded terminals in harness. Repair as necessary.
             - Replace Fuel Injector. See THROTTLE BODY in appropriate Buell Service Manual.
           - NO
             - Go to Front and Rear Fuel Injector Test DTC P0261 (23); P0262 (23); P0264 (32); P0265 (32) (Part 2 of 2)
   - NO
     - Reconnect and install airbox.

2. Check voltage on connector [84] or [85] terminal “1” (GY) wire on Fuel Injector connector to ground. Should be equivalent to Battery voltage after Ignition Switch is ON. Is it?
   - NO
     - Go to Front and Rear Fuel Injector Test DTC P0261 (23); P0262 (23); P0264 (32); P0265 (32) (Part 2 of 2)
   - YES
     - Replace ECM. Recheck connections.
       - YES
         - Perform wiggle test. See 2.7 WIGGLE TEST. Repair as necessary.
       - NO
         - Go to Front and Rear Fuel Injector Test DTC P0261 (23); P0262 (23); P0264 (32); P0265 (32) (Part 2 of 2)

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44760).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
Front and Rear Fuel Injector: DTC P0261 (23); DTC P0262 (23); DTC P0264 (32); DTC P0265 (32) (Part 2 of 2)

Continued from Front and Rear Fuel Injector Test DTC P0261 (23); P0262 (23); P0264 (32); P0265 (32)
(Part 1 of 2).

Check for battery voltage at terminal “87” or “5” of the Ignition Relay.
Is voltage present?

- YES
  - Ignition Relay is OK.
  - Measure resistance between terminal “87” or “5” of the ignition relay and terminal “1” (GY) at the fuel injector connector.
  - Is resistance less than 0.5 ohm?

  - YES
    - With DVOM still attached, perform wiggle test. See 2.7 WIGGLE TEST to locate intermittents.
    - Repair as necessary.

  - NO
    - Check for multiple codes. See 2.4 CHECKING FOR TROUBLE CODES.
    - Find and repair connection or open wire.

- NO

NOTE:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
GENERAL

Crankshaft Position (CKP) Sensor

See Figure 2-57. The Crankshaft Position (CKP) sensor is located on the front of the engine crankcase. The sensor harness connector [79] is located under a protective boot below the left ram air scoop.

NOTE
If signal is not detected or cannot synchronize (DTC P0339), engine will not start.

Table 2-39. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0339</td>
<td>56</td>
<td>CKP sensor circuit intermittent</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

TOOL NAME          | PART NUMBER  |
-------------------|--------------|
BREAKOUT BOX       | B-48115      |
HARNESS CONNECTOR TEST KIT | HD-41404-B |

Diagnostic Tips

Engine must be cranked for more than five seconds without CKP signal to set code.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
2. One megohm is very high resistance. Some meters will read OL, etc.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probes and patch cords.
4. For testing purposes, install sensor without running wiring along normal path. Disconnect and route wiring properly if system is now OK.

Figure 2-57. CKP Sensor Location
Table 2-40. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place Mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
</tbody>
</table>
Crankshaft Position Sensor: DTC P0339 (56)

1. Connect Breakout Box to harness only, leaving Electronic Control Module (ECM) disconnected. Measure resistance between Breakout Box connector [11] (Gray) terminals “18” and “26”. Resistance more than 1 megohm?

   - YES
     - Check for intermittent connection, pinched or damaged wires, and loose CKP sensor fasteners. Conditions found?

       - YES
         - Repair as necessary.

       - NO
         - Disconnect connector [79]. Leaving ECM disconnected, measure resistance between ground terminals “18” and “26” on Breakout Box [11] (Gray). Continuity to ground (less than 1 megohm resistance)?

           - YES
             - Replace CKP sensor. See appropriate BUELL SERVICE MANUAL.

           - NO
             - Replace CKP sensor. Set DVOM to AC volts and crank engine. Does DVOM read 1.0V minimum during cranking?

               - YES
                 - Repair short to ground on (GN/W) or (BK/BE) wire between connectors [11B] and [79B].

               - NO

2. NO

   - Connect DVOM (Part No. HD-39978) to terminals “18” and “26” on Breakout Box [11] (Gray). Set DVOM to AC volts and crank engine. Does DVOM read 1.0V minimum during cranking?

     - YES
       - Repair as necessary.

     - NO
       - Install known good CKP sensor. Clear codes and retest. DTC P0339 set?

         - YES
           - Replace CKP sensor. See appropriate BUELL SERVICE MANUAL.

         - NO
           - Reinstall original CKP sensor. Replace ECM.

9. Check for continuity between terminal “1” of connector [79B] and terminal “18” on Breakout Box [11] (Gray). Is continuity present?

   - YES

   - NO
     - Repair open on (GN/W) wire between terminal “1” of connector [79B] and terminal “18” of connector [11B] (Gray).

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
GENERAL

Vehicle Speed Sensor

See Figure 2-59. The vehicle speed sensor is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the speedometer through serial data.

Table 2-41. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0502</td>
<td>43</td>
<td>Vehicle Speed Sensor (VSS) high</td>
</tr>
<tr>
<td>P0502</td>
<td>43</td>
<td>Vehicle Speed Sensor (VSS) intermittent or erratic</td>
</tr>
<tr>
<td>P0608</td>
<td>37</td>
<td>Vehicle Speed Sensor (VSS) control module fail</td>
</tr>
</tbody>
</table>

Diagnostic Notes

If a short low/open or a short high condition, the P0608 code is set reflecting a problem in the Vehicle Speed Sensor (VSS), Electronic Control Module (ECM), Instrument Module (IM), or wiring harness.

Each reference number below correlates to a circled number on the flow chart(s).

1. Use SPEEDOMETER TESTER (Part No. HD-41354) and INPUT/OUTPUT CABLE (Part No. HD-41354-1) to provide a signal to the speed indication system.

2. Connect BREAKOUT BOX (Part No. B-48115) between wire harness and ECM.
Figure 2-61. Speedometer Tester (Part No. HD-41354)
Figure 2-62. Vehicle Speed Sensor Circuit (Ulysses, Lightning)

Table 2-42. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[65]</td>
<td>Vehicle Speed Sensor (VSS)</td>
<td>3-place Deutsch</td>
<td>Right rear top of crankcase</td>
</tr>
</tbody>
</table>
Figure 2-63. Vehicle Speed Sensor Circuit (Firebolt)

Table 2-43. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
<tr>
<td>[65]</td>
<td>Vehicle Speed Sensor (VSS)</td>
<td>3-place Deutsch</td>
<td>Right rear top of crankcase</td>
</tr>
</tbody>
</table>
Vehicle Speed Sensor: DTC P0502 (43); DTC P0503 (43); DTC P0608 (37) (Part 1 of 3)

Clear DTCs and confirm proper operation with no check engine lamp. DTCs can also be cleared with a Digital Technician (Part No. HD-44750).

NOTE:
Ensure all system fuses are good before performing this test.

Turn Ignition switch to ON. Does instrument module perform sweep test?

YES

Check odometer reading. Does odometer display correct vehicle mileage?

YES

Check the trip 1 and trip 2 odometer readings. Do readings reflect correct mileage?

YES

While observing trip 1 or trip 2 odometer readings, press reset button for 5 seconds, minimum. Does reading reset to zero?

YES

Go to Vehicle Speed Sensor Test, DTC P0502 (43); P0503 (43); P0608 (37) (Part 2 of 3)

NO

Check for battery voltage between IM connector [39B] terminals “12” POS (R/BK) and “13” GND (BK). Is battery voltage present?

YES

Check for continuity between IM connector [39B] terminal “13” and GND (vehicle frame). Is continuity present?

YES

Locate and repair open wire (BK).

NO

Check for battery voltage from ignition switch connector [39B] terminals “1” and “4” (+) and ground (-). Is battery voltage present?

YES

Locate and repair open circuit between IM connector [39B] terminal “12” (R/BK) and ignition switch connector [39B] terminal “3” (R/BK).

NO

Clear DTCs and confirm proper operation with no check engine lamp. DTCs can also be cleared with a Digital Technician (Part No. HD-44750).

NO

Replace instrument module.

STOP

NO

Replace ignition switch.

STOP

NO
Vehicle Speed Sensor: DTC P0502 (43); DTC P0503 (43); DTC P0608 (37) (Part 2 of 3)

Continued from Vehicle Speed Sensor Test, DTC P0502 (43); P0503 (43); P0608 (37) (Part 1 of 3).

Inspect connector [65].
Is connector mated properly to the Vehicle Speed Sensor (VSS)?

- NO
  - Mate connector [65]. Ride motorcycle for approximately 1.0 mile (1.6 km). Check for speedometer function. Speedometer functioning properly?

- YES

Remove and inspect vehicle speed sensor. Inspect for cracks in sensor housing and debris in the connector area. Replace sensor or clean if necessary. Place speedometer into diagnostic mode and clear diagnostic trouble codes. Connect all circuits and ride motorcycle for approximately 1.0 mile (1.6 km). Check for speedometer function. Speedometer functioning properly?

- NO
  - System OK.

Clear DTCs and confirm proper operation with no check engine lamp. DTCs can also be cleared with a Digital Technician (Part No. HD-44750).

GO TO Vehicle Speed Sensor Test, DTC P0502 (43); P0503 (43); P0608 (37) (Part 3 of 3)
Vehicle Speed Sensor: DTC P0502 (43); DTC P0503 (43); DTC P0608 (37) (Part 3 of 3)

Continued from Vehicle Speed Sensor Test, DTC P0502 (43); P0503 (43); P0608 (37) (Part 2 of 3).

Remove Vehicle Speed Sensor connector [65B]. With the ignition switch ON, check the voltage between connector [65] terminals “1” (+) and “3” (-). Is voltage 5.0V (nominal)?

- **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 “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”; then 3) Press ENTER. Enter 4000Hz by pressing “4000” and then ENTER. Does the speedometer on the instrument module read 70MPH?
  - **YES**: Replace Vehicle Speed Sensor.

- **NO**: Locate and repair open on (W) wire between connector [78B] terminal “13” and connector [65B] terminal “2”.
  - **YES**: If wiring is OK, replace ECM.
  - **NO**: After replacing ECM, the TPS zero-set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.

NOTE: 2008 Buell XB Diagnostics: Engine Management 2-83
IAC Operation

The ECM controls engine idle speed by moving the Idle Air Control (IAC) motor 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 motor. This causes the pintle to move in or out of the IAC motor 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.

The IAC motor position is measured in steps. This can only be done by using a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).

- A high number of steps represents a retracted pintle and open passage around throttle plate. 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 plate.

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 throttle body. 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>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0506</td>
<td>34</td>
<td>Idle Air Control (IAC) system RPM higher than expected</td>
</tr>
<tr>
<td>P0507</td>
<td>34</td>
<td>Idle Air Control (IAC) system RPM lower than expected</td>
</tr>
<tr>
<td>P0511</td>
<td>34</td>
<td>Idle Air Control (IAC) circuit</td>
</tr>
</tbody>
</table>
### Diagnostic Tips

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 will 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. See Air Cleaner in the appropriate Buell Service Manual. Turn key ON for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in bores. See Fuel Injectors in the appropriate Buell Service Manual.

- To confirm IAC function, disconnect 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 Intake Leak Test in the appropriate Buell Service Manual.

- Contaminated fuel.

- Excessive oil in crankcase (oil sumping).

- Throttle Position (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.

### Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. 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.

2. Test lamp behavior may follow two patterns. The color of the lights is not relevant to IAC motor operation.
   a. Normal behavior: At ignition switch ON, test lights will alternately flash to confirm Electronic Control Module (ECM) signals.
   b. Problem indicated: One or more lights fail to illuminate during ignition switch ON/OFF cycle.

   **NOTE**

   There is a remote possibility that one of the circuits is shorted to voltage which could have been indicated by a steady light. Disconnect the ECM and turn the ignition switch ON. Probe terminals to check for this condition.

3. Connect BREAKOUT BOX (Part No. B-48115) to main wire harness only leaving ECM disconnected. See 2.6 BREAKOUT BOX.

4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.

5. Repair faulty ECM connection or replace ECM. If ECM requires replacement, see ECM in the appropriate Buell Service Manual.

---

**Figure 2-67. IAC Motor Circuit**

**Table 2-45. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[87]</td>
<td>Idle Air Control (IAC) motor</td>
<td>All</td>
<td>4-place Delphi</td>
<td>Beneath air cleaner base-plate</td>
</tr>
</tbody>
</table>
Idle Air Control: DTC P0506 (34); DTC P0507 (34); DTC P0511 (34) (Part 1 of 2)

1. Remove air cleaner cover and element. Is throttle valve completely closed?
   - YES
   - NO

2. Monitor Idle Air Control (IAC) pintle for 2 seconds after turning Ignition Switch ON. Does pintle extend and then retract during 2 second Ignition Switch ON reset procedure?
   - YES
   - NO

   2.1. Check intake manifold for leaks. See 2.9 INTAKE LEAK TEST. Leaks found?
      - YES
      - NO

      2.1.1. Repair intake leak.

   2.2. Lubricate and adjust throttle cables.

   2.3. Problem indicated.

   2.4. Repair faulty IAC Motor connection or IAC Motor assembly.

3. Check fuel pressure. See 2.15 FUEL PRESSURE TEST. Leaks found?
   - YES
   - NO

   3.1. Repair intake leak.

   3.2. Check fuel pressure. See 2.15 FUEL PRESSURE TEST.

   - YES
   - NO

   4.1. Go to 2.13 NO ECM POWER.

   4.2. Does each wire measure 0.5 ohms or less?
      - YES
      - NO

      4.2.1. Repair short to voltage.


6. Repair intake leak.

7. Go to Idle Air Control Test DTC P0506 (34); P0507 (34); P0511 (34) (Part 2 of 2).

NOTE: Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
Idle Air Control: DTC P0506 (34); DTC P0507 (34); DTC P0511 (34) (Part 2 of 2)

Turn Ignition Switch OFF. Measure resistance between each terminal on connector [878] and ground. Is resistance greater than 1 megohm for all terminals?

- YES: Inspect ECM connections. Connections OK?
  - YES: Replace ECM.
  - NO: Repair ECM connections.

- NO: Repair short to ground.

**NOTES:**
- Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
- After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
GENERAL

Battery Voltage
A Code 16 will set if the ECM detects battery positive voltage less than 6 volts or greater than 20 volts.

- A low voltage condition typically occurs during activation of the starter or generally indicates loose wire connections.
- A high voltage condition is usually caused by a faulty voltage regulator.

Table 2-46. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0562</td>
<td>16</td>
<td>Battery voltage low</td>
</tr>
<tr>
<td>P0563</td>
<td>16</td>
<td>Battery voltage high</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

<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>

Diagnostic Notes
Each reference number below correlates to a circled number on the flow chart(s).

1. The ECM is monitoring voltage at ECM connector [10] (black) terminal “9”. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See **2.6 BREAKOUT BOX**.

2. This checks for voltage drops in the ECM power circuit. If a significant voltage drop is not present, condition may be caused by excessive starter current draw.
Figure 2-71. Battery Voltage Circuit (Ulysses, Lightning)

Table 2-47. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[91]</td>
<td>Data link connector</td>
<td>4-place Deutsch</td>
<td>Behind left airflow guide</td>
</tr>
</tbody>
</table>
Figure 2-72. Battery Voltage Circuit (Firebolt)

Table 2-48. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>To the right of windsreen</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[91]</td>
<td>Data link connector</td>
<td>4-place Deutsch</td>
<td>Beneath fairing</td>
</tr>
</tbody>
</table>
Perform charging system tests. See STARTING and CHARGING SYSTEM. Charging system OK?

YES

1. Remove spark plug cables from spark plugs. Attach Breakout Box (B-48115) to ECM. Measure voltage a Breakout Box connector [10] (Black) terminal "9" and Ground, while cranking engine. Disregard voltage during first two seconds of cranking. Is voltage above 6.2 volts?

YES

System OK.

2. Measure voltage drop between battery positive terminal (+) and Breakout Box connector [10] (Black) terminal "9" with key ON. Is voltage drop greater than 0.5 volt?

YES

Check for excessive starter current draw. See STARTING and CHARGING SYSTEM TESTING.

NO

Measure voltage drop between battery positive terminal (+) and ignition relay terminal "30" or "3" with Ignition Switch ON. Is voltage drop greater than 0.5 volt?

YES

Repair (GY) wire or terminals.

NO

Replace Ignition Relay.

Go to Battery Voltage Test DTC P0562 (16); P0563 (16) (Part 1 of 2).

NOTE:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
Battery Voltage: DTC P0562 (16); DTC P0563 (16) (Part 2 of 2)

Continued from Battery Voltage Test DTC P0562 (16); P0563 (16) (Part 1 of 2).

Measure voltage drop between battery positive terminal (+) and (GY/O) wire terminal (-) on ignition fuse with ignition switch ON. Is voltage drop greater than 0.5 volt?

YES

Measure voltage drop between battery positive terminal (+) and (R) wire terminal (-) on ignition fuse with ignition switch ON. Is voltage drop greater than 0.5 volt?

YES

Measure voltage drop between battery positive terminal (+) and (R) wire terminal (-) of battery fuse with ignition switch ON. Is voltage drop greater than 0.5 volt?

YES

Measure voltage drop between battery positive terminal (+) and (R/Y) wire terminal (-) of battery fuse with ignition switch ON. Is voltage drop greater than 0.5 volt?

YES

Replace (R/Y) wire between battery fuse and battery.

NO

Replace fuse or fuse terminals.

NO

Repair (R) wire or terminals.

NOTE:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
GENERAL

ECM Failure

All of the following codes indicate a failure which requires replacement of the Electronic Control Module (ECM). Refer to ELECTRONIC CONTROL MODULE in the appropriate Buell Service Manual.

- Code 52 - RAM failure
- Code 53 - ROM failure
- Code 54 - EE PROM failure
- Code 55 - Microprocessor failure
GENERAL

Start Relay

When the starter switch is pushed, the start relay is activated and battery current flows to the starter. When the starter switch is released, the start relay is deactivated and battery current stops flowing to the starter.

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

Table 2-49. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0617</td>
<td>46</td>
<td>Start relay circuit high</td>
</tr>
</tbody>
</table>

Figure 2-76. Start Relay (Ulysses)

Figure 2-77. Start Relay (Lightning)

Figure 2-78. Start Relay (Firebolt)
**Figure 2-79. Electric Starting System Circuit (Ulysses, Lightning)**

**Table 2-50. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Spade terminal</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
Table 2-51. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Spade terminal</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
NOTE: Before performing this test, ensure the battery is fully charged and all relevant fuses are good. Recharge or replace a suspect battery and replace blown fuses.

Press start switch. Does starter rotate?

- YES: System operation normal.
- NO: Headlamp does not illuminate with ignition switch ON (neutral lamp OK). Is headlamp burned out?
  - YES: Replace headlamp.
  - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
    - YES: Headlamp Illuminated?
      - YES: Problem solved.
      - NO: Replace Start Relay.
    - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
      - YES: Headlamp Illuminated?
        - YES: Problem solved.
        - NO: Replace Start Relay.
      - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
        - YES: Headlamp Illuminated?
          - YES: Problem solved.
          - NO: Replace Start Relay.
        - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
          - YES: Headlamp Illuminated?
            - YES: Problem solved.
            - NO: Replace Start Relay.
          - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
            - YES: Headlamp Illuminated?
              - YES: Problem solved.
              - NO: Replace Start Relay.
            - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
              - YES: Headlamp Illuminated?
                - YES: Problem solved.
                - NO: Replace Start Relay.
              - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
                - YES: Headlamp Illuminated?
                  - YES: Problem solved.
                  - NO: Replace Start Relay.
                - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
                  - YES: Headlamp Illuminated?
                    - YES: Problem solved.
                    - NO: Replace Start Relay.
                  - NO: Neutral lamp does not illuminate with ignition switch ON (headlamp OK). Does starter rotate when start switch is pressed?
                    - YES: Headlamp Illuminated?
                      - YES: Problem solved.
                      - NO: Replace Start Relay.
continued from start system relay test, dtc p0616 (46), p0617 (46) (part 1 of 2).

does starter rotate when start switch is pressed?

- yes
  - replace neutral lamp in im.
  - yes
    - check for continuity between emm connector [11b] (gray) terminal "8" (tn/y) and ground.
    - is continuity present?
      - yes
        - check neutal connector [131] for proper mating to neutral switch.
        - is connector [131] mated properly?
          - yes
            - replace neutral switch.
          - no
            - male connectors and retest.
        - no
          - locate and repair open wire (tn/y) and retest.
      - no
        - locate and repair open wire (gn/o) and retest.
    - no
      - locate and repair open wire (gn/o) and retest.
  - no
    - does starter rotate when clutch is disengaged and start switch is pressed?
      - yes
        - replace emm.
      - no
        - locate and repair open wire (gn/o) and retest.

with the ignition switch on, check voltage on connector [10b] (black) terminal "8" to ground.

- is voltage 0.6v or less?
  - yes
    - replace start relay.
  - no
    - replace emm.
**GENERAL**

**Fuel Pump**

The fuel pump assembly is shown in Figure 2-81. ECM terminals “27” and “28” provide ground to the fuel pump. These codes will set if:

- (BN/Y) wire is shorted to 12 volts. This will also cause the ignition fuse to blow.
- (BN/Y) wire is shorted to ground. This will cause the fuel pump to run continuously even when the motor is not running.
- Fuel pump motor stalls.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0628</td>
<td>33</td>
<td>Fuel pump circuit low</td>
</tr>
<tr>
<td>P0629</td>
<td>33</td>
<td>Fuel pump circuit high</td>
</tr>
</tbody>
</table>

**DIAGNOSTICS**

**PART NUMBER** | **TOOL NAME**
----------------|----------------
B-48115          | BREAKOUT BOX
HD-41404-B       | HARNESS CONNECTOR TEST KIT

**Diagnostic Notes**

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
3. If resistance greater than 1 ohm is found between ECM connector [10] terminal “27” OR “28” and fuel pump connector [86A] terminal “4”, but not both, the open must be repaired but this repair will not correct the concern.
**Figure 2-82. Fuel Pump Circuit (Ulysses, Lightning)**

**Table 2-53. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel pump</td>
<td>4-place Multilock</td>
<td>Left side of frame</td>
</tr>
</tbody>
</table>

2-100 2008 Buell XB Diagnostics: Engine Management
Figure 2-83. Fuel Pump Circuit (Firebolt)
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel pump</td>
<td>4-place Multilock</td>
<td>Left side of frame</td>
</tr>
</tbody>
</table>
Fuel Pump: DTC P0628 (33); DTC P0629 (33)

1. Attach Breakout Box (B-48115) to Electronic Control Module (ECM). With DVOM (Part No. HD-39978), measure voltage between Breakout Box terminals “7” and “28” (Black) and ground after Ignition Switch is turned ON. Meter should read less than 2.0 volts and the Fuel Pump should run for 2-3 seconds. Does it?

   YES

   With DVOM still connected, check for intermittents by performing wiggle test. See 2.7 WIGGLE TEST while repeating first test of this flow chart. Intermittents present?

      YES

      Replace Fuel Pump. See FUEL PUMP in appropriate Buell Service Manual. Clear DTCs and road test. Did check engine lamp turn ON and set only P0628?

         YES

         Repair as necessary. Reinstall original Fuel Pump. See FUEL PUMP in appropriate Buell Service Manual, and replace ECM.

         NO

         System OK.

      NO

      Fuel Pump on continuously?

         YES

         Disconnect ECM. Does Fuel Pump run continuously?

            YES

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

               YES

               Replace ECM.

               NO

               System OK.

            NO

            Check fuel pump fuse. Is fuse good?

               YES

               Check continuity of (O/GY) wire between fuel pump fuse and fuel pump connector [86A] terminal “3”. Is continuity present?

                  YES

                  Replace fuse.

                  NO

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

                     YES

                     Replace ECM.

                     NO

                     Check continuity of (BN/Y) wire between connector [10] (Black) terminals “27” and “28” and connector [96A] terminal “4”. Is continuity present?

                        YES

                        Repair open.

                        NO

                        Repair open.

               NO

               Repair open wire or connection.

         NO

         Check continuity between (O/GY) wire at fuel pump fuse and ground. Is continuity present?

            YES

            Replace ECM.

            NO

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

               YES

               Replace fuse.

               NO

               System OK.

NOTES:

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
**GENERAL**

**Cooling Fan High Voltage**

This code occurs when the engine is running and the ECM has commanded the fan on, and the voltage remains high at terminals “2” and “3” of ECM [10] (BK) connector.

*NTERE

An engine temperature (ET) sensor signal, indicating a cylinder head temperature above a preset temperature causes the ECM to command the fan on. When ignition is OFF, fan may run for approximately two and a half minutes depending on temperature of vehicle when ignition was turned off. See Table 2-55.

<table>
<thead>
<tr>
<th>Table 2-55. Cooling Fan Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FAN ON</strong></td>
</tr>
<tr>
<td>Key ON</td>
</tr>
<tr>
<td>Key ON (HDI)</td>
</tr>
<tr>
<td>Key OFF</td>
</tr>
</tbody>
</table>

This code can also set if fan blade does not spin (blocked fan blade) when fan is commanded on and battery voltage is applied to fan.

**Cooling Fan Low Voltage**

This code will set when the ignition key is ON and the ECM does not sense voltage at terminals “2” and “3” of ECM [10] (BK) connector.

<table>
<thead>
<tr>
<th>Table 2-56. Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DTC</strong></td>
</tr>
<tr>
<td>P0691</td>
</tr>
<tr>
<td>P0692</td>
</tr>
</tbody>
</table>

**DIAGNOSTICS**

**PART NUMBER** | **TOOL NAME**
--- | ---
B-48115 | BREAKOUT BOX

**Diagnostic Notes**

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
3. If voltage is present at Breakout Box connector [10] terminal “2” OR “3” but not both, the open must be repaired but this repair will not correct the concern.
4. If cooling fan runs when jumper wire is connected to Electronic Control Module (ECM) connector [10B] terminal “2” OR “3” and ground, but not both, the open must be repaired but this repair will not correct the concern.
5. If resistance greater than 1 ohm is found between Electronic Control Module (ECM) connector [10] terminal “27” OR “28” and fuel pump [86A] terminal “4”, but not both, the open must be repaired but this repair will not correct the concern.
Figure 2-85. Cooling Fan Circuit (Ulysses, Lightning)

Table 2-57. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[97]</td>
<td>Cooling fan</td>
<td>2-place Multilock</td>
<td>Behind rear cylinder</td>
</tr>
</tbody>
</table>
**Figure 2-86. Cooling Fan Circuit (Firebolt)**

**Table 2-58. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[97]</td>
<td>Cooling fan</td>
<td>2-place Multilock</td>
<td>Behind rear cylinder</td>
</tr>
</tbody>
</table>
Does cooling fan run continuously?

YES

Disconnect connector [10] (Black) at Electronic Control Module (ECM). Turn Ignition Switch ON. Does Cooling Fan run?

YES

Repair short to ground in (BK/O) wire between ECM and Cooling Fan.

NO

Go to Cooling Fan Test, DTC P0691 (36); P0692 (36) (Part 2 of 2).

STOP

NO

Is engine hot?

NOTE:
Fan will engage when cylinder head temperature exceeds 428°F (220°C).

YES

Turn Ignition Switch OFF. Connect Breakout Box to ECM connector [11] (Gray). Turn Ignition Switch ON. Measure volts at Breakout Box connector [11] (Gray) terminal “11”. Is voltage greater than 1.3 volts?

NO

Repair short to ground in (BK/O) wire between ECM and Cooling Fan.

YES

Allow engine to cool. Go to BOLD ASTERISK on this page.

NO

Turn Ignition Switch ON. Does the Cooling Fan run continuously?

YES

Detective ECM or ECM connection.

NO

System OK.

See Engine Temperature Sensor Test.

At some point in the flow chart you may be instructed to jump directly to a box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.
Continued from Cooling Fan Test, DTC P0691 (36); P0692 (36) (Part 1 of 2).
Check cooling fan fuse (10 amp) at Fuse Panel.
Is fuse ok?

YES

Connect Breakout Box (Part No. B-48115) to ECM (Black) connector (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 terminals. Connector [10] (Black) terminal ‘2’ Connector [10] (Black) terminal ‘3’ Does the Cooling Fan run?

YES

Replace ECM.

NO

Replace ECM.

NO

Disconnect cooling fan connector [97]. Remove cooling fan fuse. Check for continuity to ground between fuse block terminal “24” (“4” on Firebolt) and chassis ground. Is Continuity present?

YES

With Ignition Switch ON, check for battery voltage at [97] terminal “1” cooling fan connector. Is battery voltage present?

YES

Repair short to ground in (Y/BN) wire. Is there an obstruction preventing the Cooling Fan from rotating?

YES

Remove obstruction.

NO

Disconnect cooling fan harness at fan. Use ohmmeter to measure resistance between (Y/BN) terminal and (BK/O) wire of cooling fan connector [97A]. Is resistance greater than 1 ohm?

YES

Reinstall cooling fan fuse. Repair open in circuit between ECM connector [10] (Black) and (BK/O) wire of cooling fan connector [97B].

NO

System OK.

NO

Replace Cooling Fan.

YES

Repair open in circuit between cooling fan connector [97A] (BK/O) wire and fuse block.

NO

Repair open in circuit between (Y/BN) wire and (BK) wire of cooling fan connector [97B].

YES

Check for continuity between Breakout Box connector [10] terminals “2” and “3” and (BK/O) wire of cooling fan connector [97B]. Is Continuity present?

NO

System OK.

Replace Cooling Fan.

YES

Check for continuity between (Y/BN) wire and (BK) wire of cooling fan connector [97A]. Is Continuity present?

NO

System OK.

Replace Cooling Fan.

YES

Disconnect cooling fan harness at the fan. Place a jumper wire between (Y/BN) wire and battery positive (+). Place a jumper between cooling fan (BK) wire and ground. Does the Cooling Fan run at full speed?

NO

Replace Cooling Fan.

YES

System OK.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
DTC P1110 (22), P1111 (22), P1112 (22)  
(JAPANESE MODELS ONLY)

GENERAL

Active Intake System (Japanese Models Only)

The active intake system utilizes a solenoid in the airbox 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. See Figure 2-87 for locations of system components.

A code 22 will set if the ECM detects that 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 code 22 are:

- Mechanical fault in the active intake solenoid (8) throttle valve, or cable (2).
- Electrical fault in the solenoid circuit.
- Electrical fault in the throttle position sensor circuit.
- TPS reading not between 10.4-10.9 when activated.

Table 2-59. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1110</td>
<td>22</td>
<td>Active intake control circuit low/open</td>
</tr>
<tr>
<td>P1111</td>
<td>22</td>
<td>Active intake control circuit high</td>
</tr>
<tr>
<td>P1112</td>
<td>22</td>
<td>Active intake control throttle position sensor feedback failure</td>
</tr>
</tbody>
</table>

Diagnostics

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
</tbody>
</table>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), attach brown pin probe and patch cord to [178] or [179].

VERIFY SETTINGS

1. Prior to verifying the active intake system, perform the throttle position sensor (TPS) zero set procedure. See Throttle Position Sensor (TPS) in the appropriate Buell Service Manual.
2. Leave Digital Technician attached to vehicle.
3. In Digital Technician, go to Active Intake test screen.
4. Rotate throttle grip to wide open throttle (WOT).
5. Check that when the throttle plate reaches WOT, TPS reads above 82 degrees. If not, proceed to the cable adjustment procedure in the appropriate Buell Service Manual.
6. While holding the throttle wide open, activate the active intake tab on Digital Technician.
7. Verify that the TPS setting is between 10.4-10.9 degrees. If settings are not correct, proceed to cable adjustment procedure in the appropriate Buell Service Manual.

REMOVAL

NOTE

If solenoid bracket needs to be replaced, remove the baseplate assembly, turn it over, and remove the three fasteners securing the bracket to the baseplate.

1. Disconnect electrical connector [178] (1).
2. Hold solenoid shaft by flat spot provided and break cable connector (6) loose.
3. Unthread cable connector and disconnect cable from solenoid (8).
4. Loosen jam nut (5) and disconnect active cable (2) from cable bracket (4).

NOTE

Follow next step only if solenoid is to be replaced.

5. Loosen pinch fastener on solenoid bracket (9).
6. Remove the two fasteners at the front on the solenoid bracket (9) and slide solenoid (8) out of bracket.

NOTE

When removing baseplate it will be necessary to feed the electrical connector and active cable and grommets through the baseplate.

7. Remove baseplate (10).
8. If the active cable needs to be replaced disconnect the wheel (2).
INSTALLATION

NOTE

If solenoid bracket was removed, reinstall using the three fasteners and tighten to 48-60 in-lbs (5.4-6.7 Nm).

1. Install baseplate assembly.

NOTES

• When installing the backing plate it is important to ensure that the active cable remains in the tower on the cable wheel on the throttle body. If the cable comes out the cable will not work properly and will not be able to be adjusted.

• When installing baseplate be sure to feed the electrical connector (1) through hole in baseplate first and then insert active cable and then grommet.

• Follow next step only if solenoid was removed.

2. Install solenoid (8) into bracket (9) and tighten pinch fastener to 48-60 in-lbs (5.4-6.7 Nm) and bracket to solenoid fasteners to 20-24 in-lbs (2.3-2.7 Nm).

3. Install active cable (2) onto bracket (4) and leave jam nut (5) loose until the setting an be verified.

4. Connect active cable (2) to solenoid shaft and tighten cable connector (6) to 20-24 in-lbs (2.3-2.7 Nm).

5. Connect electrical connector [178].

6. See Cable Adjustment in the appropriate Buell Service Manual and verify active cable setting.

7. Tighten jam nuts to 48-60 in-lbs (5.4-6.7 Nm).
Figure 2-88. Active Intake System (Ulysses, Lightning)

Table 2-60. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>Behind windshield</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windshield</td>
</tr>
<tr>
<td>[178]</td>
<td>Active intake solenoid</td>
<td>2-place Deutsch</td>
<td>Under airbox cover</td>
</tr>
<tr>
<td>[179]</td>
<td>Active intake system sub-harness</td>
<td>2-place Deutsch</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Figure 2-89. Active Intake System (Firebolt)

Table 2-61. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>In fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>In fairing</td>
</tr>
<tr>
<td>[178]</td>
<td>Active intake solenoid</td>
<td>2-place Deutsch</td>
<td>Under airbox cover</td>
</tr>
<tr>
<td>[179]</td>
<td>Active intake system sub-harness</td>
<td>2-place Deutsch</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Active Intake System (Japan Models Only): DTC P1110 (22); DTC P1111 (22); P1112 (22) (Part 1 of 2)

1. Is the active intake system cable pinched or binding? Is the Active Intake Solenoid stuck?

   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 ON. Is battery voltage present?

   YES
   
   Measure voltage at [178A] terminal "1". Is battery voltage present?

   YES
   
   - Locate and repair short to voltage on (GY/O) wire.
   
   NO
   
   Measure resistance between connector [178A] terminal "1" and [179B] terminal "1". Is continuity present?

   YES
   
   Locate and repair open to (GY/O) wire.
   
   NO
   
   - STOP

   NO
   
   Disconnect connector [179B]. Measure resistance at terminal "2" to chassis ground. Is resistance less than 10,000 ohms?

   YES
   
   Locate and repair short to ground (W/GY) wire.

   NO
   
   Measure resistance between connector [178A] terminal "2" and [179B] terminal "2". Is continuity present?

   YES
   
   Locate and repair open to (W/GY) wire.

   NO
   
   - STOP

GO TO ACTIVE INTAKE SYSTEM TEST (JAPANESE MODELS ONLY), DTC P1110 (22); P1111 (22); P1112 (22) (PART 2 OF 2).

NOTE: If DTC is historic, then wiggle harness while performing measurements in chart to indicate intermittents.
Active Intake System (Japan Models Only): DTC P1110 (22); DTC P1111 (22); P1112 (22) (Part 2 of 2)

Go to Active Intake System Test (Japanese Models Only), DTC P1110 (22); P1111 (22); P1112 (22) (Part 1 of 2).

Measure resistance from active intake solenoid terminal "1" to terminal "2" [178B] (use HD-41404 Brown Pins).
Is resistance less than 4 ohms, nominal 2.4 ohms?

YES

Connect battery voltage to [178B] terminal "2" of Active Intake Solenoid (use HD-41404 Brown Pin and patch cable). 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?

YES

Hold throttle wide open. Energize Active Intake Solenoid. Does throttle close to an angle less than 11 degrees?

YES

Replace Electronic Control Module (ECM).

NO

Replace Active Intake Solenoid.

NO

Replace Active Intake Solenoid.

NOTE:
After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.

See CABLE ADJUSTMENT in the appropriate BUELL SERVICE MANUAL.
GENERAL

Bank Angle Sensor

The Bank Angle Sensor (BAS) operates from the ECM 5 volt sensor reference, and is grounded through the ECM on a common sensor ground circuit. Refer to Table 2-63. The BAS sends a signal to the ECM ranging from 0.24 - 3.4V under normal operating conditions. A signal between 3.4 - 4.79V will cause the ECM to turn off the engine. Once activated, the BAS 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. Refer to Table 2-62. 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 will act like a shorted high, and set DTC P1152. If a code occurs, the engine will continue to run.

A tipped vehicle will not set a DTC.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1151</td>
<td>44</td>
<td>Bank angle sensor shorted low</td>
</tr>
<tr>
<td>P1152</td>
<td>44</td>
<td>Bank angle sensor shorted high or failed sensor</td>
</tr>
</tbody>
</table>

Table 2-63. Bank Angle Sensor Voltage

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

Figure 2-90. Bank Angle Sensor (Top View)

Figure 2-91. Bank Angle Sensor (Connector End)
DIAGNOSTICS

<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>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

---

Figure 2-92. Bank Angle Sensor Circuit

Table 2-64. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>All</td>
<td>6-place Sumitomo</td>
<td>In fairing</td>
</tr>
</tbody>
</table>
Is Bank Angle Sensor connected?

**YES**

Disconnect Bank Angle Sensor connector [134]. Measure voltage on [134B] between terminal “5” (LGN/GY) and terminal “6” (BK/W). What is the voltage?

1. 4.75-5.25 volts
   - **YES**
   - Measure voltage between terminal “4” (R/W) and terminal “6” (BK/W). Is voltage 4-6 volts?
   - **YES**
     - Go to Bank Angle Sensor Test, DTC P1151 (44); P1152 (44) (Part 2 of 2).
   - **NO**
     - **STOP**

2. 11-13 volts
   - **YES**
     - Repair short to voltage on (LGN/GY) wire.
   - **NO**
     - 0.0 volt
     - **STOP**

**NO**


Is Bank Angle Sensor properly installed?

**YES**


**NO**

Are ferrous metals located within 0.25 in. (6.4 mm) of sides, face or top of Bank Angle Sensor?

**YES**

Install properly. See BANK ANGLE SENSOR in the appropriate Buell Service Manual.

**NO**

Return to original configuration.

Replace Bank Angle Sensor. See BANK ANGLE SENSOR in the appropriate Buell Service Manual.

**NOTE:**
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
Continued from Bank Angle Sensor Test, DTC P1151 (44); P1152 (44) (Part 1 of 2).

Disconnect connectors [10] (Black) and [11] (Gray) from ECM and plug into Breakout Box (B-48115). 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 “6” and connector [11B] (Gray) terminal “19” (GY).

Is continuity present?

YES

Check (LGN/GY) circuit continuity to ground for connector [134B] terminal “5” and connector [11B] (Gray) terminal “17”.

Is continuity present?

YES

Repair short to ground on (LGN/GY) wire.

NO

Repair open in (LGN/GY) wire.

YES

Repair open on (BK/ W) wire.

NO

Replace ECM.

NOTES:

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
2.32 DTC P1154 (26), P1155 (27)

GENERAL

Clutch Switch and Neutral Switch

Diagnostic trouble codes (DTCs) P1154 (26) and P1155 (27) will 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 2-65.

Table 2-65. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1154</td>
<td>26</td>
<td>Clutch position sensor circuit low</td>
</tr>
<tr>
<td>P1155</td>
<td>27</td>
<td>Neutral switch input circuit low</td>
</tr>
</tbody>
</table>

Figure 2-93. Neutral Switch

![Figure 2-93. Neutral Switch](image)

Figure 2-94. Left Handlebar Switch Connection (No pin 1 connection on Firebolt)

![Figure 2-94. Left Handlebar Switch Connection (No pin 1 connection on Firebolt)](image)

DIAGNOSTICS

<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>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

2. If DTC is current (lamp on continuously, clear codes return during operation), replace ECM. If DTC is historic, check for intermittents.
Figure 2-94. Clutch and Neutral Interlock Circuits (Ulysses, Lightning)

Table 2-66. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In front modules behind windscreen</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place Bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
Figure 2-96. Clutch and Neutral Interlock Circuits (Firebolt)

Table 2-67. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
</tbody>
</table>
Connect Breakout Box (Part No. B-48115) to the main harness, leaving the connector [11] (Gray) disconnected. Measure continuity between Breakout Box terminal “2” (Gray) (+) and ground (-). Is continuity present?

1. 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/LGN) wire in main wiring harness between [11B] and [95B].
   - NO
     - Locate and repair short-to-ground in left handlebar switch wiring.

2. NO
   - Replace ECM.

NOTES:
After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
Neutral Switch: DTC P1155 (27)

With the Ignition Switch OFF and the transmission in 1st or 2nd gear, connect Breakout Box (Part No. B-48115) to the main harness, leaving the Electronic Control Module (ECM) disconnected. Measure resistance between Breakout Box terminal “8” (Gray) and ground. Is resistance less than 10 ohms?

1. YES
   Disconnect Neutral Switch [131]. Measure resistance between Breakout Box terminal “8” (Gray) and ground. Is resistance less than 10 ohms?

2. NO
   Replace ECM.

3. YES
   Locate and repair short-to-ground on (TN/Y) wire in main wiring harness.

3. NO
   Replace Neutral Switch.

NOTES: After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.
INTERACTIVE MUFFLER CONTROL ACTUATOR

The interactive exhaust system utilizes an actuator valve in the muffler which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

A Code 21 will set if the ECM detects that the output for the Interactive Muffler Control Actuator is not in agreement with the feedback circuit.

- Mechanical fault in the actuator, valve or cable.
- Electrical fault in the actuator circuit.
- Electrical fault in the actuator feedback circuit.
- Electrical fault in the brake light or horn circuits.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1470</td>
<td>21</td>
<td>Interactive muffler control actuator stuck open</td>
</tr>
<tr>
<td>P1471</td>
<td>21</td>
<td>Interactive muffler control actuator stuck closed</td>
</tr>
<tr>
<td>P1477</td>
<td>21</td>
<td>Interactive muffler control actuator low/open</td>
</tr>
<tr>
<td>P1478</td>
<td>21</td>
<td>Interactive muffler control actuator high</td>
</tr>
</tbody>
</table>

Table 2-68. Code Description

Figure 2-97. Active Muffler Control Actuator (Open)

Figure 2-98. Active Muffler Control Actuator (Closed)

Figure 2-99. Active Muffler Control Actuator Motor
Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), use purple male pin probe and patch cord.

Figure 2-100. Interactive Exhaust Circuit (Ulysses, Lightning)
Table 2-69. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[24]</td>
<td>Left hand controls</td>
<td>4-place Multilock</td>
<td>Behind windshield</td>
</tr>
<tr>
<td>[93]</td>
<td>Tail light</td>
<td>3-place Amp</td>
<td>Under seat</td>
</tr>
<tr>
<td>[121]</td>
<td>Front brake switch</td>
<td>2-place Multilock</td>
<td>Underside of front master cylinder assembly</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn switch</td>
<td>Spade lugs</td>
<td>Behind windshield</td>
</tr>
<tr>
<td>[161]</td>
<td>Muffler valve actuator</td>
<td>4-place Deutsch</td>
<td>Beneath intake cover assembly</td>
</tr>
<tr>
<td>[165]</td>
<td>Sub-harness</td>
<td>3-place Packard</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Figure 2-101. Interactive Exhaust Circuit (Firebolt)
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[24]</td>
<td>Left hand controls</td>
<td>4-place Multilock</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[45]</td>
<td>Tail light</td>
<td>3-place Amp</td>
<td>Under seat</td>
</tr>
<tr>
<td>[121]</td>
<td>Front brake switch</td>
<td>2-place Multilock</td>
<td>Underside of front master cylinder assembly</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn switch</td>
<td>Spade lugs</td>
<td>In fairing</td>
</tr>
<tr>
<td>[161]</td>
<td>Muffler valve actuator</td>
<td>4-place Deutsch</td>
<td>Beneath intake cover assembly</td>
</tr>
<tr>
<td>[165]</td>
<td>Sub-harness</td>
<td>3-place Packard</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Interactive Muffler Control Actuator: DTC P1470 (21); DTC P1471 (22); DTC P1478 (22); DTC P1478 (22)

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, PTS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
GENERAL

Side Stand Sensor

The side stand sensor utilizes a Hall effect sensor to monitor side stand position. When the side stand is fully retracted, the sensor picks up the presence of the metal tab mounted on the side stand. When the side stand is extended, the engine will only start and run if the ECM receives a signal from the neutral switch indicating that the transmission is in neutral. Otherwise, the engine will start and stall.

The ECM provides 5V power feed and ground circuits to the side stand sensor. A signal is sent to the ECM based on side stand position. This signal allows the ECM to determine whether the side stand is retracted or extended.

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

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1501</td>
<td>45</td>
<td>Side stand sensor low</td>
</tr>
<tr>
<td>P1502</td>
<td>45</td>
<td>Side stand sensor high</td>
</tr>
<tr>
<td>P1503</td>
<td>45</td>
<td>Side stand down at vehicle speed 9 MPH (15 km/h) or greater</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-39978</td>
<td>DVOM</td>
</tr>
<tr>
<td>HD-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
</tbody>
</table>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See the appropriate Buell Service Manual for ECM replacement.
2. Unplug the neutral switch connector [131]. Using a DVOM (Part No. HD-39978), test continuity to ground. When the transmission is in neutral, continuity should exist. When the transmission is in gear, there should not be continuity to ground through the neutral switch.
3. When the side stand is retracted, voltage on connector [11] terminal "34" (gray) should be approximately 1.5-2V. When the side stand is extended, the voltage on connector [11] terminal "34" (gray) should be approximately 4-4.5V.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown male probe and patch cord.
Figure 2-104. Side Stand Sensor Circuit (HDI only)

Table 2-72. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11 ]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[133]</td>
<td>Side stand sensor</td>
<td>All</td>
<td>3-place Amp</td>
<td>Behind left ram air scoop</td>
</tr>
</tbody>
</table>
Side Stand Sensor Low: DTC P1501 (45); Side Stand Sensor High: DTC P1502 (45); Side Stand Sensor Down at Vehicle Speed: DTC P1503 (45) (Part 1 of 3)

Check for DTCs P1501, P1502, and P1503.
Any DTCs present?

YES

DTC P1501.

Disconnect side stand sensor connector [133].

Turn Ignition Switch ON. Place the Engine Stop Switch in the RUN position. Test terminal “1” of connector [133B] for voltage. Is voltage present?

YES

STOP

DTC P1502.

Go to Side Stand Sensor Test, DTC P1501 (45); P1502 (45); P1503 (45) (Part 2 of 3).

NO

Check for DTCs. Did DTC P1501 clear or go to history and P1502 set as a current DTC?

YES

Replace Side Stand Sensor.

NO

Repair short to ground.

DTC P1503.

Go to Side Stand Sensor Test, DTC P1501 (45); P1502 (45); P1503 (45) (Part 3 of 3).

STOP

NO

System operating normally.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.

Connect Breakout Box (Part No. B-48115) between ECM and main wiring harness before performing these tests.
Continued from Side Stand Sensor Test, DTC P1501 (45); P1502 (45); P1503 (45) (Part 1 of 3).


YES

Reconnect Turn Ignition Switch ON with Engine Stop Switch in RUN. Test for voltage on terminal "4" connector [133B]. Is voltage present?

YES

Is voltage approximately 5V?

YES

Turn off Ignition Switch. Connect Breakout Box (Part No. B-48115) 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

Repair short to voltage.

NO

Replace ECM.

YES

Test for continuity from connector [133B] terminal "1" to connector [11B] (Gray) terminal "25". Is continuity present?

YES

Repair short to ground.

NO

Replace ECM.

YES

Reconnect ECM connector [11]. Test for voltage on terminal "1" of connector [133B]. Is voltage present?

YES

Repair short to ground.

NO

Replace ECM.

YES

Reconnect ECM connector [11A]. Test for continuity from connector [133B] terminal "1" to connector [11B] (Gray) terminal "25". Is continuity present?

YES

Repair short to voltage.

NO

Replace ECM.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing Electronic Control Module (ECM) or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate BUELL SERVICE MANUAL.

Replace ECM.

Replace Side Stand Sensor.

fc01617_en
Side Stand Sensor Low: DTC P1501 (45); Side Stand Sensor High: DTC P1502 (45); Side Stand Sensor Down at Vehicle Speed: DTC P1503 (45) (Part 3 of 3)

Continued from Side Stand Sensor Test, DTC P1501 (45); P1502 (45); P1503 (45) (Part 1 of 3).

Clear DTC 1501 and/or DTC 1502 before proceeding. Are the Side Stand and associated parts in good mechanical condition?

YES

Inspect the Side Stand tab for correct clearance to Side Stand sensor 0.18 inches (4.5mm) maximum. Is the sensor mounted correctly?

YES

Turn on ignition switch and check voltage on Side Stand sensor connector [133B] terminal “4”. Is 5V present?

YES

Replace Side Stand Sensor.

NO

Make adjustments in accordance with the appropriate Buell Service Manual and retest.

YES

Check spring for proper tension. Does spring have correct tension?

YES

Operation normal.

NO

Repair open wire.

Replace ECM.

NO

Repair spring.

Replace Side Stand.

NO

Replace ECM.
GENERAL

Auxiliary Power Outlets
The 12-volt auxiliary power outlet circuit consists of two power outlets for the 12-volt electrical accessories. The front 12-volt auxiliary power outlet is located in the dash to the speedometer assembly. The rear 12-volt auxiliary power outlet is located in the tail section under the seat of the Ulysses only.

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1601</td>
<td>47</td>
<td>Auxiliary relay driver circuit</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

Diagnostic Tips
- The 12-volt auxiliary power outlets will function with the ignition switch key in the ON or PARK positions
- The 12-volt auxiliary power outlet circuit contains a 10-amp fuse to protect overloading of the circuit. Verify that the combined accessory load of the both power outlets does not exceed the amperage rating of the fuse.

Diagnostic Notes
Each reference number below correlates to a circled number on the flow chart(s).

1. Remove the seat to access the rear 12-volt auxiliary power outlet electrical connector.
2. Remove the windscreen to access the front 12-volt auxiliary power outlet electrical connector.
Figure 2-107. 12 Volt Auxiliary Power Outlet Circuit (Ulysses, Lightning)

Table 2-74. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>All</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>All</td>
<td>4-place Multilock</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>All</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[160]</td>
<td>Front 12-volt auxiliary power outlet</td>
<td>All</td>
<td>2-place Sumitomo</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[180]</td>
<td>Rear 12-volt auxiliary power outlet</td>
<td>Ulysses only</td>
<td>2-place Sumitomo</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
Table 2-75. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[22]</td>
<td>Right handlebar switch</td>
<td>4-place Multilock</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[160]</td>
<td>Front 12-volt auxiliary power outlet</td>
<td>2-place Sumitomo</td>
<td>Beneath fairing</td>
</tr>
</tbody>
</table>
Auxiliary Power Outlets: DTC P1601 (47)

1. **Auxiliary Power Outlets DTC 1601 (47).**
   - Place ignition switch ON.
   - Do outlets work?
   - (Note: Ulysses has two outlets. The second outlet is located under the seat at the rear of the vehicle.)

   - **YES**
     - System operation normal.
   - **NO**
     - Turn ignition switch OFF. With a DVOM, check the voltage at ignition switch connector [33B] terminals "1" and "4" (R) to ground. Is battery voltage present?

   - **YES**
   - Place ignition switch ON. Check voltage at relay assembly connector [62B] terminal "1" (W/BK) and ground. Is battery voltage present?
   - **YES**
   - Check voltage at relay assembly connector [62B] terminal "20" (GY) and ground. Is battery voltage present?
   - **YES**
   - Replace ECM.
   - **NO**
   - Locate and repair open wire (R) between ignition switch connector [33B] terminals "1" and "4" and fuse block assembly terminal "24".
   - **NO**
   - Locate and repair open wire between relay assembly connector [62B] terminal "16" (R/BK) and relay assembly terminal "1" (W/BK).
   - **YES**
   - Locate and repair open wire between relay assembly connector [62B] terminal "16" (R/BK) and fuse block assembly [62B] terminal "15" (R).
   - **NO**
   - If wire is OK, replace Ignition Relay.

   - **NO**
   - Replace Ignition Relay.

2. **Note: Before conducting this test, ensure the battery is fully charged and all fuses are good.**
GENERAL

Tachometer
A DTC will set if the (PK) tachometer wire is shorted to power or ground.

Table 2-76. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1653</td>
<td>35</td>
<td>Tachometer output low</td>
</tr>
<tr>
<td>P1654</td>
<td>35</td>
<td>Tachometer output high</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

<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>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.
**Figure 2-111. Tachometer Circuit (Ulysses, Lightning)**

**Figure 2-112. Tachometer Circuit (Firebolt)**

**Table 2-77. Wire Harness Connectors**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen</td>
</tr>
</tbody>
</table>
Table 2-78. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Beneath fairing</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>In fairing</td>
</tr>
</tbody>
</table>
Tachometer: DTC P1653 (35); DTC P1634 (35)

1. Attach Breakout Box (B-48115), but leave connector [10] (BK) unplugged at the Electronic Control Module (ECM).
2. Disconnect Instrument Module connector [39] with Ignition Switch ON. Measure voltage across terminal “22” (+) and terminal “24” (-) of Breakout Box connector [10] (Black).

Is battery voltage present?

- YES: Locate and repair short on (PK) wire to voltage.
- NO: Check for continuity at Breakout Box connector [10] (Black) terminals “22” and “24.”

Is continuity present?

- YES: Locate and repair short on (PK) wire to ground.

- YES: Reconnect connector [39]. Locate intermittents using wiggle test. See 2.7 WIGGLE TEST. Intermittents found?
  - YES: Repair.
  - NO: Replace ECM.

- NO: Replace Instrument Module. See INSTRUMENT MODULE in the appropriate Buell Service Manual.

NOTES:
Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).

After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.
GENERAL

Front (Code 24) and Rear (Code 25) Ignition Coils

A combination of these codes will 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. If multiple codes are set, P2303 (25), P2304 (25) the cause may be an ignition coil power failure.

See Figure 2-113. The ignition coil receives power from the ignition relay at ignition coil pin B (3) at the same time that the fuel pump and fuel injectors are activated.

Table 2-79. Code Description

<table>
<thead>
<tr>
<th>DTC</th>
<th>CHECK ENGINE LAMP CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2300</td>
<td>24</td>
<td>Front ignition coil control circuit low</td>
</tr>
<tr>
<td>P2301</td>
<td>24</td>
<td>Front ignition coil control circuit high</td>
</tr>
<tr>
<td>P2303</td>
<td>25</td>
<td>Rear ignition coil control circuit low</td>
</tr>
<tr>
<td>P2304</td>
<td>25</td>
<td>Rear ignition coil control circuit high</td>
</tr>
</tbody>
</table>

DIAGNOSTICS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41404-B</td>
<td>HARNESS CONNECTOR TEST KIT</td>
</tr>
<tr>
<td>HD-34730-2C</td>
<td>FUEL INJECTOR TEST LAMP</td>
</tr>
<tr>
<td>HD-44687</td>
<td>IGNITION COIL CIRCUIT TEST ADAPTER</td>
</tr>
</tbody>
</table>

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probes and patch cord.

2. Connect BREAKOUT BOX (Part No. B-48115) to ECM. See 2.6 BREAKOUT BOX.

3. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box. Note that cranking the engine with test lamp in place of the ignition coil can sometimes cause P2300 (24), P2301 (24), P2303 (25), P2304 (25). This condition is normal and does not by itself indicate a malfunction. Codes must be cleared if this condition occurs.

4. If resistance greater than 1 ohm is found between ECM connector [10] terminal “25” OR “34” and terminal “9”, but not both, the open must be repaired but this repair will not correct the concern. If resistance greater than 1 ohm is found between ECM connector [10] terminal “31” OR “32” and terminal “9”, but not both, the open must be repaired but this repair will not correct the concern.

Figure 2-113. Ignition Coil

Figure 2-114. Ignition Coil Circuit Test
### Figure 2-115. Ignition Coil Circuit

### Table 2-80. Wire Harness Connectors

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>MODEL</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ECM (BK)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[11]</td>
<td>ECM (GY)</td>
<td>Firebolt</td>
<td>34-place Amp (Tyco)</td>
<td>In fairing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulysses, Lightning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position (CKP) sensor</td>
<td>All</td>
<td>2-place Mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition coil</td>
<td>All</td>
<td>3-place Delphi</td>
<td>Beneath air cleaner base plate</td>
</tr>
</tbody>
</table>
Ignition Coil: DTC P2300 (24); DTC P2301 (24); DTC P2303 (25); DTC P2304 (25)

NOTE:
Use Breakout Box and test adapter for the Next Inspection(s).

Front Ignition Coil.
Insert test lamp between Electronic Control Module (ECM) terminal "9" (Black) and ECM terminal "25" of Breakout Box.
Insert test adapter between ECM terminal "9" (Black) wire and ECM terminal "34" (Black) of Breakout Box. Does test lamp flash when engine is cranked?

Rear Ignition Coil.
Insert test lamp between Electronic Control Module (ECM) terminal "9" (Black) and ECM terminal "31" of Breakout Box.
Insert test adapter between ECM terminal "9" (Black) wire and ECM terminal "32" (Black) of Breakout Box. Does test lamp flash when engine is cranked?

Faulty ignition coil connection or Ignition Coil. See IGNITION COIL in the appropriate Buell Service Manual.

Measure voltage on terminal "2" of the ignition coil [83]. Reading should be equivalent to battery voltage after the Ignition Switch is turned ON.
Is it?

Measure voltage at ignition relay terminal "87" after Ignition Switch is turned ON. Reading should be equivalent to battery voltage.
Is it?

Repair open wire or connection on (GY) wire.
Check for multiple codes. See 2.4 CHECKING FOR TROUBLE CODES.

Clear DTCs and confirm proper operation with no check engine lamp. Codes can be cleared using DIGITAL TECHNICIAN (Part No. HD-44750).
After replacing ECM or TPS, TPS zero set procedure must be performed. Refer to THROTTLE POSITION SENSOR in the appropriate Buell Service Manual.

Perform wiggle test. See 2.7 WIGGLE TEST. Intermittents found?

Repair open wire or connection.
Repair as necessary.
Replace ECM.
GENERAL

Heated Handlebar Grips are installed on the Ulysses model as standard equipment. High and low heat ranges are included consuming 18 and 11 watts, respectively. See Figure 2-116 for heater controls. Power for operation is routed through a Heated Handlebar Grips subharness connected to the Auxiliary Power circuit.

There are no diagnostic trouble codes (DTCs) for this equipment. Refer to Table 2-81 for Heated Handlebar Grips specifications.

DIAGNOSTICS

Diagnostic Tips

- The heated handlebar grips will function with the ignition switch in the ON position.
- The 12 Volt auxiliary circuit contains a 10 Amp fuse to protect overloading the circuit. Any auxiliary loads in addition to the heated handlebar grips should be reduced when the heated handlebar grips are used so as to not exceed the ampere rating of the fuse.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Remove windscreen to access the connectors for the Heated Handlebar Grips.

Table 2-81. Heated Handlebar Grips Specification

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEMPERATURE RANGE 1 (HI)</th>
<th>TEMPERATURE RANGE 2 (LO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12V±0.26 VDC</td>
<td>12V</td>
</tr>
<tr>
<td>Current</td>
<td>1.5A</td>
<td>0.93A</td>
</tr>
<tr>
<td>Watts (@ 12V)</td>
<td>18W, ±15%</td>
<td>11W</td>
</tr>
<tr>
<td>Heating Element Resistance</td>
<td>8 Ohms</td>
<td>13 Ohms</td>
</tr>
</tbody>
</table>

Figure 2-116. Heated Handlebar Grips Control Switch
1. Right heated handlebar grip [189R]
2. Right hand controls [22]
3. Heated handlebar grip subharness [206]
4. Auxiliary power [160]
5. Left heated handlebar grip [189L]
6. Left hand controls [24]

Figure 2-117. Heated Handlebar Grips Connector Locations
Figure 2-118. Heated Handlebar Grips Circuit

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[22A]</td>
<td>Right handlebar grip controls</td>
<td>4-place Multilock</td>
<td>Inside windscreen</td>
</tr>
<tr>
<td>[24B]</td>
<td>Left handlebar grip controls</td>
<td>8-place Multilock</td>
<td>Inside windscreen</td>
</tr>
<tr>
<td>[160A]</td>
<td>Auxiliary power</td>
<td>2-place Sumitomo</td>
<td>Inside windscreen</td>
</tr>
<tr>
<td>[189L]</td>
<td>Left heated handlebar grip</td>
<td>3-place Deutsch</td>
<td>Inside windscreen</td>
</tr>
<tr>
<td>[189R]</td>
<td>Right heated handlebar grip</td>
<td>3-place Deutsch</td>
<td>Inside windscreen</td>
</tr>
<tr>
<td>[260B]</td>
<td>Heated handlebar grip subharness</td>
<td>2-place Sumitomo</td>
<td>Inside windscreen</td>
</tr>
</tbody>
</table>
Heated Handlebar Grips Test (Part 1 of 2)

1. Place ignition switch ON, and the Heated Handlebar Grips switch to the LOW position. Are both handgrips inoperative?

   YES
   - Disconnect [189L] and [189R]. With the Heated Handlebar Grip switch HIGH, check for continuity between connector [206B] terminal "1" (O/R) and connector [189LB] terminal "2" (BN) and then terminal "3" (BE). Repeat for connector [189RB].
   
   NO
   - Perform 2.35 DTC P1601 (47)

2. Place ignition switch and Heated Handlebar Grip switch OFF. Disconnect [206B] from vehicle wiring harness connector [160A]. Place ignition switch to ON. Measure the voltage from vehicle harness connector [160B] to ground. Is battery voltage present?

   YES
   - Replace Heated Handlebar Grip switch.

   NO
   - Go to Heated Handlebar Grip Test (Part 2 of 2).

3. Place ignition switch OFF. Check continuity between [206B] terminal "2" (O/R) and ground. Is continuity present?

   YES
   - Locate and repair open wire to ground as applicable.

   NO
   - Replace Heated Handlebar Grip switch.

Ensure the battery is fully charged, auxiliary fuse is good, and all auxiliary devices removed.
From Heated Handlebar Grip Test (Part 1 of 2).

Handgrips work at least partially.

Place ignition switch to ON, and the Heated Handlebar Grip switch to LOW. Does heat increase in both grips?

**YES**

Place Heated Handlebar Grip switch to HIGH. Does heat increase in both grips?

**YES**

System Operation Normal.

**NO**

Does heat remain LOW in both grips?

**YES**

Place ignition switch OFF. Disconnect [189L] or [189R] as appropriate. Measure the resistance between [189LA] or [189RA] terminal "1" (BK) and "2" (BN) (13 Ohms), then between "1" (BK) and "3" (BE) (21 Ohms). Are resistance values correct?

**NO**

Replace appropriate Heated Handlebar Grip.

**YES**

Disconnect [206B]. With the Heated Handlebar Grip switch HIGH, check for continuity between connector [206B] terminal "1" (O/R) and connector [189LB] terminal "2" (BN) and then terminal "3" (BE). Repeat for connector [189RB]. Is continuity present?

**YES**

Locate and repair shorted wire(s) as applicable.

**NO**

Repeat 2.7 WIGGLE TEST. If no intermittents found, repeat test.

**NO**

Locate and repair open wire(s) as applicable.
<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 TERMINALS</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 SEALED SPLICE CONNECTORS</td>
<td>A-20</td>
</tr>
</tbody>
</table>
AMP MULTILOCK CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41609</td>
<td>AMP MULTILOCK CRIMPER</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.
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
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.

5. Gently tug on wire to pull wire and terminal from cavity.
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.

**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.

Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.
2. See Figure A-2 and Figure A-5. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).

3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

<table>
<thead>
<tr>
<th>WIRE GAUGE</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Front</td>
</tr>
<tr>
<td>16</td>
<td>Middle</td>
</tr>
<tr>
<td>18</td>
<td>Rear</td>
</tr>
</tbody>
</table>

1. Insulation crimp tail
2. Wire crimp tail
3. Locking bar groove

Figure A-4. AMP Multilock Connector: Pin Terminal

1. Insulation crimp tail
2. Wire crimp tail
3. Locking bar groove

Figure A-5. AMP Multilock Connector: Socket 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.

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-2 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 crimper 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 crimper tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

8. Raise up locking bar (8) and remove crimped terminal.
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

Figure A-6. AMP Multilock Connector: Terminal Crimping Procedure

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
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-8. 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
**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.

**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**

1. Arrow on socket locking wedge
2. Arrow on pin locking wedge
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.

\begin{itemize}
  \item If wire leads require new terminals, see the instructions for crimping terminals.
  \item 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.
  \item 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.
\end{itemize}

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.

\begin{itemize}
  \item The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.
  \item 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.
  \item 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.
\end{itemize}
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.

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 TERMINALS</td>
</tr>
</tbody>
</table>

Figure A-15. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

1. Wire seal
2. Pin housing
3. Pin terminal
4. Locking wedge
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 stripper 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 nest 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)
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 CONNECTORS

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 an X-Acto 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 X-Acto knife
5. Pull on lead to draw terminal into chamber

Figure A-22. 280 Metri-Pack Connector: Remove/Install Socket Terminal
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.

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, depress 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 depress 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.

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 CONNECTORS

630 METRI-PACK CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT600-3</td>
<td>SNAP-ON PICK</td>
</tr>
</tbody>
</table>

**General**

Referred 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. 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.
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>
<thead>
<tr>
<th>WIRE GAUGE</th>
<th>COLOR</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>Red</td>
<td>70585-93</td>
<td>3/8 in. (9.5 mm)</td>
</tr>
<tr>
<td>14-16</td>
<td>Blue</td>
<td>70586-93</td>
<td>3/8 in. (9.5 mm)</td>
</tr>
<tr>
<td>10-12</td>
<td>Yellow</td>
<td>70587-93</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-25. The connector is crimped twice - one side and then the other.

1. See Figure A-24. 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-25. 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.

6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

**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/explosion 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-25. 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.
1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted sealant

Figure A-25. Sealed Splice Connector
## CONNECTOR LOCATIONS

### Table B-1. Buell Connector Locations

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[5]</td>
<td>J-Fuse</td>
<td>Spade terminals</td>
<td>Under seat (Firebolt only)</td>
</tr>
<tr>
<td>[7]</td>
<td>Tail harness</td>
<td>8-place Multilock</td>
<td>Left side under tail section (Firebolt only)</td>
</tr>
<tr>
<td>[10]</td>
<td>Electronic Control Module (ECM) (black)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat (Ulysses, Lightning) In fairing (Firebolt)</td>
</tr>
<tr>
<td>[11]</td>
<td>Electronic Control Module (ECM) (gray)</td>
<td>34-place Amp (Tyco)</td>
<td>Under seat (Ulysses, Lightning) In fairing (Firebolt)</td>
</tr>
<tr>
<td>[18]</td>
<td>Right rear turn signal</td>
<td>2 1-place bullet</td>
<td>Under rear wire cover (Ulysses) Under seat (Lightning) Under tail section (Firebolt)</td>
</tr>
<tr>
<td>[19]</td>
<td>Left rear turn signal</td>
<td>2 1-place bullet</td>
<td>Under rear wire cover (Ulysses) Under seat (Lightning) Under tail section (Firebolt)</td>
</tr>
<tr>
<td>[22]</td>
<td>Right hand controls</td>
<td>4-place Multilock</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[24]</td>
<td>Left hand controls</td>
<td>8-place Multilock</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[30]</td>
<td>Flasher</td>
<td>5-place Amp</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[31R]</td>
<td>Right front turn signal</td>
<td>2 1-place bullet</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[31L]</td>
<td>Left front turn signal</td>
<td>2 1-place bullet</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>4-place Augat</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlight connector</td>
<td>4-place Amp</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[39]</td>
<td>Instrument module</td>
<td>20-place Multilock</td>
<td>Behind windscreen (Ulysses, Lightning) Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[45]</td>
<td>License plate lamp</td>
<td>2 1-place bullet</td>
<td>Under rear wire cover (Ulysses, Lightning) Under seat (Firebolt)</td>
</tr>
<tr>
<td>[46]</td>
<td>Stator</td>
<td>2-place Packard</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[61]</td>
<td>Fuse assembly</td>
<td>Socket terminals</td>
<td>Under seat (Ulysses, Lightning) Right side of fairing (Firebolt)</td>
</tr>
<tr>
<td>[62]</td>
<td>Relay assy</td>
<td>Spade terminals</td>
<td>Under seat (Ulysses, Lightning) Left side of fairing (Firebolt)</td>
</tr>
<tr>
<td>[65]</td>
<td>Vehicle Speed Sensor (VSS)</td>
<td>3-place Deutsch</td>
<td>Right rear top of crankcase</td>
</tr>
<tr>
<td>[77]</td>
<td>Voltage regulator</td>
<td>2-place Packard</td>
<td>Behind left ram air scoop</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankcase Position (CKP) sensor</td>
<td>2-place Mini-Deutsch</td>
<td>Below left ram air scoop</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition coil</td>
<td>3-place Packard</td>
<td>Beneath aircleaner baseplate</td>
</tr>
<tr>
<td>[84]</td>
<td>Front fuel injector</td>
<td>2-place Packard</td>
<td>Beneath aircleaner baseplate</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear fuel injector</td>
<td>2-place Packard</td>
<td>Beneath aircleaner baseplate</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>[86]</td>
<td>Fuel pump</td>
<td>4-place Multilock</td>
<td>Left side of frame</td>
</tr>
<tr>
<td>[87]</td>
<td>Idle air control</td>
<td>4-place Delphi</td>
<td>Beneath air cleaner baseplate</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position (TP) sensor</td>
<td>3-place Amp</td>
<td>Beneath air cleaner baseplate</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature (IAT) sensor</td>
<td>2-place Amp</td>
<td>In air cleaner baseplate</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Temperature (ET) sensor</td>
<td>1-place bullet</td>
<td>Beneath air cleaner baseplate</td>
</tr>
<tr>
<td>[91A]</td>
<td>Data link connector</td>
<td>4-place Deutsch</td>
<td>Beneath left airflow guide (Ulysses)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Under seat (Lightning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Under fairing (Firebolt)</td>
</tr>
<tr>
<td>[93]</td>
<td>Tail light</td>
<td>3-place Amp (Tyco)</td>
<td>Back of tail light, under seat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Tyco) (Ulysses)</td>
<td>Under seat (Lightning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Under fairing (Firebolt)</td>
</tr>
<tr>
<td>[95]</td>
<td>Clutch switch</td>
<td>2-place Multilock</td>
<td>Underside of clutch lever assembly</td>
</tr>
<tr>
<td>[97]</td>
<td>Cooling fan</td>
<td>2-place Multilock</td>
<td>Bottom of rear cylinder under seat</td>
</tr>
<tr>
<td>[120]</td>
<td>Oil pressure switch</td>
<td>Post terminal</td>
<td>Bottom of oil pump</td>
</tr>
<tr>
<td>[121]</td>
<td>Rear brake switch</td>
<td>2-place Multilock</td>
<td>Under seat</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn</td>
<td>Spade terminals</td>
<td>Behind windscreen (Ulysses, Lightning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In fairing (Firebolt)</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Spade terminal</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>1-place bullet</td>
<td>Under sprocket cover</td>
</tr>
<tr>
<td>[133]</td>
<td>Side stand sensor</td>
<td>3-place Deutsch</td>
<td>Behind left ram air scoop</td>
</tr>
<tr>
<td>[134]</td>
<td>Bank angle sensor</td>
<td>6-place Sumitomo</td>
<td>Under seat (Ulysses, Lightning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In fairing (Firebolt)</td>
</tr>
<tr>
<td>[137]</td>
<td>Oxygen sensor</td>
<td>1-place Packard</td>
<td>Above rear cylinder head</td>
</tr>
<tr>
<td>[160]</td>
<td>Front auxiliary power outlet</td>
<td>2-place Sumitomo</td>
<td>Behind windscreen (Ulysses, Lightning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beneath fairing (Firebolt)</td>
</tr>
<tr>
<td>[161]</td>
<td>Interactive exhaust to actuator</td>
<td>4-place Sumitomo</td>
<td>Under intake cover</td>
</tr>
<tr>
<td>[165]</td>
<td>Interactive exhaust subharness to main harness</td>
<td>3-place Deutsch</td>
<td>Under seat</td>
</tr>
<tr>
<td>[178]</td>
<td>Active intake system to solenoid</td>
<td>2-place Deutsch</td>
<td>Under air cleaner cover</td>
</tr>
<tr>
<td>[180]</td>
<td>Rear auxiliary power outlet</td>
<td>2-place Sumitomo</td>
<td>Under seat (Ulysses only)</td>
</tr>
<tr>
<td>[189L]</td>
<td>Left heated grip</td>
<td>3-place Deutsch</td>
<td>Behind windscreen (Ulysses only)</td>
</tr>
<tr>
<td>[189R]</td>
<td>Right heated grip</td>
<td>3-place Deutsch</td>
<td>Behind windscreen (Ulysses only)</td>
</tr>
<tr>
<td>[206]</td>
<td>Heated grip subharness connector</td>
<td>3-place Sumitomo</td>
<td>Behind windscreen (Ulysses only)</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 that verifies that no connection (9) between two wire traces exists and a symbol identifying two wires that are twisted together (10).

Table B-2. Wire Color Codes

<table>
<thead>
<tr>
<th>ALPHA CODE</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>Blue</td>
</tr>
<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>Grey</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>
<tr>
<td>TN</td>
<td>Tan</td>
</tr>
<tr>
<td>V</td>
<td>Violet</td>
</tr>
<tr>
<td>W</td>
<td>White</td>
</tr>
<tr>
<td>Y</td>
<td>Yellow</td>
</tr>
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</table>
## Wiring Diagram List

<table>
<thead>
<tr>
<th>DIAGRAM</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Harness, Ulysses and Lightning</td>
<td>Figure B-2</td>
</tr>
<tr>
<td>Main Harness, Firebolt</td>
<td>Figure B-3</td>
</tr>
<tr>
<td>Engine Management Circuit, All Models</td>
<td>Figure B-4</td>
</tr>
<tr>
<td>Lighting Circuit, Ulysses and Lightning</td>
<td>Figure B-5</td>
</tr>
<tr>
<td>Lighting Circuit, Firebolt</td>
<td>Figure B-6</td>
</tr>
<tr>
<td>Component Circuits, All Models</td>
<td>Figure B-7</td>
</tr>
<tr>
<td>Horn and Instruments Circuit, All Models</td>
<td>Figure B-8</td>
</tr>
<tr>
<td>Starting Circuit, Ulysses and Lightning</td>
<td>Figure B-9</td>
</tr>
<tr>
<td>Starting Circuit, Firebolt</td>
<td>Figure B-10</td>
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<tr>
<td>Charging Circuits, All Models</td>
<td>Figure B-11</td>
</tr>
<tr>
<td>Heated Handlebar Grips (Ulysses only)</td>
<td>Figure B-12</td>
</tr>
</tbody>
</table>
Figure B-4.
Engine Management Circuit, All Models
Figure B-5.
Lighting Circuit, Ulysses and Lightning
Figure B-6. Lighting Circuit, Firebolt
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Sub-Harness Connector
12V Auxiliary Outlet Connector
Right Hand Controls
Left Hand Controls

To Heated Grips Switch

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1. Active intake solenoid (Japan only)
2. Ignition coil
3. Fuel pump
4. Crank Position (CKP) sensor

Figure B-13. Wiring Harness, Left Side View (Ulysses)
1. Active Intake Solenoid (Japan only)
2. Ignition coil
3. Fuel pump
4. Crank Position (CKP) sensor

Figure B-14. Wiring Harness, Left Side View (Lightning)
1. Active intake solenoid (Japan only)
2. Ignition coil
3. Fuel pump
4. Crankshaft Position (CKP) sensor
5. To ECM

Figure B-15. Wiring Harness, Left Side View (Firebolt)
1. Fuel injector (2)  
2. Idle Air Control (IAC)  
3. Throttle Position Sensor (TPS)  
4. Intake Air Temperature (IAT) sensor  
5. Oxygen (O2) sensor

Figure B-16. Wiring Harness, Top View (Ulysses)
1. Fuel injector (2)
2. Idle Air Control (IAC)
3. Throttle Position Sensor (TPS)
4. Intake Air Temperature (IAT) sensor
5. Oxygen (O2) sensor

Figure B-17. Wiring Harness, Top View (Lightning)
1. Fuel injector (2)
2. Idle Air Control (IAC)
3. Throttle Position Sensor (TPS)
4. Intake Air Temperature (IAT) sensor
5. Oxygen (O2) sensor
6. Engine Temperature (ET) sensor

Figure B-18. Wiring Harness, Top View (Firebolt)
1. Vehicle Speed Sensor (VSS)
2. Cable, starter to battery positive
3. Solenoid
4. Oil pressure switch
5. Neutral switch
6. Relay terminal

Figure B-19. Wiring Harness, Right Side View (Ulysses)
1. Vehicle Speed Sensor (VSS)
2. Cable, starter to battery positive
3. Solenoid
4. Voltage regulator
5. Oil pressure switch
6. Neutral switch
7. Relay terminal

Figure B-20. Wiring Harness, Right Side View (Lightning)
1. Vehicle Speed Sensor (VSS)
2. Cable, starter to battery positive
3. Solenoid
4. Voltage regulator
5. Oil pressure switch
6. Neutral switch
7. Relay terminal

Figure B-21. Wiring Harness, Right Side View (Firebolt)
1. Exhaust valve actuator
2. Muffler valve

Figure B-22. Exhaust Valve Actuator, Right Side View (Ulysses)
1. Exhaust valve actuator
2. Muffler valve

Figure B-23. Exhaust Valve Actuator, Right Side View (Lightning)
1. Exhaust valve actuator  
2. Muffler valve

Figure B-24. Exhaust Valve Actuator, Right Side View (Firebolt)
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</table>
METRIC CONVERSION

C.1

CONVERSION TABLE
Table C-1. Metric Conversions
MILLIMETERS to INCHES
(MM x 0.03937 = IN.)

INCHES to MILLIMETERS
(IN. x 25.40 = MM)

MM

IN.

MM

IN.

MM

IN.

MM

IN..

IN.

MM

IN.

MM

IN.

MM

IN.

MM

.1

.0039

25

.9842

58

2.283

91

3.582

.001

.025

.6

15.240

1-15/16

49.21

3-5/16

84.14

.2

.0078

26

1.024

59

2.323

92

3.622

.002

.051

5/8

15.875

2

50.80

3-3/8

85.72

.3

.0118

27

1.063

60

2.362

93

3.661

.003

.076

11/16

17.462

2-1/16

52.39

3.4

86.36

.4

.0157

28

1.102

61

2.401

94

3.701

.004

.102

.7

17.780

2.1

53.34

3-7/16

87.31

.5

.0197

29

1.142

62

2.441

95

3.740

.005

.127

3/4

19.050

2-1/8

53.97

3-1/2

88.90

.6

.0236

30

1.181

63

2.480

96

3.779

.006

.152

.8

20.320

2-3/16

55.56

3-9/16

90.49

.7

.0275

31

1.220

64

2.519

97

3.819

.007

.178

13/16

20.638

2.2

55.88

3.6

91.44

.8

.0315

32

1.260

65

2.559

98

3.858

.008

.203

7/8

22.225

2-1/4

57.15

3-5/8

92.07

.9

.0354

33

1.299

66

2.598

99

3.897

.009

.229

.9

22.860

2.3

58.42

3-11/16

93.66

1

.0394

34

1.338

67

2.638

100

3.937

.010

.254

15/16

23.812

2-5/16

58.74

3.7

93.98

2

.0787

35

1.378

68

2.677

101

3.976

1/64

.397

1

25.40

2-3/8

60.32

3-3/4

95.25

3

.1181

36

1.417

69

2.716

102

4.016

.020

.508

1-1/16

26.99

2.4

60.96

3.8

96.52

4

.1575

37

1.456

70

2.756

103

4.055

.030

.762

1.1

27.94

2-7/16

61.91

3-13/16

96.84

5

.1968

38

1.496

71

2.795

104

4.094

1/32

.794

1-1/8

28.57

2-1/2

63.50

3-7/8

98.42

6

.2362

39

1.535

72

2.834

105

4.134

.040

1.016

1-3/16

30.16

2-9/16

65.09

3.9

99.06

7

.2756

40

1.575

73

2.874

106

4.173

.050

1.270

1.2

30.48

2.6

66.04

3-15/16

100.01

8

.3149

41

1.614

74

2.913

107

4.212

.060

1.524

1-1/4

31.75

2-5/8

66.67

4

101.6

9

.3543

42

1.653

75

2.953

108

4.252

1/16

1.588

1.3

33.02

2-11/16

68.26

4-1/16

102.19

10

.3937

43

1.693

76

2.992

109

4.291

.070

1.778

1-5/16

33.34

2.7

68.58

4.1

104.14

11

.4331

44

1.732

77

3.031

110

4.331

.080

2.032

1-3/8

34.92

2-3/4

69.85

4-1/8

104.77

12

.4724

45

1.772

78

3.071

111

4.370

.090

2.286

1.4

35.56

2.8

71.12

4-3/16

106.36

13

.5118

46

1.811

79

3.110

112

4.409

.1

2.540

1-7/16

36.51

2-13/16

71.44

4.2

106.68

14

.5512

47

1.850

80

3.149

113

4.449

1/8

3.175

1-1/2

38.10

2-7/8

73.02

4-1/4

107.95

15

.5905

48

1.890

81

3.189

114

4.488

3/16

4.762

1-9/16

39.69

2.9

73.66

4.3

109.22

16

.6299

49

1.929

82

3.228

115

4.527

.2

5.080

1.6

40.64

2-15/16

74.61

4-5/16

109.54

17

.6693

50

1.968

83

3.268

116

4.567

1/4

6.350

1-5/8

41.27

3

76.20

4-3/8

111.12

18

.7086

51

2.008

84

3.307

117

4.606

.3

7.620

1-11/16

42.86

3-1/16

77.79

4.4

111.76

19

.7480

52

2.047

85

3.346

118

4.645

5/16

7.938

1.7

43.18

3.1

78.74

4-7/16

112.71

20

.7874

53

2.086

86

3.386

119

4.685

3/8

9.525

1-3/4

44.45

3-1/8

79.37

4-1/2

114.30

21

.8268

54

2.126

87

3.425

120

4.724

.4

10.160

1.8

45.72

3-3/16

80.96

4-9/16

115.89

22

.8661

55

2.165

88

3.464

121

4.764

7/16

11.112

1-13/16

46.04

3.2

81.28

4.6

116.84

23

.9055

56

2.205

89

3.504

122

4.803

1/2

12.700

1-7/8

47.62

3-1/4

82.55

4-5/8

117.47

24

.9449

57

2.244

90

3.543

123

4.842

9/16

14.288

1.9

48.26

3.3

83.82

4-11/16

119.06

2008 Buell XB Diagnostics: Appendix C Conversions C-1


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.)
TORQUE CONVERSIONS

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) \( \times 12.00000 \) = inch pounds (in-lbs).
- inch pounds (in-lbs) \( \times 0.08333 \) = 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) \( \times 0.737563 \) = foot pounds (ft-lbs).
- Newton meters (Nm) \( \times 8.85085 \) = inch pounds (in-lbs).
- foot pounds (ft-lbs) \( \times 1.35582 \) = Newton meters (Nm).
- inch pounds (in-lbs) \( \times 0.112985 \) = Newton meters (Nm).
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<td>Amperes</td>
</tr>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>ACC</td>
<td>Accessory</td>
</tr>
<tr>
<td>ACR</td>
<td>Automatic Compression Release</td>
</tr>
<tr>
<td>AGM</td>
<td>Absorbed Glass Mat (battery)</td>
</tr>
<tr>
<td>AMP</td>
<td>Ampere</td>
</tr>
<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
</tr>
<tr>
<td>B+</td>
<td>Battery Voltage</td>
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<td>BAS</td>
<td>Bank Angle Sensor</td>
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<td>BTDC</td>
<td>Before Top Dead Center</td>
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<td>Calibration</td>
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<td>Cold Cranking Amps</td>
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<td>Crankshaft Position</td>
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<td>Centimeter</td>
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<td>Direct Current</td>
</tr>
<tr>
<td>DLC</td>
<td>Data Link Connector</td>
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<td>DOM</td>
<td>Domestic</td>
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<td>DTC</td>
<td>Diagnostic Trouble Code</td>
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<tr>
<td>DVOM</td>
<td>Digital Volt Ohm Meter</td>
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<tr>
<td>ECM</td>
<td>Electronic Control Module</td>
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<td>Engine Coolant Temperature</td>
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<tr>
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<td>Electrically Erasable Programmable Read Only Memory</td>
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<td>Electronic Fuel Injection</td>
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<td>Engine Temperature</td>
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<td>Evaporative Emissions Control System</td>
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<tr>
<td>ft-lbs</td>
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<td>fl oz.</td>
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<td>g</td>
<td>Gram</td>
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<td>Gross Axle Weight Rating</td>
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<td>H-DSSS</td>
<td>Harley-Davidson Smart Security System</td>
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<td>Hands Free Security Module</td>
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<td>Idle Air Control</td>
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<td>ACRONYM OR ABBREVIATION</td>
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<tr>
<td>IM</td>
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<tr>
<td>In.</td>
<td>Inch</td>
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<td>INJ PW</td>
<td>Injector Pulse Width</td>
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<tr>
<td>in-lbs</td>
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<td>L</td>
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<td>LED</td>
<td>Light Emitting Diode</td>
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<tr>
<td>mA</td>
<td>Milliampere</td>
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<td>MAP</td>
<td>Manifold Absolute Pressure</td>
</tr>
<tr>
<td>ml</td>
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<tr>
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<td>no.</td>
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<td>P&amp;A</td>
<td>Parts and Accessories</td>
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<td>Pounds per Square Inch</td>
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<td>RPM</td>
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<td>Cubic Feet per Hour at Standard Conditions</td>
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<td>Throttle Control Actuator</td>
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<td>Top Dead Center</td>
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<td>Twist Grip Sensor</td>
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<td>Throttle Position</td>
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<td>TMAP</td>
<td>Intake Air Temperature/Manifold Absolute Pressure</td>
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<td>Turn Signal Module</td>
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<td>V</td>
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<td>VAC</td>
<td>Volts of Alternating Current</td>
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