# 2013 Harley-Davidson Sportster Models Electrical Diagnostic Manual

**99495-13**

# IMPORTANT NOTICE

**Harley-Davidson 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.**

**Harley-Davidson Motor Company**

# 2013 Harley-Davidson Sportster Models Electrical Diagnostic Manual


99495-13

Printed in the U.S.A.

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2013 Harley-Davidson Sportster Models Electrical Diagnostic Manual (99495-13)

Please clip out and mail to:
Service Communications Department
Harley-Davidson Motor Company
P.O. Box 653
Milwaukee, WI USA 53201

# NOTES

# 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 Harley-Davidson product and assist in the performance of repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved diagnostic methods. We sincerely believe that this manual will make your association with Harley-Davidson products more pleasant and profitable.

## HOW TO USE YOUR SERVICE MANUAL

Refer to the table below for the content layout of this manual.



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

For example, a cross-reference shown as **2.2 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.2 SPECIFICATIONS.

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

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

**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. Start each job with a clean work area. This will allow the repair to proceed as smoothly as possible. It will also reduce the incidence of misplaced tools and parts. Clean a motorcycle that is excessively dirty before work starts. Cleaning will occasionally uncover sources of trouble. Gather any tools, instruments and any parts needed for the job before work begins. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

*NOTES*

- *To avoid unnecessary disassembly, carefully read all related service information before repair work begins.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), it must first be disarmed. Keep the fob close to the vehicle or use DIGITAL TECHNICIAN II (Part No. HD-48650) to disable the system. Activate the system after service is completed.*

## SERVICE BULLETINS

In addition to the information presented in this manual, Harley-Davidson Motor Company will periodically issue service bulletins to Harley-Davidson 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**

**Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001b)**

To achieve satisfactory and lasting repairs, carefully follow the service manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. 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**

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

**CAUTION**

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

***NOTICE***

**NOTICE indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140b)**

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.

**⚠WARNING**

**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, remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Harley-Davidson 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 Harley-Davidson 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

**⚠WARNING**

**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, contact Loctite Corp. at www.loctite.com.

## PRODUCT REGISTERED MARKS

Apple, Alcantara S.p.A., Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Garmin, Gunk, Hydroseal, Hylomar, iPhone, iPod, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, Michelin, MPZ, Mulitilock, nano, NGK, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sems, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto, XM Satellite Radio, and zumo are among the trademarks of their respective owners.

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All photographs, illustrations and procedures 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, Harley-Davidson reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

# GENERAL INFORMATION

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## 1.3 DIAGNOSTICS AND TROUBLESHOOTING



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## A.12 DELPHI GT 280 SEALED 73-TERMINAL ECM CONNECTOR



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# NOTES

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## SPECIFICATIONS

**Table 1-1. Fuel System Specifications**

| FUEL SYSTEM | TYPE |
|---|---|
| Intake | XL - side draft<br>XR - down draft throttle body |
| Recommended fuel | 91 Octane |

**Table 1-2. Idle Speed Specifications**

| ADJUSTMENT | RPM |
|---|---|
| Normal idle speed | 800-1250 Nominal, non-adjustable |

**Table 1-3. Battery Specifications**

| BATTERY | SPECIFICATIONS |
|---|---|
| Size | 12V/12 AH/225CCA |
| Type | Sealed, AGM |

**Table 1-4. Spark Plug Specifications**

| SPARK PLUG | SPECIFICATIONS | |
|---|---|---|
| Gap (XL) | 0.038-0.043 in. | 0.96-1.09 mm |
| Gap (XR) | 0.032-0.038 in. | 0.81-0.97 mm |
| Torque with anti-seize applied to threads | 12-18 ft-lbs | 16.3-24.4 Nm |
| Type (XL) | Harley-Davidson No. 6R12 (no substitute) | |
| Type (XR) | Harley-Davidson No. 10R12X (no substitute) | |

**Table 1-5. Spark Plug Cables**

| SPECIFICATION | FRONT | REAR |
|---|---|---|
| Length in. | 6.25-6.60 | 19.37-19.63 |
| Length mm | 158.7-167.6 | 491.9-498.6 |
| Resistance-ohms | 1563-4402 | 4843-13,093 |

**Table 1-6. Ignition Coil Specifications**

| WINDING | RESISTANCE |
|---|---|
| Ignition coil primary resistance at room temperature | 0.3-0.7 Ohm |
| Ignition coil secondary resistance at room temperature | 1500-2400 Ohms |

**Table 1-7. Starter Specifications**

| STARTER | SPECIFICATIONS |
|---|---|
| Cranking current | 200A |
| Free speed | 3000 rpm (min) |
| Free current | 90A |
| Stall torque | 8.0 ft-lbs (10.8 Nm) |

**Table 1-8. Fuel Pump Pressure Specifications**

| RANGE | VALUE |
|---|---|
| Normal | 55-62 psi (380-425 kPA) |

**Table 1-9. Alternator Specifications**

| MEASUREMENT | VALUE |
|---|---|
| AC voltage output | 20-28 VAC per 1000 rpm |
| Stator coil resistance | 0.1-0.3 Ohm |

**Table 1-10. Regulator Specifications**

| MEASUREMENT | VALUE |
|---|---|
| Amperes @ 3600 rpm | 32A |
| Voltage @ 3600 rpm | 14.3-14.7V @ 75 °F (24 °C) |

**Table 1-11. Fuse Specifications**

| ITEM | RATING (AMPERES) |
|---|---|
| ACCY fuse | 15 |
| Battery fuse | 15 |
| ECM fuse | 15 |
| Ignition fuse | 15 |
| Lights fuse | 15 |
| Main fuse | 30 |

## COMPONENT LOCATIONS

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

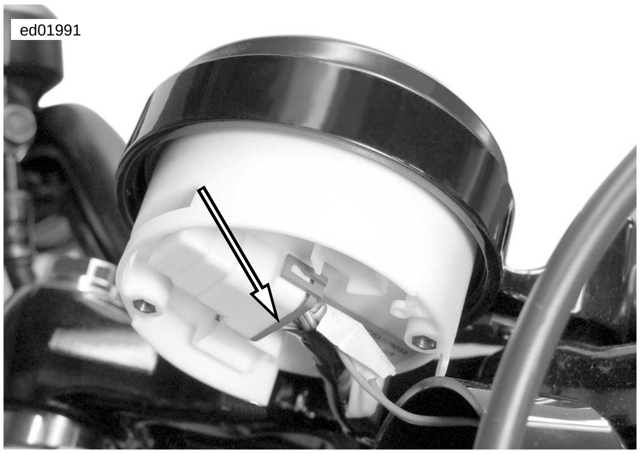
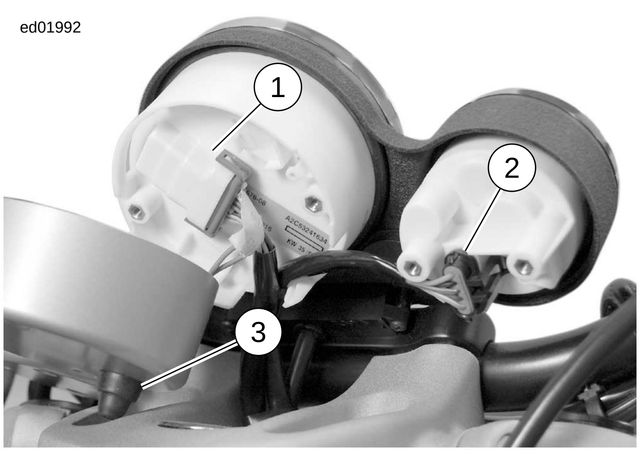
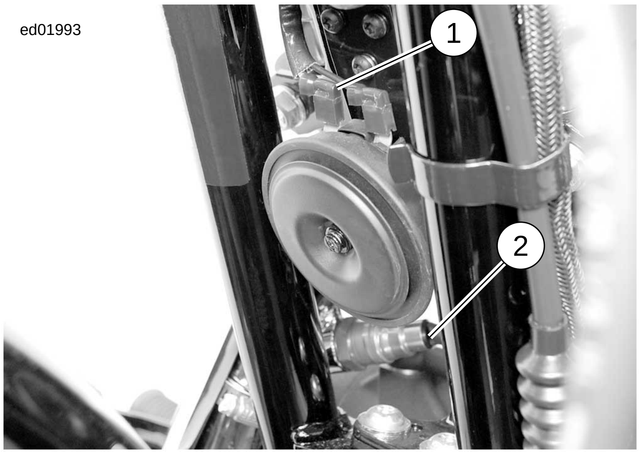



**Figure 1-1. Speedometer [39]: XL**



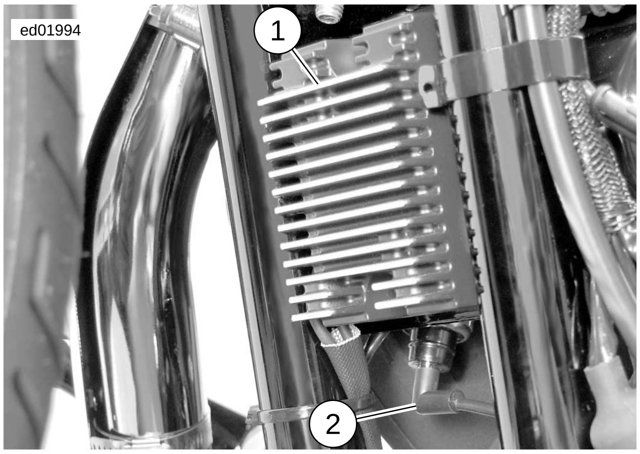

1. **Tachometer [108]**
2. **Speedometer [39]**
3. **Trip odometer reset switch**

**Figure 1-2. Instruments: XR**



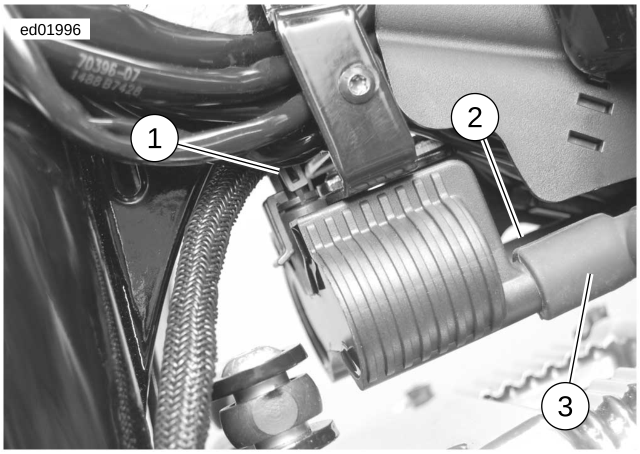

1. **Horn [122]**
2. **Front O2 sensor**

**Figure 1-3. Horn (Typical)**



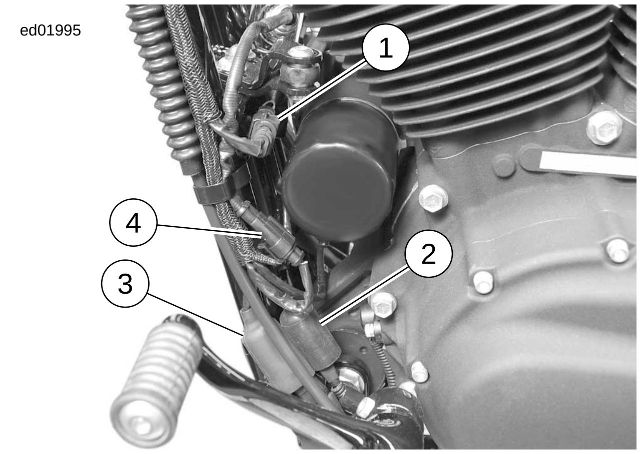

1. **Voltage regulator**
2. **Oil pressure switch [120]**

**Figure 1-4. Voltage Regulator: XL**



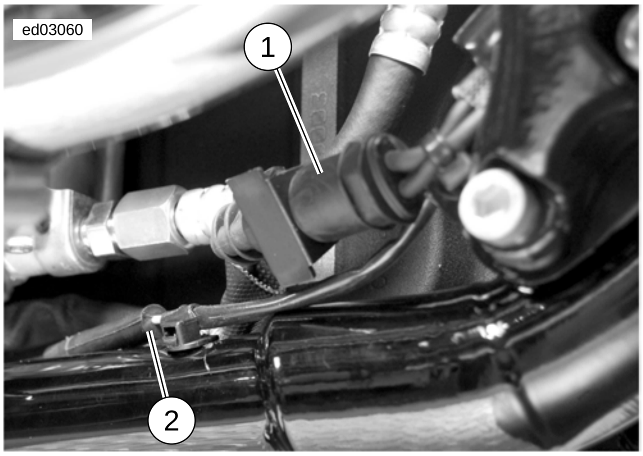

1. **Ignition coil [83]**
2. **Rear spark plug wire**
3. **Front spark plug wire**

**Figure 1-5. Ignition Coil**



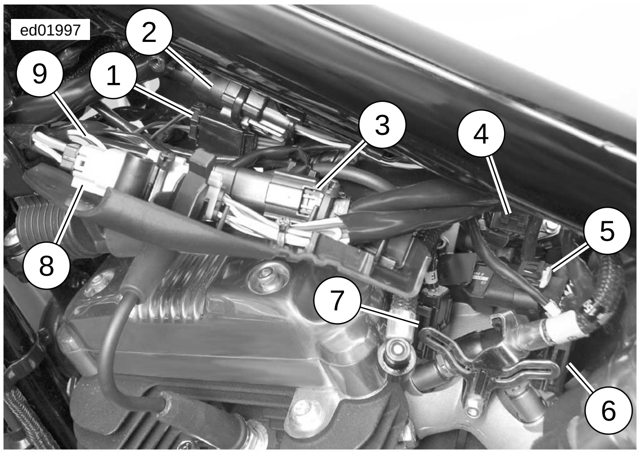

1. Voltage regulator [77]
2. CKP sensor [79]
3. JSS (HDI) [133]
4. Front O2 sensor [138]

**Figure 1-6. Lower Left Front**



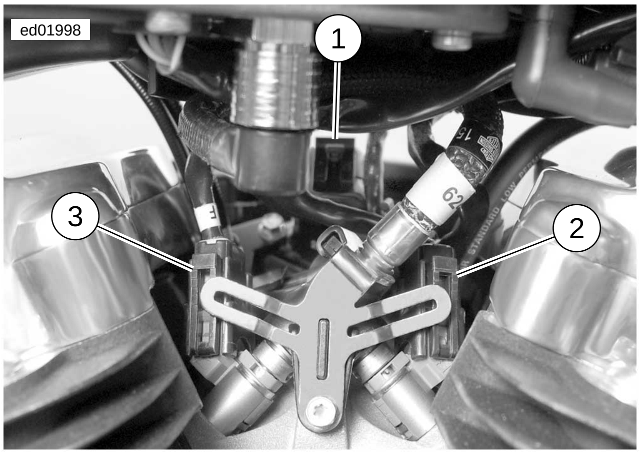

1. Voltage regulator to stator [47]
2. Neutral switch [136]

**Figure 1-7. Lower Right Front**



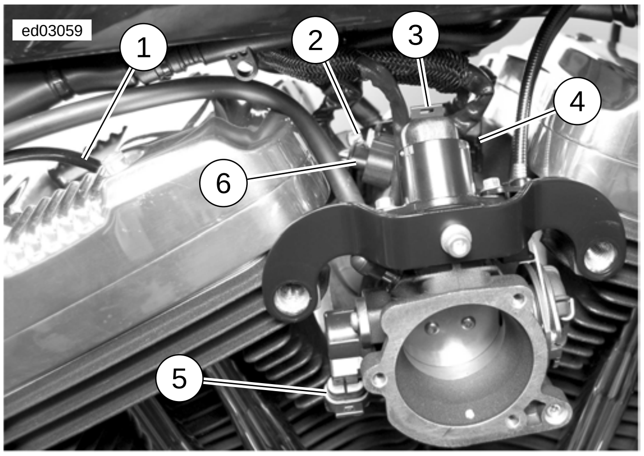

1. Front turn signals [31]
2. Instruments [20]
3. Right hand controls [22]
4. IAC [87]
5. TMAP [80]
6. Rear fuel injector [85]
7. Front fuel injector [84]
8. Left hand controls [24]
9. Headlamp [38]

**Figure 1-8. Under Fuel Tank Left Side**



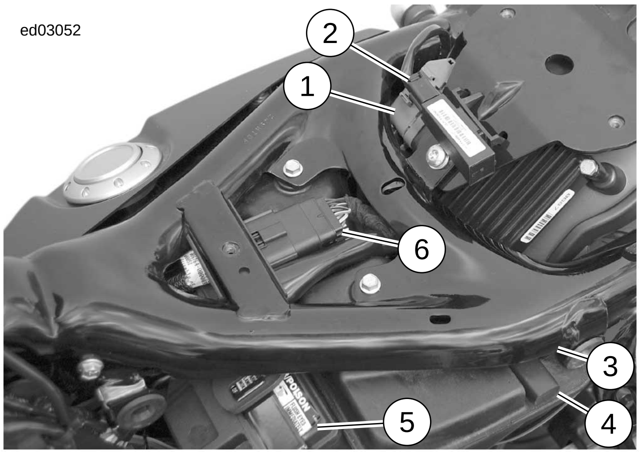

1. IAC [87]
2. Rear fuel injector [85]
3. Front fuel injector [84]

**Figure 1-9. Between Cylinder Heads Left Side**



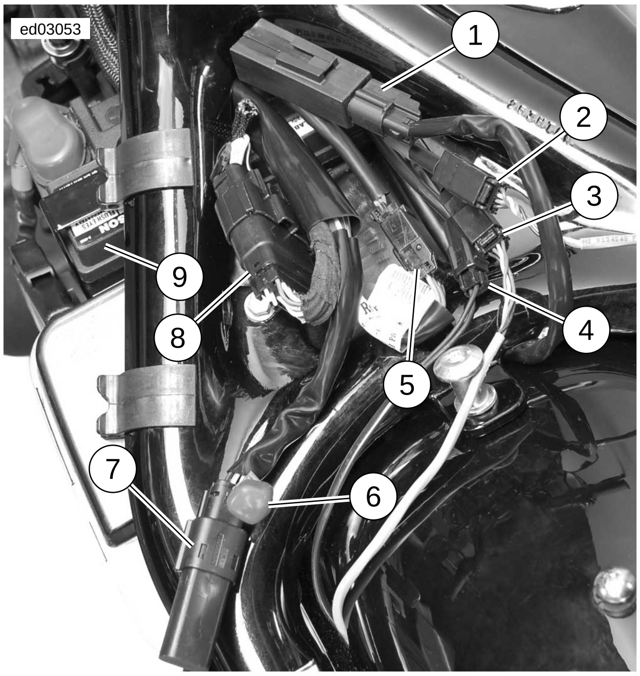

1. ET sensor
2. Rear fuel injector [85]
3. IAC [87]
4. Front fuel injector [84]
5. TPS [88]
6. TMAP sensor [80]

**Figure 1-10. Between Cylinders Right Side**



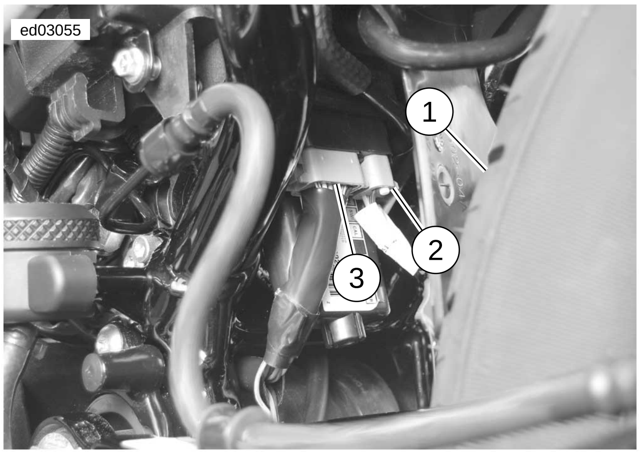

1. ECM [78]
2. Security antenna [209]
3. P&A battery [160]
4. Fuel sender resistor assembly [200]
5. Battery
6. Engine sensor harness [145]

**Figure 1-12. ECM: XR**



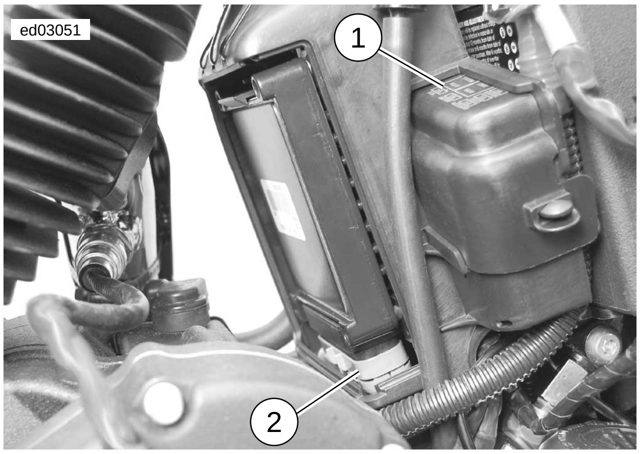

1. Security antenna [209]
2. Right rear turn signal [18] (HDI)
3. Left rear turn signal [19] (HDI)
4. License plate lamp [40]
5. Tail lamp harness to main harness [7]
6. P&A battery [160]
7. Fuel sender resistor assembly [200]
8. Engine sensor harness [145]
9. Battery

**Figure 1-11. Under Seat: XL (Typical)**



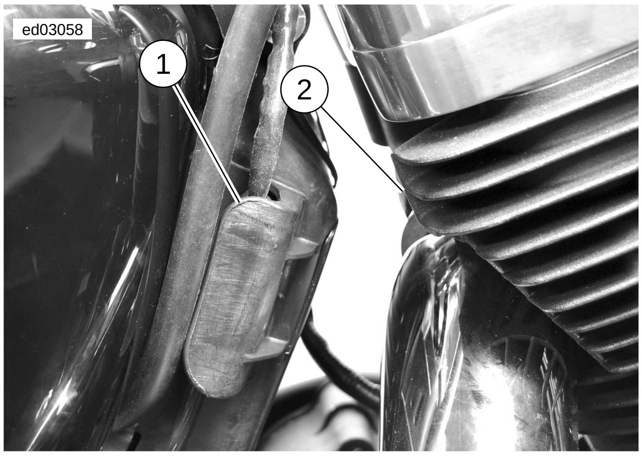

1. Rear tire
2. HFSM antenna [208]
3. TSM, TSSM or HFSM [30]

**Figure 1-13. TSM, TSSM or HFSM**



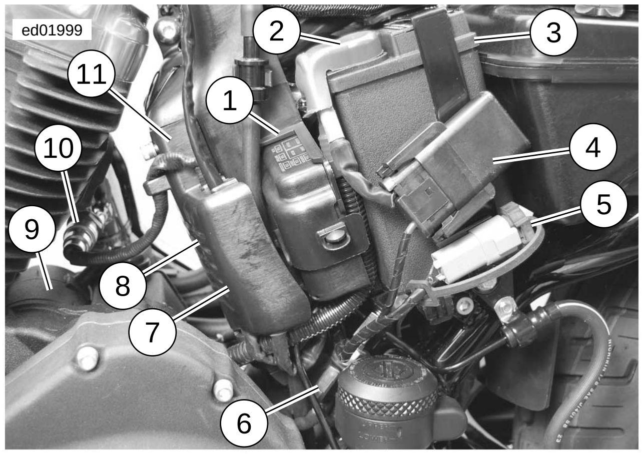

1. Fuse block [61]
2. ECM [78]

**Figure 1-14. ECM: XL**



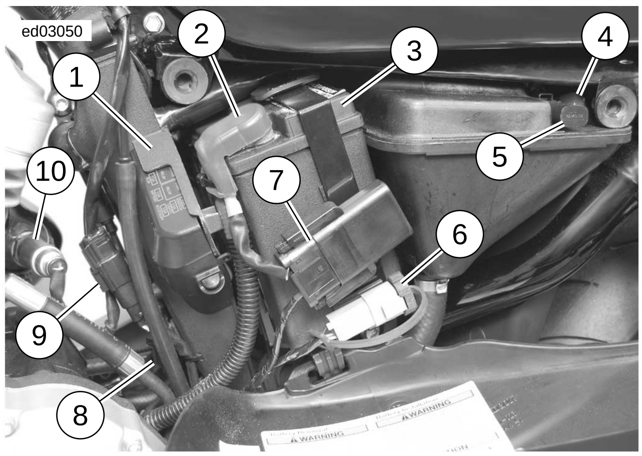

1. ET sensor [90]
2. Rear cylinder

**Figure 1-15. ET Sensor [90]**



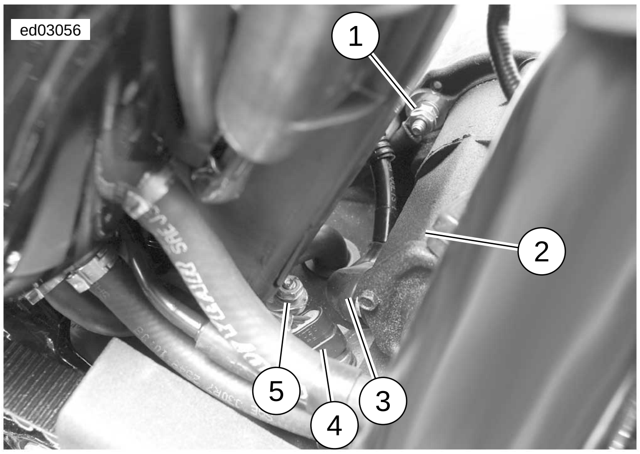

1. Fuse block [61]
2. Positive battery cable
3. Battery
4. Main fuse [5]
5. DLC [91]
6. Rear stop lamp switch (XL models) [121]
7. Fuel pump and low fuel switch [141]
8. Rear O2 sensor [137]
9. Starter
10. Rear O2 sensor
11. ECM

**Figure 1-16. Under Left Side Cover: XL**



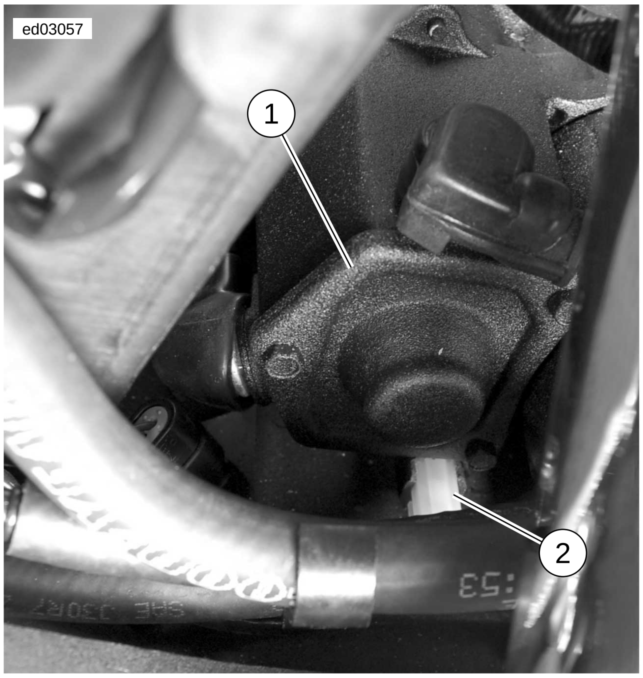

1. Fuse block [61]
2. Positive battery cable
3. Battery
4. P&A battery [160]
5. Fuel sender resistor assembly [200]
6. DLC [91]
7. Main fuse [5]
8. Rear O2 sensor [137]
9. Fuel pump and low fuel switch [141]
10. Rear O2 sensor

**Figure 1-17. Under Left Side Cover: XR**




1. **Harness ground [GND1]**
2. **Starter**
3. **Battery to starter**
4. **VSS [65]**
5. **Battery ground**

**Figure 1-18. Grounds**




1. **Starter**
2. **Starter solenoid [128]**

**Figure 1-19. Starter Solenoid [128]**

# DIAGNOSTIC TOOLS 1.2

## HOW TO USE DIAGNOSTIC TOOLS

| PART NUMBER | TOOL NAME |
|---|---|
| GRX-3110 HD | BATTERY DIAGNOSTIC STATION |
| HD-26792 | SPARK TESTER |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-39978 | DIGITAL MULTIMETER (FLUKE 78) |
| HD-41199-3 | IAC TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-43876 | BREAKOUT BOX |
| HD-44687 | IGNITION COIL CIRCUIT TEST ADAPTER |
| HD-46601 | BREAKOUT BOX ADAPTERS |
| HD-48650 | DIGITAL TECHNICIAN II |

### GRX-3110 HD Battery Diagnostic Station

Follow the instructions in the BATTERY DIAGNOSTIC STATION (Part No. GRX-3110 HD) instruction manual to perform a battery test. The test results include a decision on the battery condition.

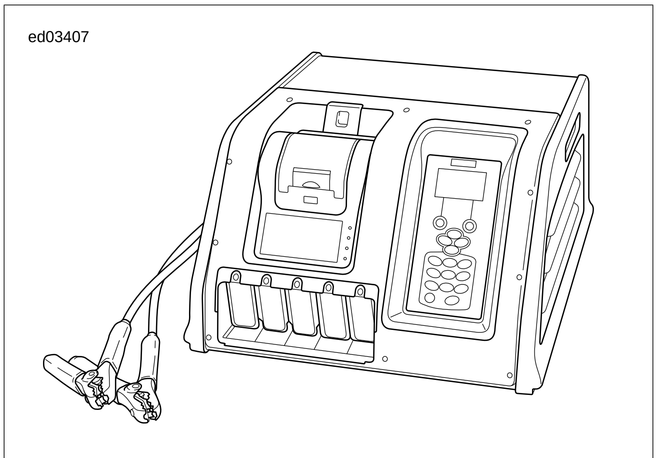



**Figure 1-20. Advanced Battery Conductance and Electrical System Analyzer Kit**

### HD-26792 Spark Tester

See Figure 1-21. The SPARK TESTER (Part No. HD-26792) is used to verify adequate spark at the spark plug. Attach the tester to the coil or spark plug cable and to ground. While cranking the engine, a spark should jump across the gap on the tester leads.

*NOTE*

*The ignition system will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.*

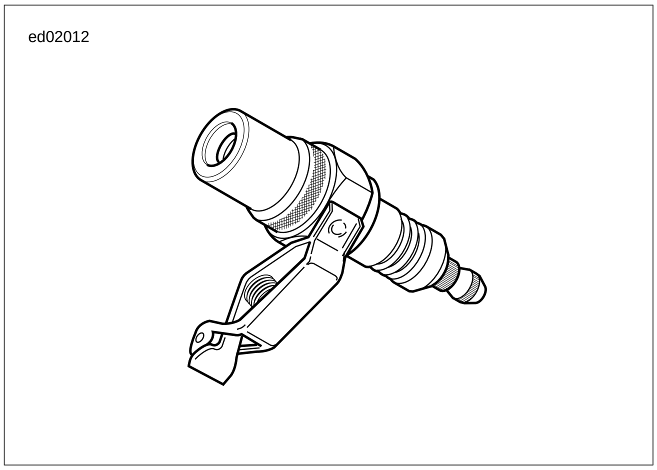



**Figure 1-21. Spark Tester**

### HD-34730-2E Fuel Injector Test Light

The FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) and IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) are used to test the fuel injector drivers as well as the ignition coil drivers in the ECM.

1. Connect the BREAKOUT BOX (Part No. HD-43876).
2. Disconnect the fuel injector connectors.
3. See Figure 1-22 for typical setup. Connect one side of the fuel injector test light to power and the other to the terminal on the ECM for the circuit you are testing.
4. Crank the engine.
5. If the test light flashes, the circuit is working properly.

HOME


1. **Fuel injector test light**
2. **Ignition coil circuit test adapter**
3. **Breakout box**

**Figure 1-22. Fuel Injector Test Light**

## HD-39978 Digital Multimeter (Fluke 78)

The DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) is used for various tests throughout this manual.

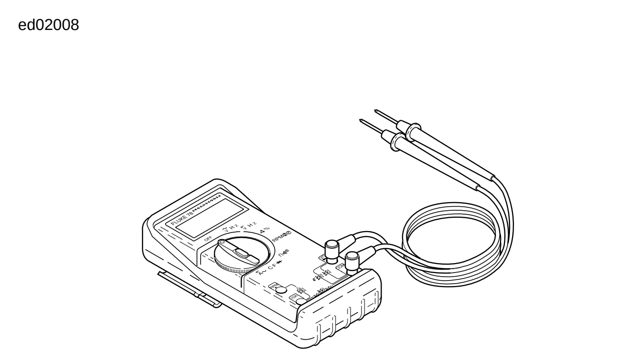



**Figure 1-23. Digital Multimeter (Fluke 78)**

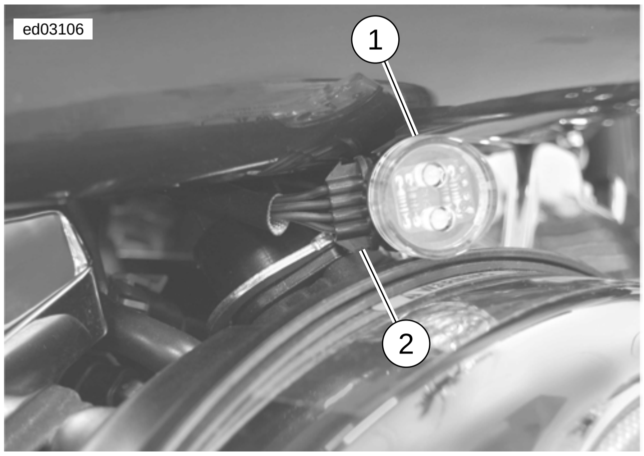
## HD-41199-3 IAC Test Light

The IAC TEST LIGHT (Part No. HD-41199-3) is used to verify that the electrical circuit from the ECM to the IAC is operating correctly.

1. See Figure 1-24. Disconnect IAC [87B] and connect test light.
2. Turn IGN ON for 2 seconds, then turn IGN OFF for 10 seconds. Test light behavior may follow two patterns. The color of the lights is not relevant to IAC operation.
   a. **Normal behavior:** At IGN ON, test lights will alternately flash and then remain on to confirm ECM signals. At IGN OFF, lights alternately flash and go out after 10 second reset procedure.
   b. **Problem indicated:** One or more lights fail to illuminate during IGN ON/IGN OFF cycle.

   *NOTE*

   *There is a remote possibility that one of the circuits is shorted to voltage which would have been indicated by a steady light. Disconnect ECM and turn ignition ON. Probe terminals to check for this condition.*
3. Disconnect test light and connect IAC [87B].




1. **IAC test light HD-41199-3**
2. **IAC [87]**

**Figure 1-24. IAC Test Light (Part No. HD-41199-3)**

## HD-41404 Harness Connector Test Kit

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

*NOTE*

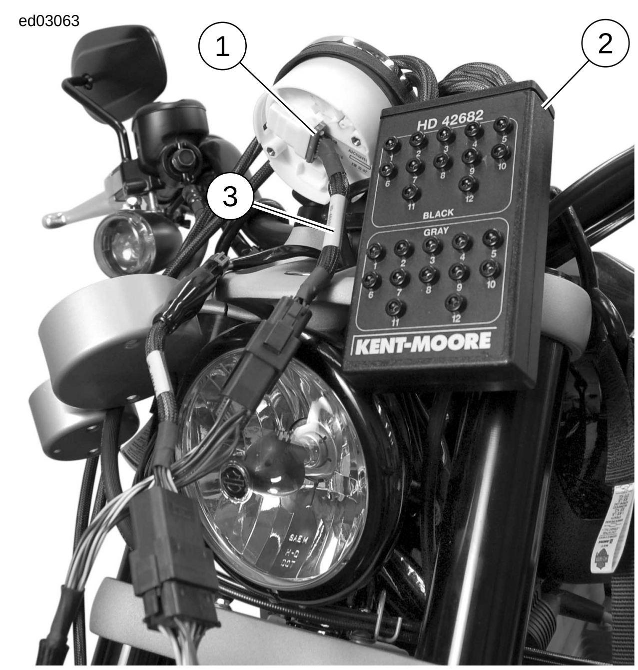
*To prevent terminal damage while using the probe tips, insert the probe tip straight into the cavity and keep it stable during the test. Do not wiggle or move the probe tip once it has been inserted into the terminal. Do not use more than one probe per terminal or cavity at any one time.*

## HD-42682 Breakout Box

The BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the speedometer [39] (XR) and tachometer [108] (XL). Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install breakout box in series using the black connectors as follows:

1. Access the speedometer [39] (XR) and tachometer [108] (XL).

2. See Figure 1-25. Press latch and disconnect speedometer [39B] (XR) or tachometer [108B] (XL).
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39A] and [39B] (XR) or [108A] and [108B] (XL).
4. Attach black connectors from BREAKOUT BOX (Part No. HD-42682) to BREAKOUT BOX ADAPTERS (Part No. HD-46601). All tests will be performed using the black side of the breakout box.
5. When testing is completed, remove the breakout box and jumper harness, and restore connections.




1. **Tachometer [108]**
2. **Breakout box HD-42682**
3. **Breakout box adapter HD-46601**

**Figure 1-25. Breakout Box Connection (XR)**

## HD-42682 Breakout Box (TSM, TSSM or HFSM)

The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install breakout box in series as follows:

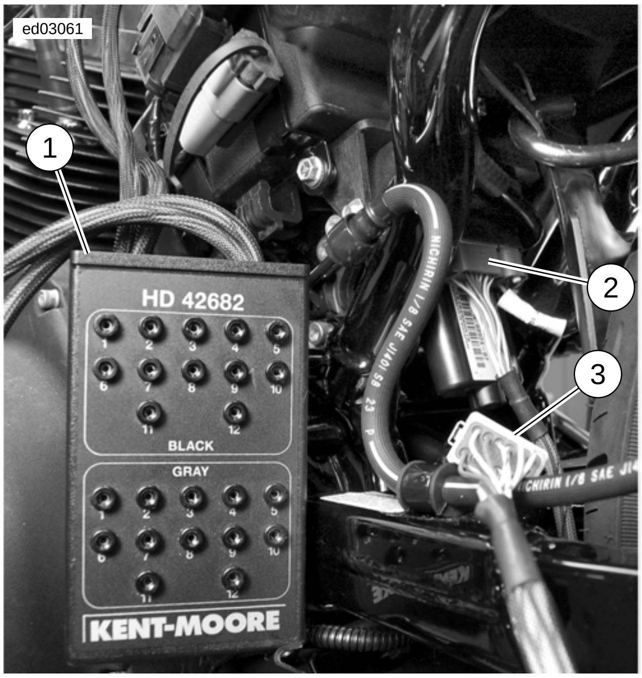
*NOTE*

*For HFSM: Disarm security system, then remove main fuse while the system remains disarmed.*

1. Access TSM, TSSM or HFSM.
2. Disconnect HFSM antenna jumper [208B] and [30B] from TSM, TSSM or HFSM:
   a. **For HFSM:** Press latches and disconnect [208B].
   b. Press latches and disconnect [30B].
3. See Figure 1-26. Connect BREAKOUT BOX (Part No. HD-42682) to connectors.
4. **For HFSM:** Mate antenna [208B] to HFSM.
5. When testing is completed remove the breakout box and restore connections.

*NOTE*

*Vehicle will not start with TSM, TSSM or HFSM disconnected or incorrectly mounted.*




1. **Breakout box to harness connection**
2. **Breakout box to TSM, TSSM, HFSM connection**
3. **Breakout box**

**Figure 1-26. Breakout Box Connection Point at TSM, TSSM, HFSM (Typical)**

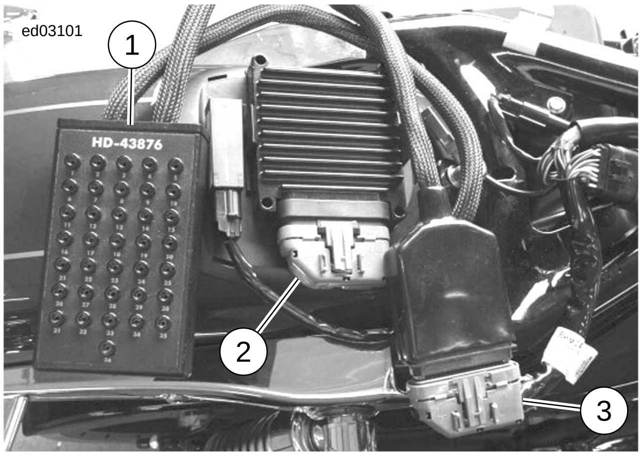
## HD-43876 Breakout Box (ECM)

The BREAKOUT BOX (Part No. HD-43876) splices into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install breakout box in series as follows:

*NOTE*

*See wiring diagrams for ECM terminal functions. ECM is located under passenger seat.*

1. Access the ECM.
2. Press latch and disconnect ECM [78B].
3. See Figure 1-27. Connect BREAKOUT BOX (Part No. HD-43876) to connectors.
4. When testing is completed, remove the breakout box and restore connections.




1. **Breakout box**
2. **ECM connector**
3. **Wiring harness connector**

**Figure 1-27. Breakout Box**

## HD-44687 Ignition Coil Circuit Test Adapter

The IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) are used to test the fuel injector drivers as well as the ignition coil drivers in the ECM.

1. Connect the BREAKOUT BOX (Part No. HD-43876).
2. Disconnect the fuel injector connectors.
3. See Figure 1-22 for typical setup. Connect one side of the fuel injector test light to power and the other to the terminal on the ECM for the circuit you are testing.
4. Crank the engine.
5. If the test light flashes, the circuit is working properly.

## HD-48650 Digital Technician II

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

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

## VOLTAGE DROP

### Voltage Drop Test

The voltage drop test:

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

A voltage drop test measures the difference in voltage between two points in a circuit. The amount of voltage dropped over any part of a circuit is directly related to the amount of resistance in that part of the circuit. A poor connection may cause an ohmmeter to give a good reading, but voltage drop test will locate the problem.

Components such as wires, switches and connectors are designed to have very little resistance and therefore very little voltage drop. A possible fault is indicated when a voltage drop is greater than 1.0V across components. This could indicate a high resistance in that circuit.

The benefits of testing this way are:

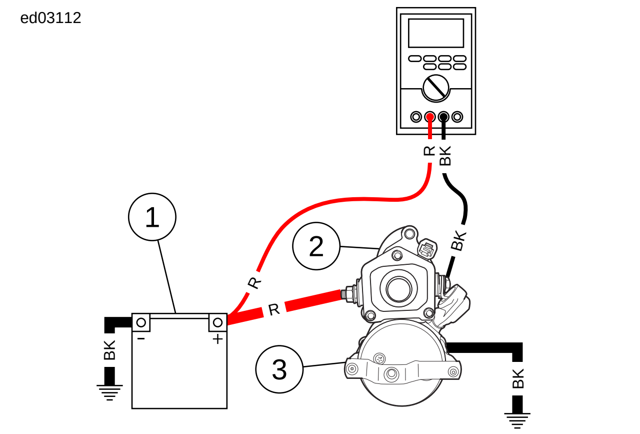
- Readings are not as sensitive to real battery voltage.
- Readings show the actual voltage dropped not just the presence of voltage.
- The system is tested as it is actually being used.
- Testing is more accurate and displays hard-to-find poor connections.
- Starting circuits, lighting circuits or ignition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

When testing a typical power circuit, place the positive (red) meter lead on the most positive part of the circuit (or the positive battery post). Remember, there is nothing more positive than the positive post of the battery. Place the negative (black) meter lead at the positive side of the connector in question. Activate the circuit. Move the negative meter lead through the circuit until the high voltage drop is found.

When testing a typical ground circuit, 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. Place the positive meter lead at the negative side of the connector in question. Activate the circuit. Move the positive meter lead through the circuit until the high voltage drop is found.

The following steps demonstrate a typical starter circuit voltage drop test:

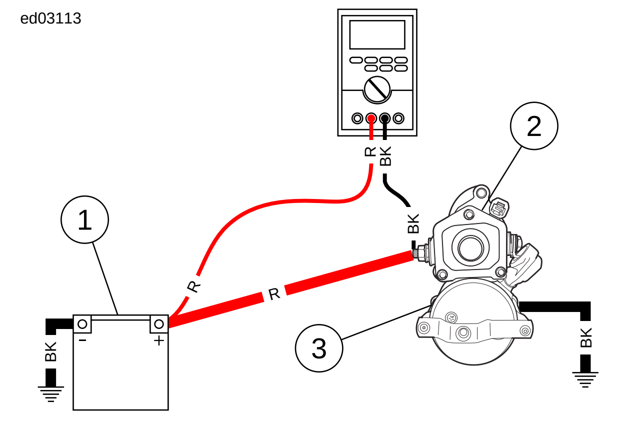
1. Disconnect the fuel pump connector [86] to prevent the engine from starting.
2. See Figure 1-28. Connect the red meter lead to the positive battery post. Connect the black meter lead to the starter side post of the starter solenoid and observe the meter reading. Crank the starter and observe the meter reading. The difference in the voltage is the voltage drop.




1. **Battery**
2. **Starter solenoid**
3. **Starter motor**

**Figure 1-28. To Starter Solenoid Starter Terminal**

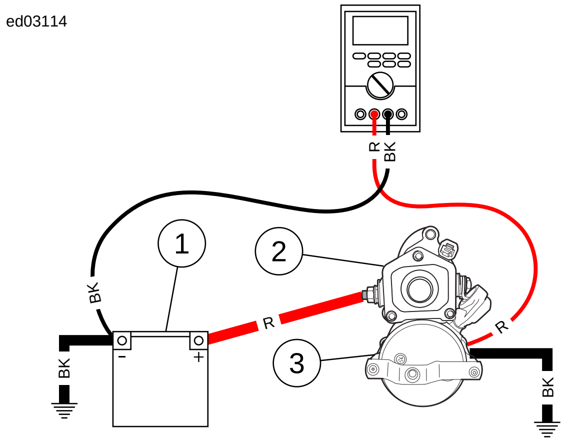
3. See Figure 1-29. Move the black meter lead to the battery side post on the starter solenoid. Crank the starter.




1. **Battery**
2. **Starter solenoid**
3. **Starter motor**

**Figure 1-29. To Starter Solenoid Battery Terminal**

4. See Figure 1-30. Finally move the black meter lead to the negative battery post and the red meter lead to the starter case. Crank the starter.




1. **Battery**
2. **Starter solenoid**
3. **Starter motor**

**Figure 1-30. Starter Ground Circuit**

## WIGGLE TEST

| PART NUMBER | TOOL NAME |
|---|---|
| HD-39978 | DIGITAL MULTIMETER (FLUKE 78) |
| HD-48637 | BREAKOUT BOX |
| HD-48650 | DIGITAL TECHNICIAN II |

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

1. See Figure 1-31. Connect DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) to wiring harness between the suspect connections. When diagnosing ECM connections, use BREAKOUT BOX (Part No. HD-48637) to simplify the procedure. See 1.2 DIAGNOSTIC TOOLS.
2. Set the multimeter to read voltage changes.
3. Start the motorcycle engine and run at idle.
4. Shake or wiggle the harness to detect intermittents. If intermittents are present, radical voltage changes register on the multimeter.

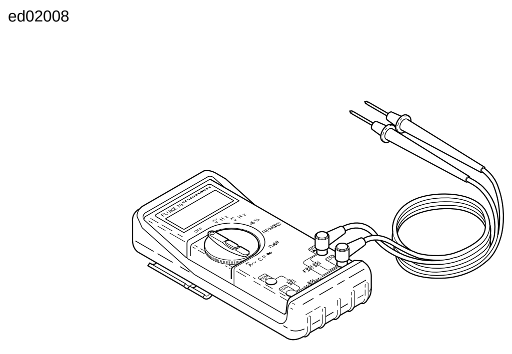
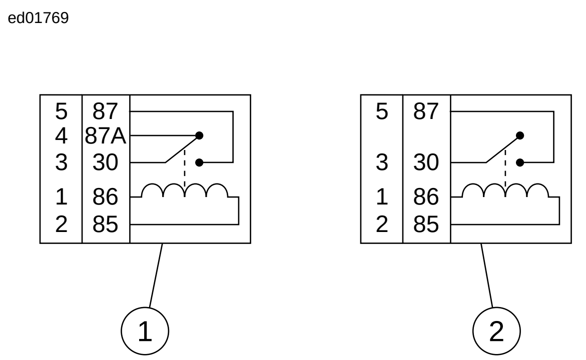



**Figure 1-31. Digital Multimeter (Fluke 78)**

## RELAY DIAGNOSTICS

### Relay Variation

See Figure 1-32. Relays normally have four or five terminals. The circuitry inside the relays are very similar with the exception of the normally closed contact being eliminated in the four terminal relay. Some relays have five terminals at the base, even though internally 4 or 87A are not connected. See this topic whenever a relay terminal is referenced in this manual to make sure the proper terminal is being accessed.




1. **Standard 5 terminal relay**
2. **Standard 4 terminal relay**

**Figure 1-32. Standard Relays**

### Relay Test

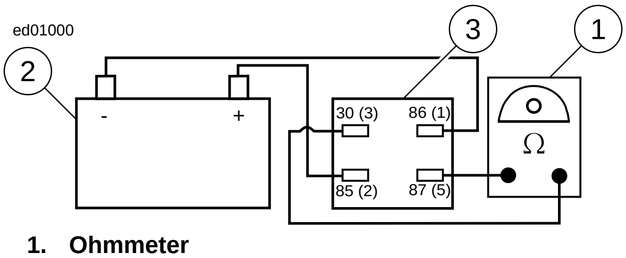
A relay can be tested using the motorcycle's 12V battery and a multimeter.

1. Unplug the relay from relay block.
2. See Figure 1-33 and Figure 1-34 to energize the relay. Connect relay terminal 85 to the negative battery terminal and relay terminal 86 to the positive battery terminal.

*NOTE*

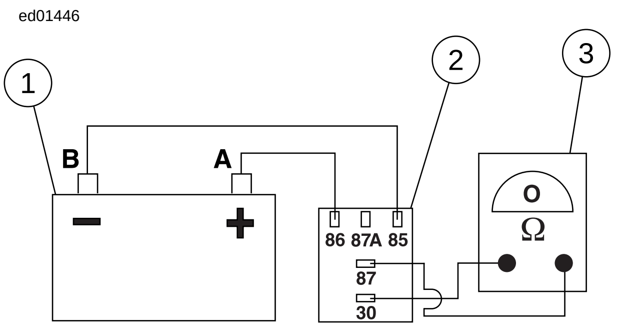
*Some relays contain internal diodes. If the applied voltage is not the correct polarity, the diode could be damaged.*

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




1. **Ohmmeter**
2. **Battery**
3. **Start relay**

**Figure 1-33. Four Terminal Relay Test**




1. **Battery**
2. **Start relay**
3. **Ohmmeter**

**Figure 1-34. Five Terminal Relay Test**

## JOB/TIME CODES VALUES

| PART NUMBER | TOOL NAME |
| --- | --- |
| HD-48650 | DIGITAL TECHNICIAN II |

Dealership technicians filing warranty claims should use the job/time code values printed in bold text at the end of the appropriate repair. When using DIGITAL TECHNICIAN II (Part No. HD-48650), dealership technicians filling out warranty claims should use the job/time code given by the computer.

# NOTES

TABLE OF CONTENTS

# NOTES

# INITIAL DIAGNOSTICS 2.1

## DESCRIPTION AND OPERATION

Use initial diagnostics as a starting point to efficiently troubleshoot concerns. A basic understanding of electronics and a general knowledge of the vehicle are necessary to effectively use this manual.

*NOTE*

*Certain diagnostic procedures require part removal. See the service manual for details.*

Before diagnosing a concern, perform a general functional test of the vehicle to verify the concern. This will also identify any other issues that may affect diagnostics. Use the procedures in this chapter for initial diagnostics.

*NOTE*

*When working through a diagnostic procedure follow the steps in the order instructed. Never jump to a test in another procedure. All "Go to test" statements refer to a test in that procedure.*

## RETRIEVING TROUBLE CODES

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

There are two levels of diagnostics.

- The most sophisticated mode uses a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using the odometer self-diagnostics. Speedometer, tachometer, TSM, TSSM or HFSM, ECM and ABS (if equipped) codes can be accessed and cleared.

## ODOMETER SELF-DIAGNOSTICS

### Diagnostic Mode

1. To enter diagnostic mode press and hold the trip odometer reset switch while turning the IGN ON.
2. Release the trip odometer reset switch. "diag" will appear on the odometer display.
3. Press and release the trip odometer reset switch. "PSSPtb" will appear on the odometer display.
4. PSSPtb indicates the different modules that could display codes if equipped.

**Table 2-1. Modules That Set DTCs**

| DESIGNATOR | MODULE |
|---|---|
| P | ECM codes |
| S | TSM, TSSM or HFSM codes |
| SP | Speedometer codes |
| t | Tachometer codes |
| b | ABS codes |

5. Quickly press and release the trip odometer reset switch to cycle through the letters. The letters will flash as they are selected.
6. Once the corresponding letter is flashing to the desired module press and hold the trip odometer reset switch.
7. If no DTCs are present, "none" will appear on display.
8. If any DTCs are stored in the module, either current or historic, they will appear on the odometer. Quickly pressing and releasing the trip odometer reset switch will cycle through the stored DTCs.

*NOTE*

*The ECM will show "no rsp" if the engine stop switch is not in the RUN position. Verify the engine stop switch is in the RUN position.*

9. If odometer displays "no rsp" then the motorcycle may not be equipped with the module. If the motorcycle is equipped with the selected module then go to other modules and look for applicable communication codes.
10. When all the DTCs have been cycled the odometer will display "end".
11. To clear all the DTCs in that module press and hold the trip odometer reset switch. If DTCs are not to be cleared quickly press and release the trip odometer reset switch. The part number of the module will be displayed.
12. Press and release the trip odometer reset switch again to continue to the next module.
13. Turn the IGN OFF to exit diagnostic mode.

## INITIAL DIAGNOSTICS

### 1. Verifying Current DTC Test

1. Check for DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

*NOTE*

*Historic DTCs are not to be diagnosed unless the condition is reoccurring and intermittent.*

2. Are current DTCs present?
   a. **Yes.** Refer to Table 2-2.
   b. **No.** Go to Test 2.

### 2. Battery Power Test

1. Verify battery is charged. See 3.1 BATTERY TESTING.
2. Does vehicle have battery power?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 3.

### 3. Ignition Power Test

1. With the engine stop switch in the off position, turn IGN ON.

2. Do the headlamps and instruments illuminate?
   a. **Yes.** Go to Test 4.
   b. **No.** Refer to Table 2-3.

## 4. Engine Stop Switch Circuit Test

1. Turn the engine stop switch to the RUN position.
2. Does the check engine lamp illuminate for a few seconds, then turn off?
   a. **Yes.** Go to Test 5.
   b. **No.** See 6.21 NO ECM POWER.

## 5. Security System Test

1. Turn the IGN OFF-ON.
2. Observe the security lamp.
3. Does the security lamp illuminate for a few seconds and then turn off?
   a. **Yes.** Go to Test 6.
   b. **No.** See 5.9 SECURITY SYSTEM.

## 6. Starter System Test

1. Press the start button.
2. Does the starter spin and crank the engine?
   a. **Yes.** Go to Test 7.
   b. **No.** See 3.2 STARTING SYSTEM.

## 7. Engine Running Test

1. Start the engine.
2. Does the engine start and run correctly?
   a. **Yes.** Go to Test 8.
   b. **No.** See 6.1 EFI SYSTEM.

## 8. Verification Test

1. Operate the systems of the vehicle to verify the concern.
2. Was the concern duplicated?
   a. **Yes.** See appropriate diagnostic. Refer to Table 2-3.
   b. **No.** Concern is intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

# DIAGNOSTICS

## Diagnostic Tips

- For a quick check of instrument function, a "WOW" test can be performed by entering odometer self-diagnostics. Background lighting should illuminate, gauge needles should sweep their full range of motion, and indicator lamps controlled by the serial data circuit (battery, security and check engine) should illuminate.
- If the instrument fails "WOW" test, check for battery, ground and ignition voltage to the instrument. If any feature in the speedometer or tachometer is non-functional, see 4.1 INSTRUMENTS.

**Table 2-2. Diagnostic Trouble Codes (DTCs) and Fault Conditions**

| DTC | PRIORITY ORDER | FAULT CONDITION | SOLUTION |
|---|---|---|---|
| B0563 | 66 | TSM, TSSM or HFSM voltage high | 3.6 DTC B0563, P0562, P0563 |
| B1004 | 70 | Fuel sender low | 4.2 DTC B1004, B1005 |
| B1005 | 71 | Fuel sender open/high | 4.2 DTC B1004, B1005 |
| B1006 | 72 | Speedometer accessory voltage high | 3.7 DTC B1006, B1007 |
| B1007 | 73 | Speedometer ignition voltage high | 3.7 DTC B1006, B1007 |
| B1008 | 74 | Trip odometer rest switch closed | 4.3 DTC B1008 |
| B1121 | 57 | Left turn output fault | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1122 | 58 | Right turn output fault | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1123 | 59 | Left turn signal short-to-ground | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1124 | 60 | Right turn signal short-to-ground | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1125 | 61 | Left turn signal short-to-voltage | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1126 | 62 | Right turn signal short-to-voltage | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126 |
| B1131 | 67 | Alarm output low | 5.14 DTC B1131, B1132 |
| B1132 | 68 | Alarm output high | 5.14 DTC B1131, B1132 |

**Table 2-2. Diagnostic Trouble Codes (DTCs) and Fault Conditions**

| DTC | PRIORITY ORDER | FAULT CONDITION | SOLUTION |
|---|---|---|---|
| B1134 | 56 | Start relay output high | 5.15 DTC B1134 |
| B1135 | 19 | Accelerometer fault | 5.8 DTC B1135, B1136, B1141, B1142 |
| B1136 | 20 | Accelerometer tip-over self-test fault | 5.8 DTC B1135, B1136, B1141, B1142 |
| B1141 | 69 | Ignition switch open/low | 5.8 DTC B1135, B1136, B1141, B1142 |
| B1142 | 18 | Internal fault | 5.8 DTC B1135, B1136, B1141, B1142 |
| B1143 | 63 | Security antenna short-to-ground | 5.16 DTC B1143, B1144, B1145 |
| B1144 | 64 | Security antenna short-to-battery | 5.16 DTC B1143, B1144, B1145 |
| B1145 | 65 | Security antenna open | 5.16 DTC B1143, B1144, B1145 |
| B1154 | 21 | Clutch swith short-to-ground | 5.17 DTC B1154, B1155 |
| B1155 | 22 | Neutral switch short-to-ground | 5.17 DTC B1154, B1155 |
| P0107 | 35 | MAP sensor open/low | 6.4 DTC P0107, P0108 |
| P0108 | 36 | MAP sensor high | 6.4 DTC P0107, P0108 |
| P0112 | 39 | IAT sensor voltage low | 6.5 DTC P0112, P0113 |
| P0113 | 40 | IAT sensor open/high | 6.5 DTC P0112, P0113 |
| P0117 | 37 | ET sensor voltage low | 6.6 DTC P0117, P0118 |
| P0118 | 38 | ET sensor open/high | 6.6 DTC P0117, P0118 |
| P0122 | 23 | TP sensor open/low | 6.7 DTC P0122, P0123 |
| P0123 | 24 | TP sensor high | 6.7 DTC P0122, P0123 |
| P0131 | 50 | Front O2 sensor low or engine running lean | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0132 | 52 | Engine front O2 running rich | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0134 | 54 | Front O2 sensor open/not responding/high | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0151 | 51 | Rear O2 sensor low or engine running lean | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0152 | 53 | Engine rear O2 running rich | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0154 | 55 | Rear O2 sensor open/not responding/high | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154 |
| P0261 | 31 | Front injector open/low | 6.9 DTC P0261, P0262, P0263, P0264 |
| P0262 | 33 | Front injector high | 6.9 DTC P0261, P0262, P0263, P0264 |
| P0263 | 32 | Rear injector open/low | 6.9 DTC P0261, P0262, P0263, P0264 |
| P0264 | 34 | Rear injector high | 6.9 DTC P0261, P0262, P0263, P0264 |
| P0373 | 17 | CKP sensor intermittent | 6.10 DTC P0373, P0374 |
| P0374 | 16 | CKP not detected/cannot synchronize | 6.10 DTC P0373, P0374 |
| P0501 | 43 | VSS low | 6.11 DTC P0501, P0502 |
| P0502 | 44 | VSS high | 6.11 DTC P0501, P0502 |
| P0505 | 47 | Loss of idle speed control | 6.12 DTC P0505 |
| P0562 | 41 | ECM voltage low | 3.6 DTC B0563, P0562, P0563 |
| P0563 | 42 | ECM voltage high | 3.6 DTC B0563, P0562, P0563 |
| P0603 | 2 | ECM EEPROM error | 6.13 DTC P0603, P0605 |
| P0605 | 1 | ECM flash error | 6.13 DTC P0603, P0605 |

**Table 2-2. Diagnostic Trouble Codes (DTCs) and Fault Conditions**

| DTC | PRIORITY ORDER | FAULT CONDITION | SOLUTION |
|---|---|---|---|
| P0661 | 48 | Intake solenoid low/open | 6.14 DTC P0661, P0662 |
| P0662 | 49 | Intake solenoid high/shorted | 6.14 DTC P0661, P0662 |
| P1001 | 12 | System relay coil open/low | 6.16 DTC P1001, P1002, P1003, P1004 |
| P1002 | 11 | System relay coil high/shorted | 6.16 DTC P1001, P1002, P1003, P1004 |
| P1003 | 10 | System relay contacts open | 6.16 DTC P1001, P1002, P1003, P1004 |
| P1004 | 13 | System relay contacts closed | 6.16 DTC P1001, P1002, P1003, P1004 |
| P1009 | 14 | Incorrect password | 6.15 DTC P1009, P1010 |
| P1010 | 15 | Missing password | 6.15 DTC P1009, P1010 |
| P1351 | 27 | Front ignition coil open/low | 6.17 DTC P1351, P1352, P1354, P1355 |
| P1352 | 29 | Front ignition coil high/shorted | 6.17 DTC P1351, P1352, P1354, P1355 |
| P1354 | 28 | Rear ignition coil open/low | 6.17 DTC P1351, P1352, P1354, P1355 |
| P1355 | 30 | Rear ignition coil high/shorted | 6.17 DTC P1351, P1352, P1354, P1355 |
| P1501 | 25 | JSS low | 6.18 DTC P1501, P1502 |
| P1502 | 26 | JSS high | 6.18 DTC P1501, P1502 |
| P1653 | 75 | Tachometer low | 6.19 DTC P1653, P1654 |
| P1654 | 76 | Tachometer high | 6.19 DTC P1653, P1654 |
| U1016 | 6 | Loss of ECM serial data | 2.3 DTC U1016, U1064, U1097, U1098, U1255 |
| U1064 | 5 | Loss of TSM, TSSM or HFSM serial data | 2.3 DTC U1016, U1064, U1097, U1098, U1255 |
| U1097 | 7 | Loss of speedometer serial data | 2.3 DTC U1016, U1064, U1097, U1098, U1255 |
| U1098 | 8 | Loss of tachometer serial data | 2.3 DTC U1016, U1064, U1097, U1098, U1255 |
| U1255 | 9 | Missing response at module | 2.3 DTC U1016, U1064, U1097, U1098, U1255 |
| U1300 | 3 | Serial data low | 2.4 DTC U1300, U1301 OR BUS ER |
| U1301 | 4 | Serial data open/high | 2.4 DTC U1300, U1301 OR BUS ER |

## CODE TYPES

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

There are two types of DTCs: current and historic. If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) or odometer self-diagnostics.

*NOTES*

- *Odometer self-diagnostics will display both current and historic DTCs. To differentiate between current and historic DTCs, a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) must be employed.*
- *Current DTCs reside in the memory of the ECM, TSM, TSSM or HFSM, speedometer or tachometer until the DTC is resolved.*
- *A historic DTC can be cleared by use of the odometer self-diagnostics or after a total of 50 ignition cycles (start and run cycle) have elapsed. After the 50 ignition cycle retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

### Current

Current DTCs are those which presently disrupt motorcycle operation and are set during the current ignition cycle. See the appropriate diagnostic procedures for solutions.

### Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC. DTCs will also lose their current status when the ignition is turned off. If the problem still exists when the ignition is turned on the code will show as current.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC will clear itself. The security lamp or check engine lamp will only indicate the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See

2.1 INITIAL DIAGNOSTICS, Multiple Trouble Codes if multiple DTCs are found.

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

## MULTIPLE TROUBLE CODES

All DTCs are assigned a priority number to determine the order in which they should be diagnosed. In the event there are multiple DTCs present always diagnose the highest priority first. Refer to Table 2-2.

After each DTC is repaired, restore connections, clear DTCs and start vehicle. Perform self-diagnostics test and verify repair, verify if DTCs are present, and if DTCs are still present. Refer to Table 2-2.

## CLEARING DTCS

DTCs should be cleared after any diagnostic or repair procedure is performed. The odometer is capable of displaying and clearing ECM, TSM, TSSM or HFSM, speedometer, tachometer and ABS DTCs. Once the DTCs are cleared perform a road test to verify DTCs do not return. It is important to perform a road test and not simply start the motorcycle since some DTCs may require vehicle speed or other inputs in order to validate repair.

## SECURITY LAMP

The security lamp functions in the same manner as the check engine lamp, except that it is controlled by the TSSM or HFSM. Codes in the TSM or HFSM illuminate the security lamp. If the speedometer sets codes B1004 or B1005, the low fuel lamp on the speedometer or tachometer also illuminates.

## CHECK ENGINE LAMP

To diagnose ECM system problems, start by observing the behavior of the check engine lamp.

*NOTES*

- *"IGN ON" means that the ignition switch is turned to IGN and the engine stop switch is set to RUN (although the engine is **not** running).*
- *When the IGN is turned ON, the check engine lamp will illuminate for approximately four seconds and then turn off.*
- *If the check engine lamp is not illuminated at IGN ON or if it fails to turn off after the initial four-second period, then see 6.21 NO ECM POWER.*

1. See Figure 2-1. After the check engine lamp turns off following the first four second illumination period, one of three events may occur.
   a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
   b. The lamp stays off for only four seconds and then comes back on for an eight second period. This indicates a DTC is stored, but no current DTC exists.
   c. If the lamp remains on beyond the eight-second period, a current DTC exists.
2. See 2.1 INITIAL DIAGNOSTICS, Code Types for a complete description of DTC formats.

*NOTE*

*Some DTCs can only be fully diagnosed during actuation. For example, a problem with the ignition coil will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by the vehicle start sequence. In this manner, there may sometimes be a false indication of the current DTC.*

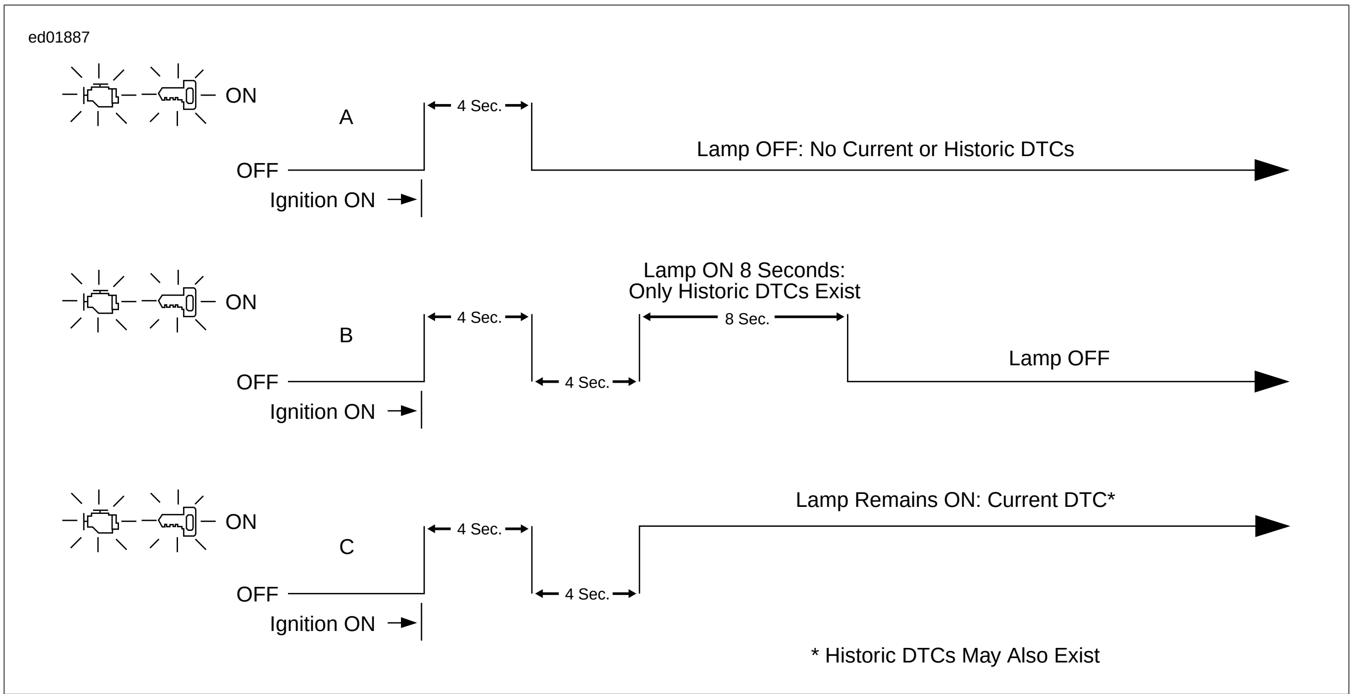



**Figure 2-1. Check Engine Lamp and Security Lamp Operation**

## SYMPTOMS

If no DTCs are present but there is a symptom or concern indicating a malfunction, address and repair the symptom if it is not a normal characteristic of the system. Refer to Table 2-3 for a list of symptoms.

**Table 2-3. Symptom Table**

| SYMPTOM | DIAGNOSTIC PROCEDURE |
|---|---|
| Battery runs down during use | 3.5 CHARGING SYSTEM |
| Both turn signals on one side inoperative, no DTCs | 5.3 TURN SIGNALS |
| Bus Er displayed | 2.2 SERIAL DATA COMMUNICATION |
| Charging system inoperative | 3.5 CHARGING SYSTEM |
| Check engine lamp inoperative | 6.21 NO ECM POWER |
| Engine cranks, but will not start | 6.20 ENGINE CRANKS, BUT WILL NOT START |
| Fuel gauge inoperative | 4.1 INSTRUMENTS |
| Headlamp inoperative | 5.4 HEADLAMPS |
| Hesitation, loss of power | 6.23 HESITATION, LOSS OF POWER |
| High beam indicator inoperative | 4.5 INDICATOR LAMPS |
| Horn always on | 5.2 HORN |
| Horn inoperative | 5.2 HORN |
| Low battery after extended IGN OFF | 3.5 CHARGING SYSTEM |
| Low fuel lamp always on | 4.5 INDICATOR LAMPS |
| Low fuel lamp inoperative | 4.5 INDICATOR LAMPS |
| Low or no charging | 3.5 CHARGING SYSTEM |
| Neutral lamp always on | 4.5 INDICATOR LAMPS |
| Neutral lamp inoperative | 4.5 INDICATOR LAMPS |
| No ECM power | 6.21 NO ECM POWER |
| Misfire at idle or under load | 6.24 MISFIRE AT IDLE OR UNDER LOAD |
| Oil pressure lamp always on | 4.5 INDICATOR LAMPS |

**Table 2-3. Symptom Table**

| SYMPTOM | DIAGNOSTIC PROCEDURE |
|---|---|
| Oil pressure lamp inoperative | 4.5 INDICATOR LAMPS |
| One turn signal lamp inoperative, no DTCs | 5.3 TURN SIGNALS |
| Overcharging | 3.5 CHARGING SYSTEM |
| P&A battery power inoperative | 5.1 ACCESSORIES |
| Position lamp inoperative (HDI) | 5.6 RUNNING LAMPS |
| Running lamps inoperative | 5.6 RUNNING LAMPS |
| Security lamp inoperative | 5.9 SECURITY SYSTEM |
| Speedometer inoperative | 4.1 INSTRUMENTS |
| Starter does not spin | 3.2 STARTING SYSTEM |
| Starter inoperative | 3.2 STARTING SYSTEM |
| Starter solenoid clicks | 3.2 STARTING SYSTEM |
| Starter spins, but does not engage | 3.2 STARTING SYSTEM |
| Starter stalls or spins too slowly | 3.2 STARTING SYSTEM |
| Starts, then stalls | 6.22 STARTS, THEN STALLS |
| Stop lamp inoperative | 5.5 STOP LAMPS |
| Tachometer inoperative | 4.1 INSTRUMENTS |
| Turn signal indicator inoperative | 4.5 INDICATOR LAMPS |
| Turn signal inoperative | 5.3 TURN SIGNALS |
| Turn signals flash at double normal rate | 5.3 TURN SIGNALS |
| Turn signals will not cancel on turn completion | 5.3 TURN SIGNALS |

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

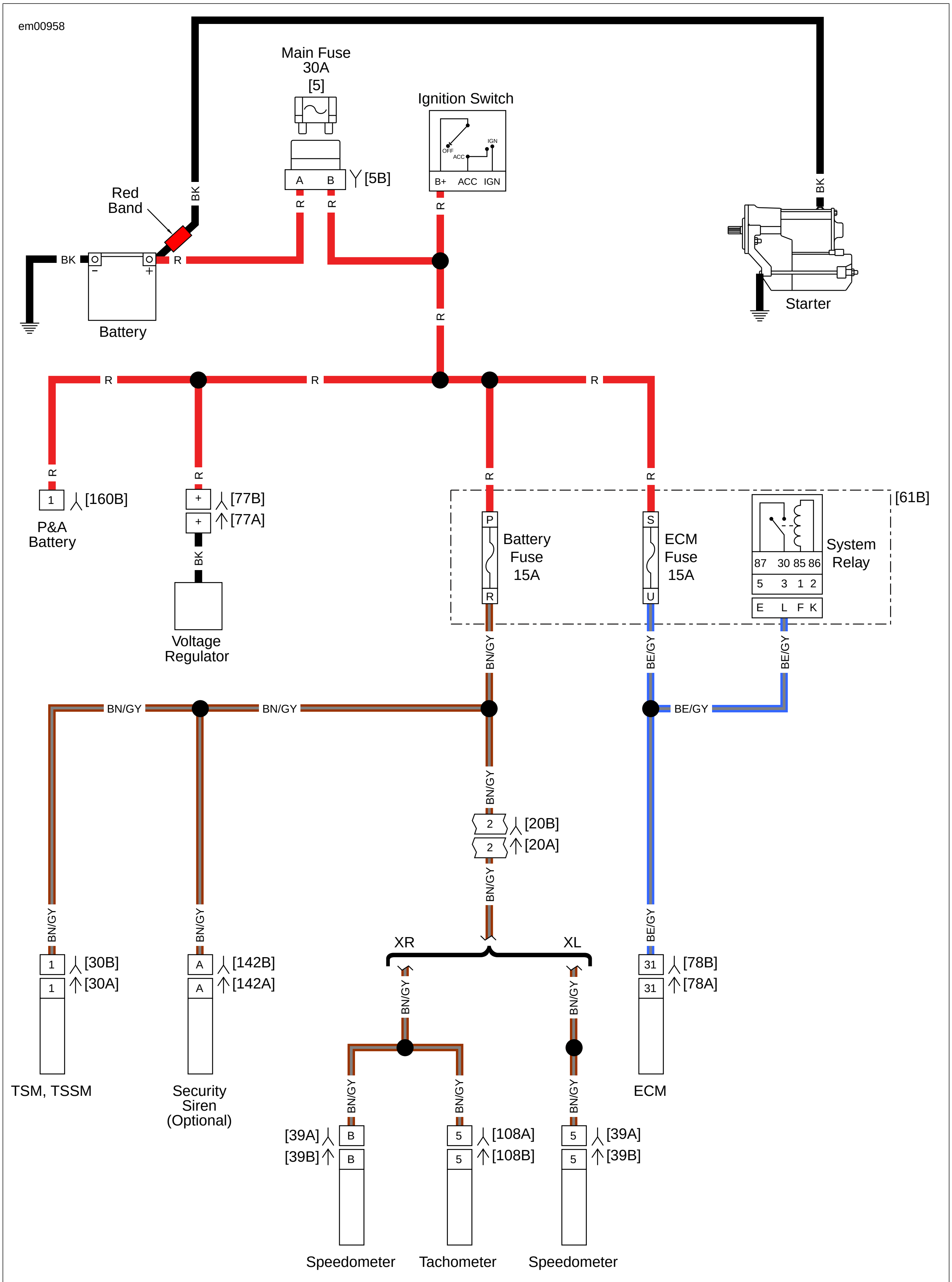



**Figure 2-2. Battery Power**

HOME

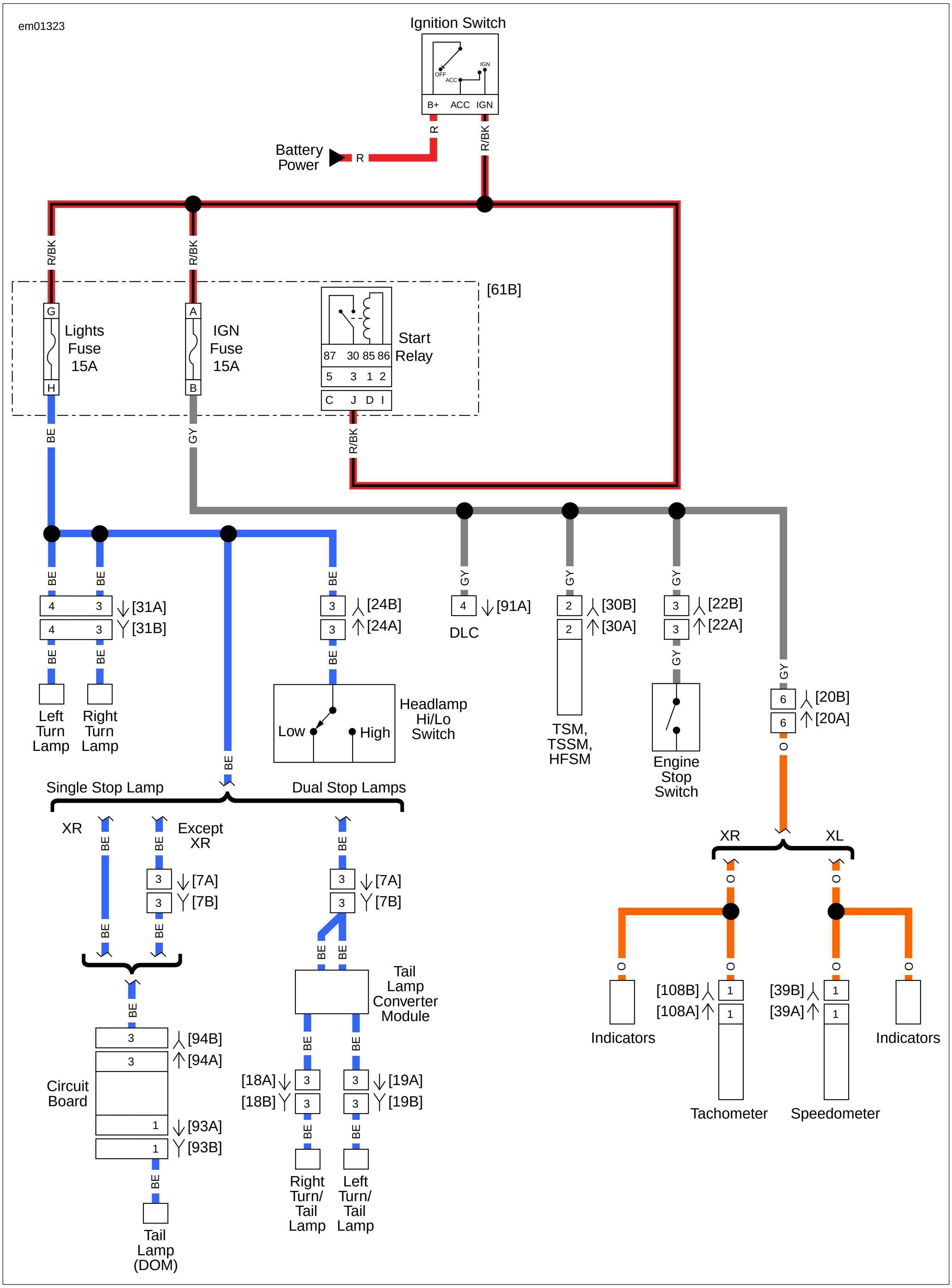



**Figure 2-3. Ignition Power**

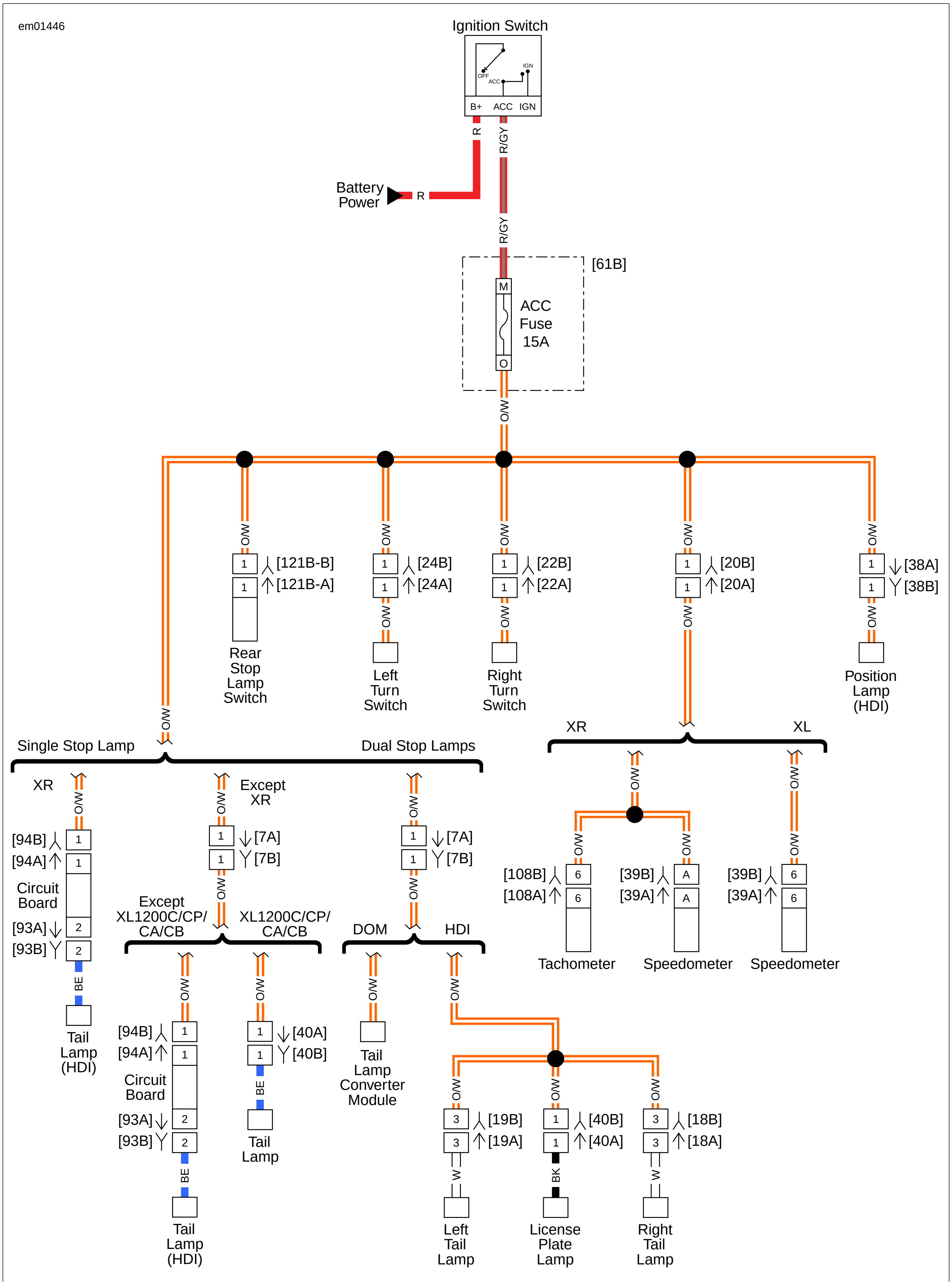



**Figure 2-4. Accessory Power**

HOME

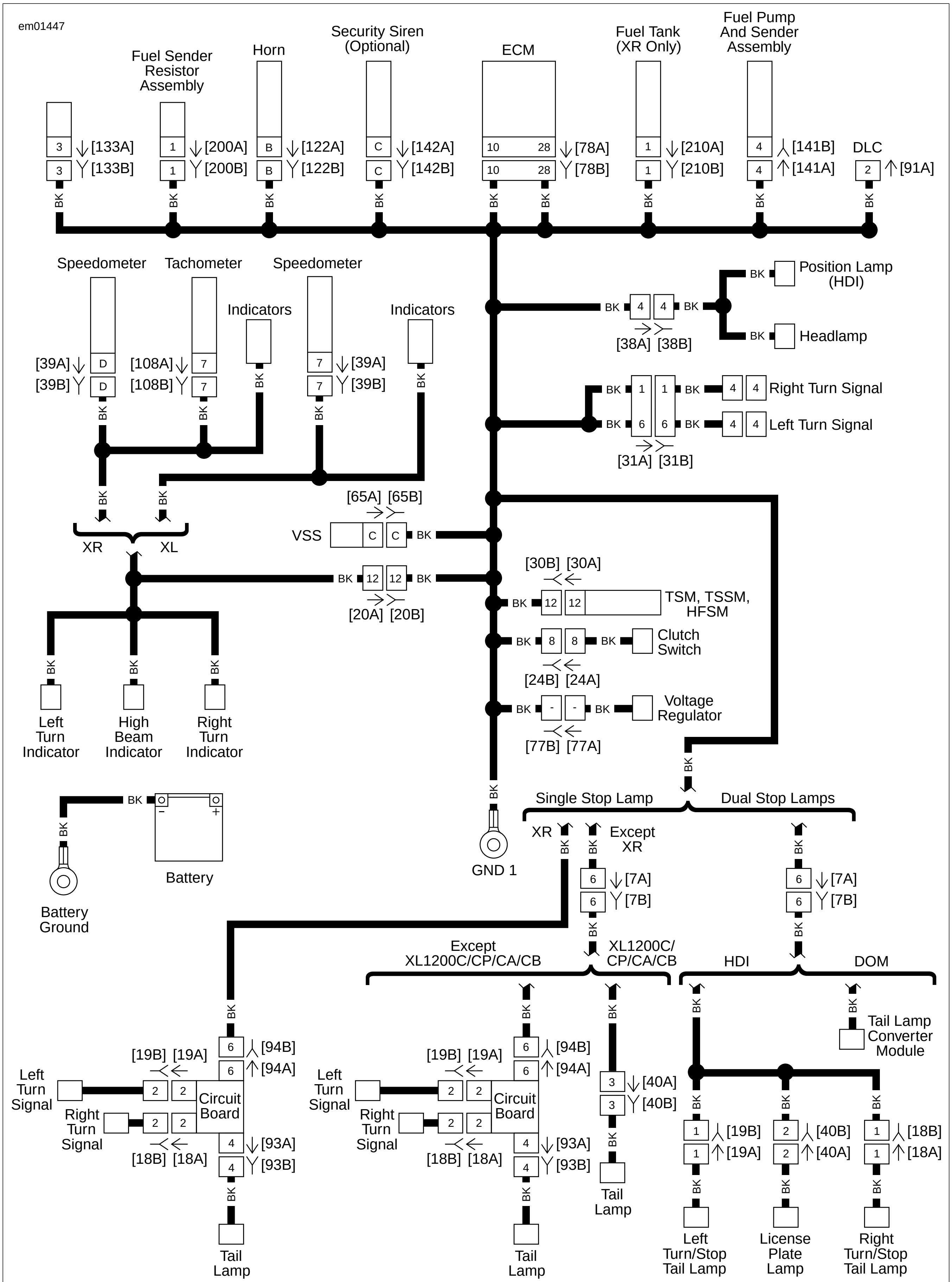


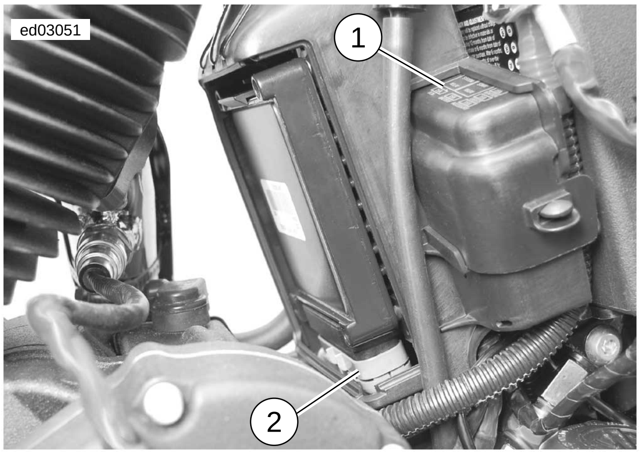

**Figure 2-5. Chassis Grounds**

# SERIAL DATA COMMUNICATION 2.2

## DESCRIPTION AND OPERATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

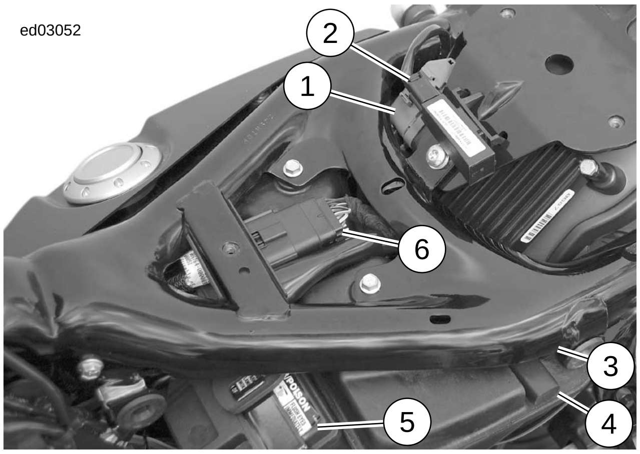
Serial data communication circuits are used by modules and diagnostic tools to share information.




1. **Fuse block [61]**
2. **ECM [78]**

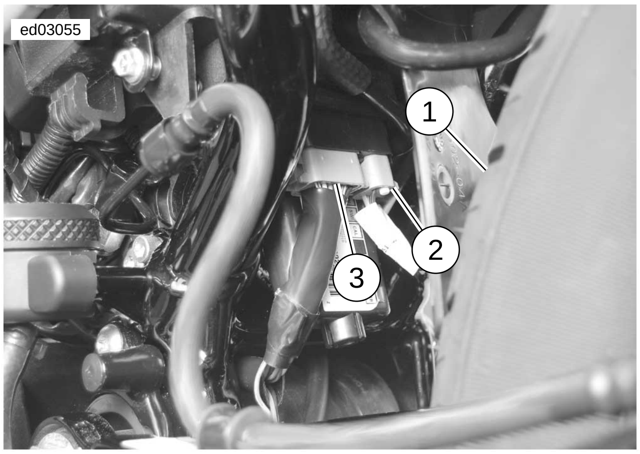
**Figure 2-6. ECM: XL**

The speedometer, ECM, TSM, TSSM or HFSM and tachometer (if equipped) all communicate on the serial data line. The serial data line is a LGN/V wire that runs to all the modules and is used to transfer data from one module to the other. This line also runs to the DLC [91] and is used to communicate with the modules using DIGITAL TECHNICIAN II (Part No. HD-48650).




1. **ECM [78]**
2. **Security antenna [209]**
3. **P&A battery [160]**
4. **Fuel sender resistor assembly [200]**
5. **Battery**
6. **Engine sensor harness [145]**

**Figure 2-7. ECM: XR**




1. **Rear tire**
2. **HFSM antenna [208]**
3. **TSM, TSSM or HFSM [30]**

**Figure 2-8. TSM, TSSM or HFSM**

## COMPONENTS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### Electronic Control Module (ECM)

See Figure 2-6 and Figure 2-7. The ECM is located behind the rear cylinder (XL) and under the seat (XR). The ECM monitors the sensors from the engine and fuel systems in order to manage the fuel and spark delivery to the motorcycle which enhances performance and driveability.

### Speedometer and Tachometer

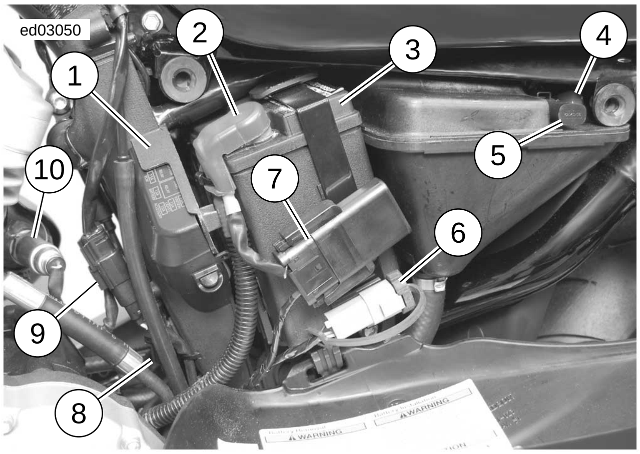
The speedometer and tachometer contain part of the indicator and warning lamps for the motorcycle. They use the serial data line to receive information from the other modules to know which lamps to illuminate at any given time.

### TSM, TSSM or HFSM

See Figure 2-8. The TSM, TSSM or HFSM is located under the battery. It monitors the turn signals switches and controls the turn signals. The clutch and neutral switches are also inputs to the TSM, TSSM or HFSM. It uses these inputs to determine when it is safe to allow the motorcycle to start. It allows starter engagement and sends the information to the ECM over the serial data line letting the ECM know to activate the fuel injectors. The TSSM or HFSM also controls the security functions on the motorcycle if equipped with the factory security system.

### Data Link Connector (DLC)

See Figure 2-9. The DLC is located under the left side cover. The DLC is used to connect the DIGITAL TECHNICIAN II (Part No. HD-48650) to the motorcycle.




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **P&A battery [160]**
5. **Fuel sender resistor assembly [200]**
6. **DLC [91]**
7. **Main fuse [5]**
8. **Rear O2 sensor [137]**
9. **Fuel pump and low fuel switch [141]**
10. **Rear O2 sensor**

**Figure 2-9. Under Left Side Cover: XR**

## COMMUNICATION DTCS AND "BUS ER"

Different issues with the serial data circuit may set different DTCs. A single module that loses communication cannot set DTCs. This causes the other modules to set DTCs indicating a communication failure with the inoperative module.

### Diagnostic Tips

Modules must have power and be grounded in order to communicate. Therefore, when checking any communication DTC, verify the power and ground connections on the suspected module. In some cases "Bus Er" will show on the odometer.

# DTC U1016, U1064, U1097, U1098, U1255 2.3

## DESCRIPTION AND OPERATION

The serial data circuit provides a means for the ECM, speedometer, tachometer and TSM, TSSM or HFSM to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components.

- DTC U1016 indicates that the ECM is not capable of sending this state of health message. It also indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.
- DTC U1064 indicates that the TSM, TSSM or HFSM is not capable of sending this state of health message. It also indicates that there was communication on the data bus since power up, but was lost or interrupted during that key cycle.
- DTC U1097 indicates the speedometer is not capable of sending its state of health message.
- DTC U1098 indicates the tachometer is not capable of sending its state of health message.
- DTC U1255 indicates that no messages were present during power up of the current key cycle.

*NOTE*

*It is important to always start from 2.1 INITIAL DIAGNOSTICS before proceeding with this test.*

**Table 2-4. Code Description**

| DTC | DESCRIPTION |
|---|---|
| U1016 | Loss of all ECM serial data (state of health) |
| U1064 | Loss of TSM, TSSM or HFSM serial data (state of health) |
| U1097 | Loss of speedometer serial data (state of health) |
| U1098 | Loss of tachometer serial data (state of health) |
| U1255 | Serial data error/missing message |

### Diagnostic Tips

The TSM, TSSM or HFSM controls the turn signals and supplies voltage for the turn signals to operate. A short on the turn signal circuits can cause the battery fuse to open. If no short to ground is found in the battery fuse circuit check the turn signal circuits between the TSM, TSSM or HFSM and the turn signals for a short to ground.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

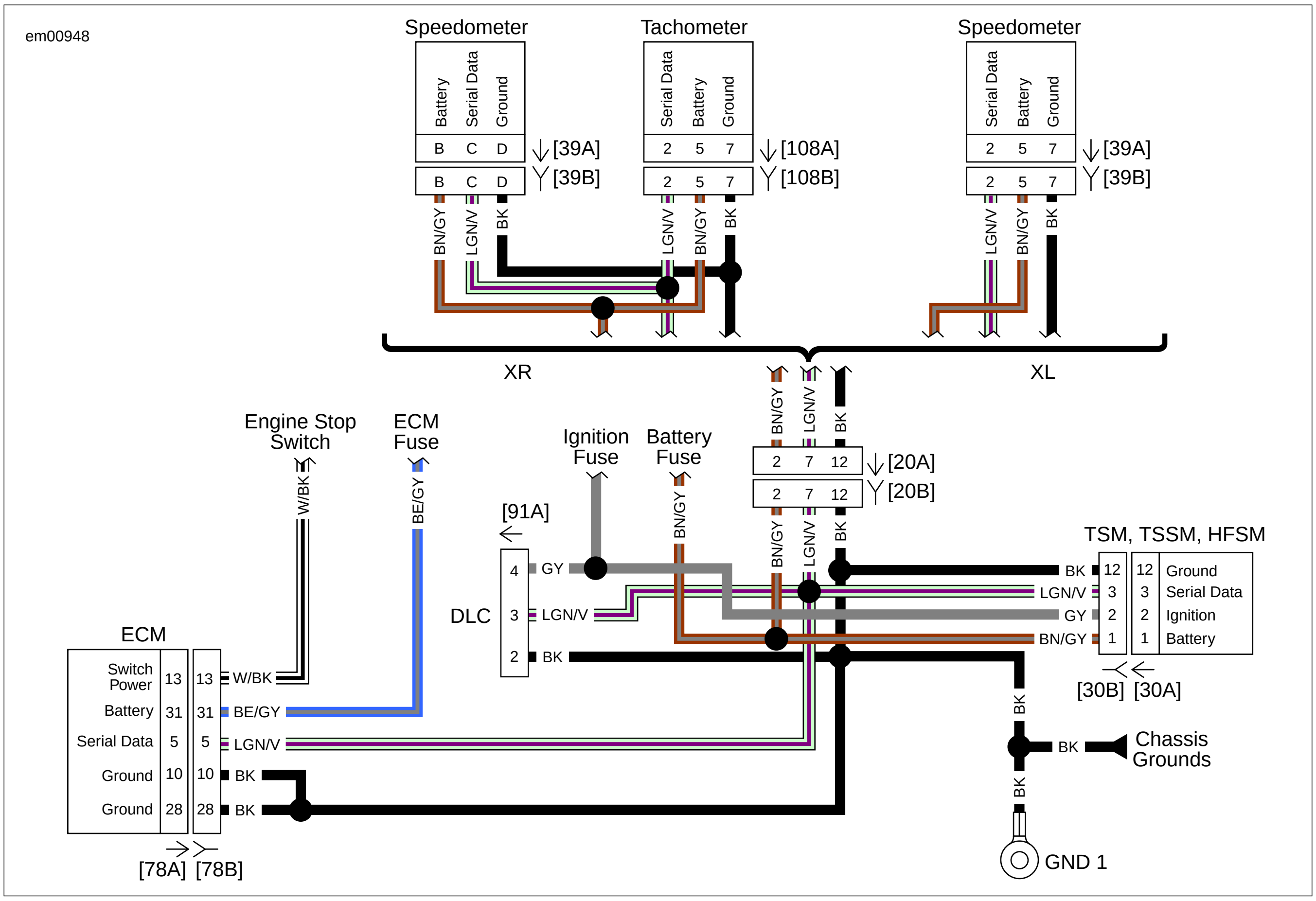



**Figure 2-10. Serial Data Circuit**

## DTC U1016

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-43876 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-5. DTC U1016 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open ground |
| Open switched power |
| Open serial data circuit |

## 1. Open Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity from breakout box terminals 10 and 28 to ground.
3. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in ground circuit.

## 2. Switched Power Circuit Open Test

1. With IGN ON and engine stop switch in the RUN position, test for voltage at breakout box terminal 13.
2. Is battery voltage present?
   a. **Yes, the TSM, TSSM or HFSM is reporting the DTC.** Go to Test 3.
   b. **Yes, the speedometer is reporting the DTC.** Go to Test 4.
   c. **Yes, the tachometer is reporting the DTC.** Go to Test 5.
   d. **No.** Repair open in (W/BK) wire.

## 3. TSM, TSSM or HFSM Serial Data Circuit Continuity Test

1. With the IGN OFF, install BREAKOUT BOX (Part No. HD-42682) at the TSM, TSSM or HFSM. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between TSM, TSSM or HFSM breakout box terminal 3 and ECM breakout box terminal 5.

3. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open on (LGN/V) wire.

## 4. Speedometer Serial Data Circuit Continuity Test

1. Connect harness BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39A] and [39B]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between speedometer breakout box terminal 2 and ECM breakout box terminal 5.
3. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open on (LGN/V) wire.

## 5. Tachometer Serial Data Circuit Continuity Test

1. Connect harness BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [108A] and [108B]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [108A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between tachometer breakout box terminal 2 and ECM breakout box terminal 5.
3. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open on (LGN/V) wire.

# DTC U1064, U1255

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-43876 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-6. DTC U1064, U1255 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open battery fuse |
| Open battery circuit |
| Open ground circuit |
| Open serial data circuit |
| Short to ground in power circuit |

## 1. Fuse Test

1. Inspect battery fuse.
2. Is battery fuse good?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 6.

## 2. Loss of Battery Power Test

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and TSM, TSSM or HFSM [30A] and BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the speedometer [39] (XL) or tachometer [108] (XR). See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON and engine stop switch in the RUN position, use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter to test for voltage at TSM, TSSM or HFSM breakout box terminal 1.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BN/GY) wire.

## 3. Loss of Ignition Power Test

1. Test for voltage at terminal 2 of the TSM, TSSM or HFSM breakout box.
2. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY) wire.

## 4. Loss of Ground Test

1. Turn IGN OFF.
2. Test for continuity to ground from TSM, TSSM or HFSM breakout box terminal 12.
3. Is continuity present?
   a. **Yes, the speedometer is reporting the DTC.** Go to Test 5.
   b. **Yes, the ECM is reporting the DTC.** Go to Test 7.
   c. **Yes, the tachometer is reporting the DTC.** Go to Test 8.
   d. **No.** Repair open in ground circuit.

## 5. Speedometer Serial Data Circuit Continuity Test

1. Test for continuity between speedometer breakout box terminal 2 and TSM, TSSM or HFSM breakout box terminal 3.
2. Is continuity present?
   a. **Yes.** Replace the TSM, TSSM or HFSM.
   b. **No.** Repair open on (LGN/V) wire.

## 6. Power Circuit Short to Ground Test

1. Disconnect the siren (if equipped).
2. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and TSM, TSSM or HFSM [30A] and BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the speedometer [39] (XL) or tachometer [108] (XR). See 1.2 DIAGNOSTIC TOOLS.

3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between speedometer (XL) tachometer (XR) breakout box terminal 5 to ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (BN/GY) wire and replace battery fuse.
   b. **No.** See diagnostic tips. Replace battery fuse and test for intermittent short to ground. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

## 7. ECM Serial Data Circuit Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. at the ECM. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between TSM, TSSM or HFSM breakout box terminal 3 and ECM breakout box terminal 5.
3. Is continuity present?
   a. **Yes.** Replace TSM, TSSM or HFSM.
   b. **No.** Repair open on (LGN/V) wire.

## 8. Tachometer Serial Data Circuit Continuity Test

1. Test for continuity between tachometer breakout box terminal 2 and TSM, TSSM or HFSM breakout box terminal 3.
2. Is continuity present?
   a. **Yes.** Replace the TSM, TSSM or HFSM.
   b. **No.** Repair open on (LGN/V) wire.

## DTC U1097, U1255

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-43876 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-7. DTC U1097, U1255 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open battery fuse |
| Open ignition circuit |
| Open ground circuit |
| Open serial data circuit |
| Short to ground in power circuit |

## 1. Fuse Test

1. Inspect battery fuse.
2. Is battery fuse good?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 5.

## 2. Loss of Power Test

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and TSM, TSSM or HFSM [30A].
2. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the speedometer [39]. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON and engine stop switch in the RUN position, use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter to test for voltage at speedometer breakout box terminal 5.
4. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BN/GY) wire.

## 3. Loss of Ground Test

1. Turn IGN OFF.
2. Test for continuity to ground from speedometer breakout box terminal 7.
3. Is continuity present?
   a. **Yes, the TSM, TSSM or HFSM is reporting the DTC.** Go to Test 4.
   b. **Yes, the ECM is reporting the DTC.** Go to Test 6.
   c. **No.** Repair open in ground circuit.

## 4. Speedometer Serial Data Circuit Continuity Test

1. Test for continuity between speedometer breakout box terminal 2 and TSM, TSSM or HFSM breakout box terminal 3.
2. Is continuity present?
   a. **Yes.** Replace the speedometer.
   b. **No.** Repair open on (LGN/V) wire.

## 5. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-42682), using BREAKOUT BOX ADAPTERS (Part No. HD-46601) between wire harness [39B] and speedometer [39A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for short to ground breakout box terminal 5.
3. Is a short to ground present?
   a. **Yes.** Repair short to ground in (BN/GY) wire and replace battery fuse.
   b. **No.** Replace battery fuse and test for intermittent short to ground. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

## 6. ECM Serial Data Circuit Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.

2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter test for continuity between speedometer breakout box terminal 2 and ECM breakout box terminal 5.
3. Is continuity present?
   a. **Yes.** Replace speedometer.
   b. **No.** Repair open on (LGN/V) wire.

## DTC U1098, U1255

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-43876 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-8. DTC U1098, U1255 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open IGN fuse |
| Open ignition circuit |
| Open ground circuit |
| Open serial data circuit |
| Short to ground in power circuit |

### 1. Fuse Test

1. Inspect battery fuse.
2. Is battery fuse good?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 5.

### 2. Loss of Power Test

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and TSM, TSSM or HFSM [30A] and BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the tachometer [108]. See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON and engine stop switch in the RUN position, use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter to test for voltage at tachometer breakout box terminal 5.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BN/GY) wire.

### 3. Loss of Ground Test

1. Turn IGN OFF.
2. Test for continuity to ground from tachometer breakout box terminal 7.
3. Is continuity present?
   a. **Yes, the TSM, TSSM or HFSM is reporting the DTC.** Go to Test 4.
   b. **Yes, the ECM is reporting the DTC.** Go to Test 6.
   c. **No.** Repair open in ground circuit.

### 4. Tachometer Serial Data Circuit Continuity Test

1. Test for continuity between tachometer breakout box terminal 2 and TSM, TSSM or HFSM breakout box terminal 3.
2. Is continuity present?
   a. **Yes.** Replace the tachometer.
   b. **No.** Repair open on (LGN/V) wire.

### 5. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-42682), using BREAKOUT BOX ADAPTERS (Part No. HD-46601) between wire harness [108B] and tachometer [108A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for short to ground breakout box terminal 5.
3. Is a short to ground present?
   a. **Yes.** Repair short to ground in (BN/GY) wire and replace battery fuse.
   b. **No.** Replace battery fuse and test for intermittent short to ground. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

### 6. ECM Serial Data Circuit Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between tachometer breakout box terminal 2 and ECM breakout box terminal 5.
3. Is continuity present?
   a. **Yes.** Replace tachometer.
   b. **No.** Repair open on (LGN/V) wire.

# DTC U1300, U1301 OR BUS ER 2.4

## DESCRIPTION AND OPERATION

The typical serial data voltage range is 0V (inactive) to 7V (active). Due to the high speed voltage fluctuations of the signal, voltages will be much lower on a multimeter. In analog mode, a multimeter reading serial data will show continuous voltage when active, typically 0.6-0.8V. The range for acceptable operations is 0-7.0V.

**Table 2-9. Code Description**

| DTC | DESCRIPTION |
|---|---|
| U1300 | Serial data open/low |
| U1301 | Serial data high |

## Diagnostic Tips

- If serial data is shorted, these DTCs will automatically cause the check engine lamp to illuminate. The odometer will read "BUS Er" in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

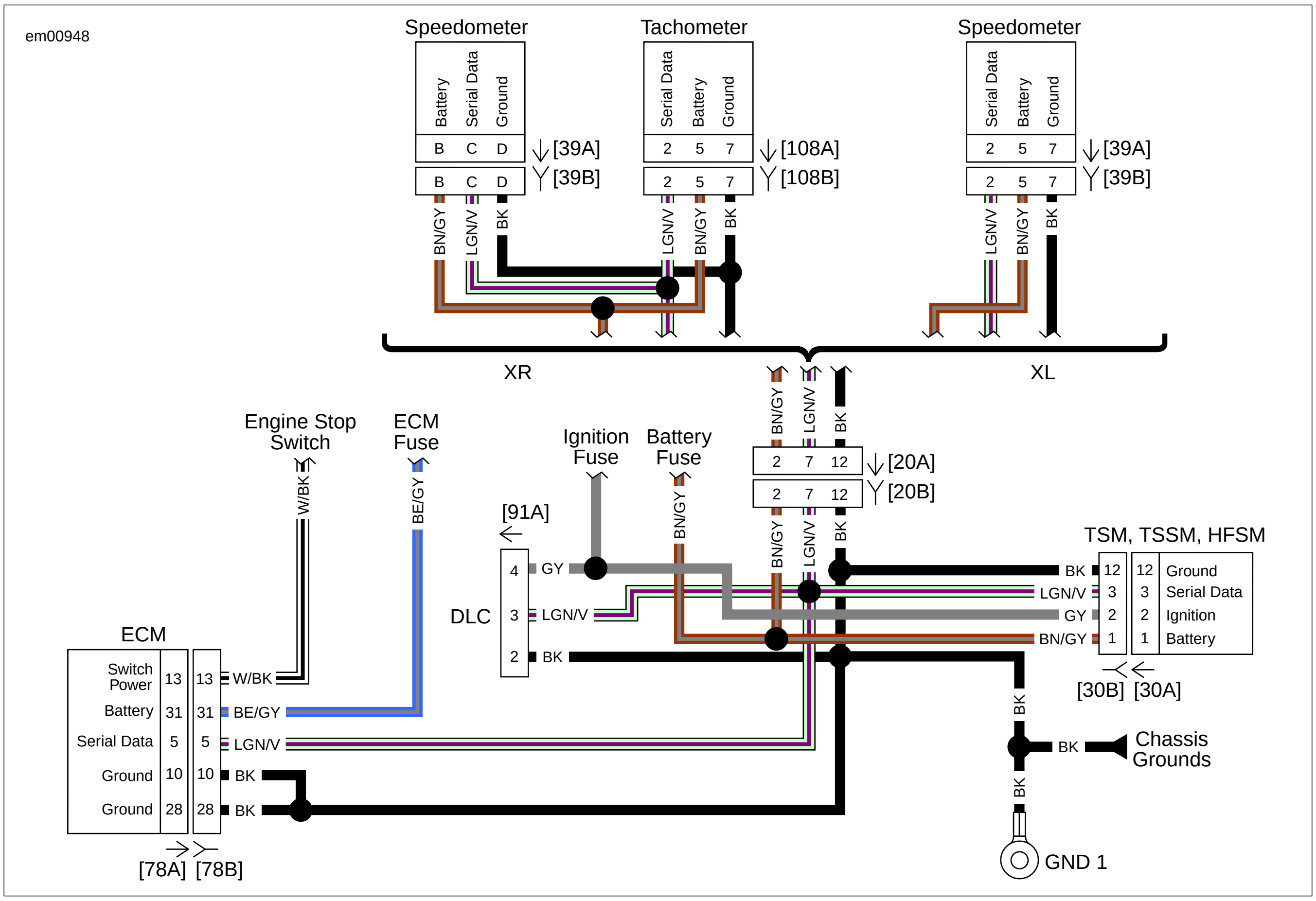



**Figure 2-11. Serial Data Circuit**

## DTC U1300

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-10. DTC U1300 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in serial data wire |
| Open in serial data circuit |

### 1. Serial Data Short to Ground Test

1. Turn IGN ON.
2. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 7.

### 2. ECM Test

1. Turn IGN OFF.
2. Disconnect the ECM [78B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace ECM.

### 3. TSM, TSSM or HFSM Test

1. Turn IGN OFF.
2. Disconnect the TSM, TSSM or HFSM [30A].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes, XL.** Go to Test 4.
   b. **Yes, XR.** Go to Test 6.
   c. **No.** Replace TSM, TSSM or HFSM.

### 4. Tachometer Test: XL (If Vehicle is not Equipped with Tachometer, Go to Test 5.)

1. Turn IGN OFF.
2. Disconnect tachometer [108].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace tachometer.

### 5. Serial Data Short to Ground Test: XL

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity from DLC [91A] terminal 3 to ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/V) wire.
   b. **No.** Go to Test 8.

### 6. Speedometer Test: XR

1. Turn IGN OFF.
2. Disconnect speedometer [39B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace speedometer.

### 7. Serial Data Short to Ground Test: XR

1. Turn IGN OFF.
2. Disconnect tachometer [108B].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity from DLC [91A] terminal 3 to ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/V) wire.
   b. **No.** Go to Test 8.

### 8. Serial Data Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the wiring harness [39B] (XL) or [108B] (XR), leaving the speedometer (XL) or tachometer (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity from terminal 2 of breakout box to DLC [91A] terminal 3.
3. Is continuity present?
   a. **Yes.** Replace speedometer (XL) or tachometer (XR).
   b. **No.** Repair open in (LGN/V) wire.

### 9. Intermittent Test

1. Turn IGN OFF.
2. Disconnect the ECM [78B], speedometer [39B], TSM, TSSM or HFSM [30B], and tachometer [108B] (if equipped).
3. Test for continuity between DLC [91A] terminal 3 and ground while performing a wiggle test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/V) wire.
   b. **No.** Verify that current DTC U1300 is set.

## DTC U1301

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 2-11. DTC U1301 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to voltage in serial data circuit |

### 1. Serial Data Short to Voltage Test

1. Turn IGN ON.
2. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 7.

### 2. ECM Test

1. Turn IGN OFF.
2. Disconnect the ECM [78B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace ECM.

### 3. TSM, TSSM or HFSM Test

1. Turn IGN OFF.
2. Disconnect the TSM, TSSM or HFSM [30B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes, XL.** Go to Test 4.
   b. **Yes, XR.** Go to Test 6.
   c. **No.** Replace TSM, TSSM or HFSM.

### 4. Tachometer Test: XL (If Vehicle is not Equipped with Tachometer, Go to Test 5.)

1. Turn IGN OFF.
2. Disconnect the tachometer [108B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace tachometer.

### 5. Serial Data Short to Voltage Test: XL

1. Turn the IGN OFF.
2. Disconnect the speedometer [39B].
3. Turn IGN ON.
4. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage from DLC [91A] terminal 3 to ground.
5. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (LGN/V) wire.
   b. **No.** Go to Test 8.

### 6. Speedometer Test: XR

1. Turn IGN OFF.
2. Disconnect speedometer [39B].
3. Turn IGN ON.
4. Does BUS Er appear on odometer display?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace speedometer.

### 7. Serial Data Short to Ground Test: XR

1. Turn the IGN OFF.
2. Disconnect tachometer [108B].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage from DLC [91A] terminal 3 to ground.
4. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (LGN/V) wire.
   b. **No.** Go to Test 8.

### 8. Serial Data Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the wiring harness [39B] (XL) or [108B] (XR), leaving the speedometer (XL) or tachometer (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity from breakout box terminal 7 to DLC [91A] terminal 3.
4. Is continuity present?
   a. **Yes.** Replace speedometer (XL) or tachometer (XR).
   b. **No.** Repair open in (LGN/V) wire.

### 9. Intermittent Test

1. Turn IGN OFF.
2. Disconnect the ECM [78B], speedometer [39B], TSM, TSSM or HFSM [30B], and tachometer [108B] (if equipped).
3. Turn IGN ON.
4. Test for voltage between DLC [91A] terminal 3 and ground while performing a wiggle test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
5. Is voltage present?
   a. **Yes.** Repair short to voltage in (LGN/V) wire.
   b. **No.** Verify that current DTC U1301 is set.

# NOTES

TABLE OF CONTENTS

# NOTES

# BATTERY TESTING 3.1

## GENERAL

Test battery condition by using a voltage, charging or load test.

Always fully charge battery prior to load testing.

*NOTE*

*An automatic, constant monitoring battery charger/tender with a charging rate of 5 Amps or less at less than 14.6V is recommended. The use of constant current chargers (including trickle chargers) to charge sealed AGM batteries is not recommended. Any overcharge will cause dry-out and premature battery failure.*

## VOLTMETER TEST

The voltmeter test provides a general indication of battery state of charge or condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. Refer to Table 3-1.

If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform a load test. See 3.1 BATTERY TESTING, Load Test.

**Table 3-1. Voltmeter Test For Battery Charge Conditions**

| VOLTAGE | STATE OF CHARGE |
|---|---|
| 12.7 | 100% |
| 12.6 | 75% |
| 12.3 | 50% |
| 12.0 | 25% |
| 11.8 | 0% |

## BATTERY DIAGNOSTIC TEST

| PART NUMBER | TOOL NAME |
|---|---|
| GRX-3110 HD | BATTERY DIAGNOSTIC STATION |

Test the battery using the GRX. Perform a battery test as follows:

1. Disconnect and remove battery.
2. Connect the BATTERY DIAGNOSTIC STATION (Part No. GRX-3110 HD) leads to the battery terminal.
3. Read the GRX instruction manual before performing a battery test.

The test results will include a decision on the battery condition and the measured state of charge. See Figure 3-1. The GRX printer will provide a printout including the test results:

- GOOD BATTERY - Return the battery to service.
- REPLACE BATTERY - Replace the battery.


**Figure 3-1. Battery Test Results Printout (Typical)**

## LOAD TEST

**⚠WARNING**

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

1. With vehicle battery on a bench, charge the battery.

*NOTE*

*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.*

**⚠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)**

2. See Figure 3-2. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

*NOTE*

*To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.*

3. 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). Refer to Table 3-2.

## ⚠WARNING

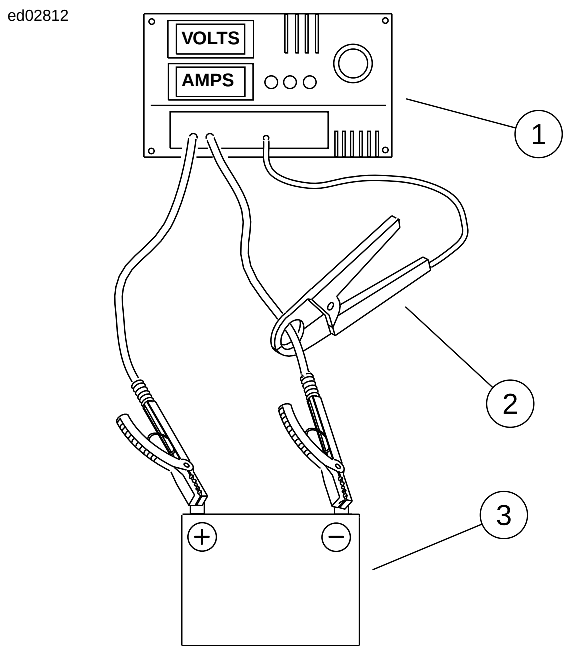
**Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)**

## ⚠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)**

## *NOTICE*

**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)**




1. **Load tester**
2. **Induction pickup**
3. **Battery**

**Figure 3-2. Load Test Battery**

**Table 3-2. Battery Load Test**

| COLD CRANKING AMPERAGE (CCA) | 100% | 50% |
|---|---|---|
| Sportster models | 225 | 110 |

# STARTING SYSTEM 3.2

## DESCRIPTION AND OPERATION

With IGN ON, battery voltage is supplied to the start relay and ignition fuse. The ignition fuse supplies battery voltage to the engine stop switch and TSM, TSSM or HFSM.

With engine stop switch to RUN, battery voltage is supplied to the start switch and the ECM. The TSM, TSSM or HFSM monitors the clutch switch, neutral switch and the state of the security system. If the security system is not armed and either the clutch lever is pulled in or the motorcycle is in neutral, the TSM, TSSM or HFSM provides ground to the start relay coil.

When the start switch is pressed, power flows to the coil side of the start relay. The TSM, TSSM or HFSM supplies the ground to the start relay, energizing the start relay. This allows battery voltage from the ignition switch to flow through the start relay to the starter solenoid. This energizes the solenoid and full battery power is sent to the starter.

## COMPONENTS

### Starter

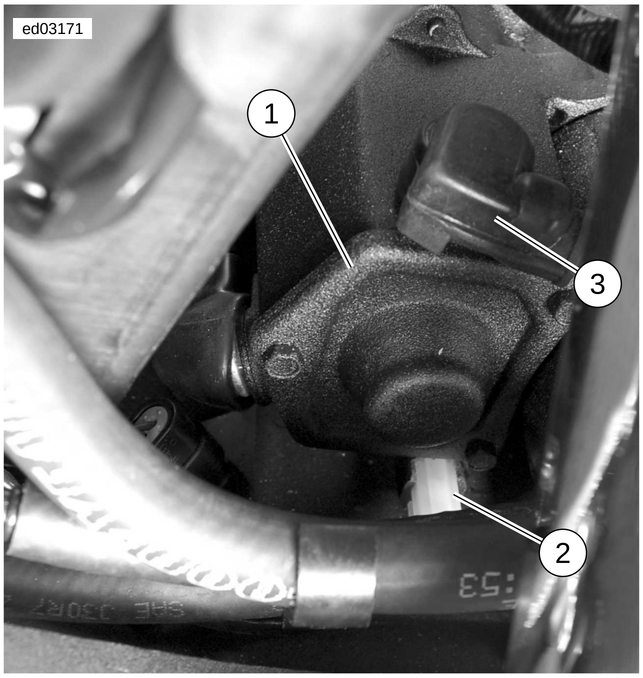
The starter receives power from the battery through the starter solenoid and is grounded through the starter case. When the starter solenoid is energized, two events happen:

- The plunger pulls inward which allows current to flow to the starter motor.
- The pinion gear engages with the ring gear on the clutch shell.

With the starter motor turning, the rotation is transferred to the following:

- The starter armature gear transfers rotation to the idler gear.
- The idler gear transfers rotation to the starter clutch.
- The starter clutch transfers rotation through a spline gear to the starter drive shaft which also drives the pinion gear.
- The pinion gear transfers its rotation to the ring gear on the clutch shell.
- The primary chain drives the alternator rotor sprocket on the end of the crankshaft.

The starter clutch is equipped with one way clutch so when the engine starts, it allows the clutch shell and sprocket to spin freely without causing any damage to the starter motor. After the engine starts and the start switch is released, the plunger returns to its normal position, disengaging the pinion gear from the clutch shell and sprocket.




1. **Starter**
2. **Starter solenoid [128]**
3. **Cap, positive battery cable post**

**Figure 3-3. Starter Solenoid [128]**

### Starter Solenoid

See Figure 3-3. The starter solenoid provides power to the starter. The solenoid is a means of controlling a high amperage device with a low amperage switch. The low amperage switch in this circuit is the start relay. When the start relay is activated it sends voltage to the starter solenoid making a magnetic field that pulls a larger circuit closed, allowing voltage to the starter.

### Engine Stop Switch

The engine stop switch is located on the right hand controls. With the engine stop switch in the RUN position, battery voltage is supplied to the start switch and the ECM.

### Start Switch

The start switch is a push button switch located in the right hand controls. When the start switch is pressed, power flows to the coil side of the start relay.

### Start Relay

The start relay is located in the fuse block under the left side cover. Power is supplied to the coil side of the start relay when the start switch is pressed. The TSM, TSSM or HFSM controls the ground to the coil side of the relay. When the relay is energized, it supplies power from the ignition switch to the starter solenoid.

### Ignition Switch

The ignition switch turns the electrical power to the vehicle on and/or off. The ignition switch has three positions. In the OFF position, the ignition switch turns off all power to the vehicle except for the components powered directly by the battery. When the ignition switch is in the ACC position it allows power to flow through the ACCY fuse and supplies power to only certain parts of the vehicle such as the lights. In the ON or IGN position the ignition switch supplies power for all the systems on the vehicle.

## Battery

**⚠WARNING**

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

**⚠WARNING**

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

**⚠WARNING**

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

**⚠WARNING**

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

**⚠WARNING**

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

***NOTICE***

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

The AGM batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries.

The battery is recharged by the alternator and kept from over-charging by the regulator during use.

Battery condition can be determined by a voltage test, a conductance test or a load test. See 3.1 BATTERY TESTING.

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

## Grinding Noise Or Erratic Starting

1. Remove starter.
2. Inspect the starter mounting surface and mating area on inner primary for arcing and pitting. This condition is caused by insufficient ground and or clamp load.
3. Clean mating surfaces.
4. Inspect starter pinion gear. Replace starter clutch assembly if damaged (cracked or missing teeth). Rounding of pinion gear teeth is considered normal. If pinion gear needs to be replaced, inspect ring gear on clutch. Replace clutch ring gear if damaged.
5. Install starter.

## Job/Time Code Values

Dealership Technicians filing warranty claims should use the job/time code values printed in (bold text) beside the appropriate repair.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

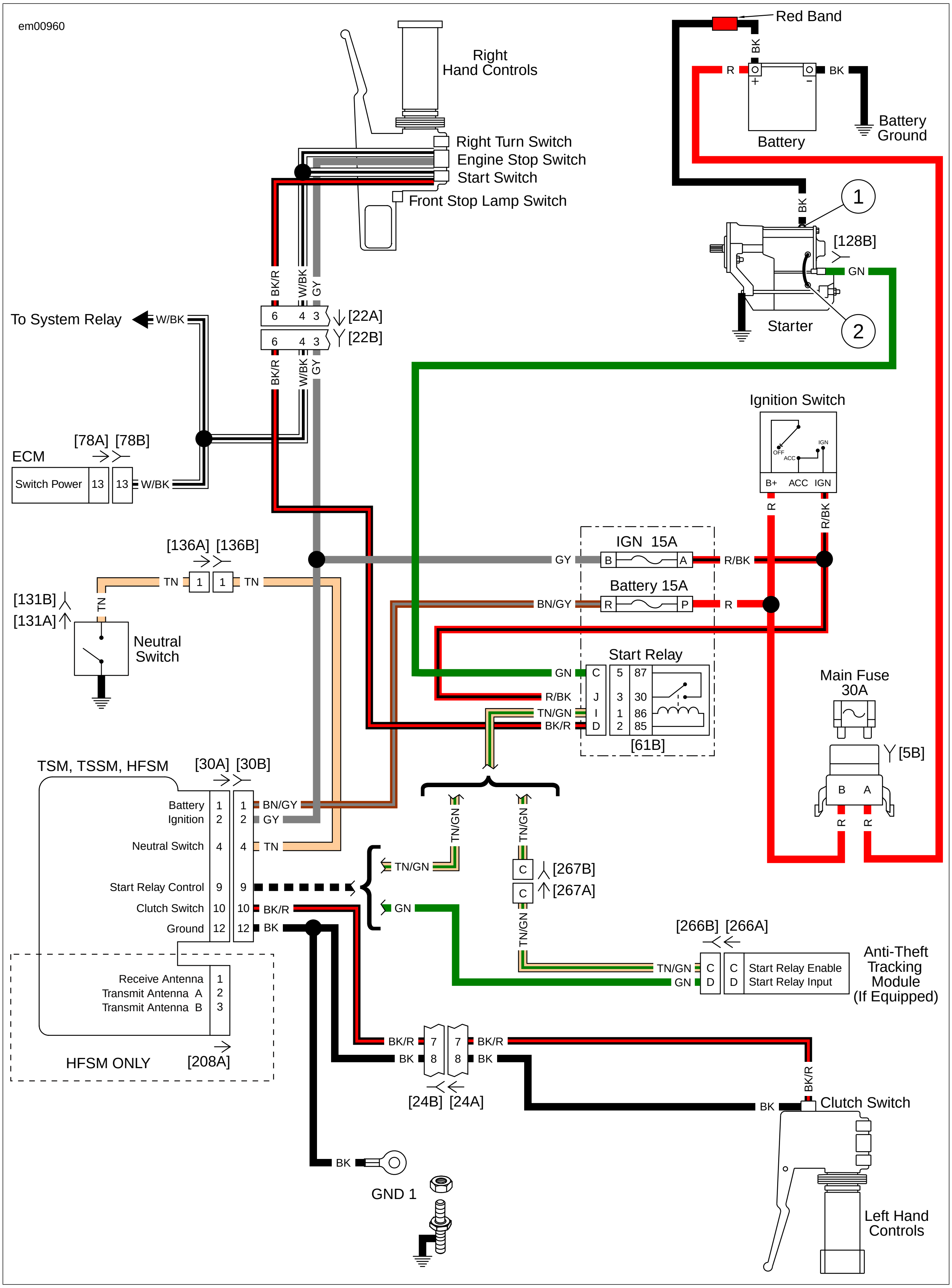



**Figure 3-4. Starting Circuit**

## STARTER TROUBLESHOOTING

The troubleshooting tables contain detailed procedures to solve and correct problems. Follow 3.2 STARTING SYSTEM to diagnose starting system problems. The 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop procedure will help you to locate poor connections or components with excessive voltage drops.

**Table 3-3. Starter Does Not Run or Runs at Very Low Speeds**

| SOURCE OF PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Battery | Voltage drop due to discharged battery. | Charge battery. |
| | Short-circuit or open between electrodes. | Replace battery. |
| | Poor contact condition of battery terminal(s). | Clean and retighten. |
| Wiring | Poor or no connection at either end of the battery positive or negative cable. | Repair or replace cable(s). |
| | Cracked or corroded battery cable ends. | Clean, tighten or replace cable(s) as needed. |
| | Open wire(s) or poor connection at handlebar switch or start relay, especially relay ground wire (grounds through TSM, TSSM or HFSM). | Tighten connections or repair or replace wire(s). |
| Start switch, clutch switch, engine stop switch or neutral switch | Poor switch contacts or open switch. | Replace switch. |
| Start relay | Open coil winding. | Replace relay. |
| | Poor or no continuity at relay points. | Replace relay. |
| | TSM, TSSM or HFSM has disabled start relay. | Disarm security system inspect for neutral or clutch circuit issue. |
| Starter solenoid | Poor contact condition caused by burned contacts. | Replace solenoid assembly. |
| | Windings open or short-circuited. | Replace solenoid assembly. |
| Starter motor | Brushes worn below specification. | Replace starter. |
| | Commutator burnt. | Replace starter. |
| | Commutator high mica. | Replace starter. |
| | Field winding grounded. | Replace starter. |
| | Armature winding grounded or short-circuited. | Replace starter. |
| | Free running current draw out of range. | Replace starter. |
| | Insufficient brush spring tension. | Replace starter. |
| Starter clutch | Starter clutch failure. | Replace starter clutch assembly. |

**Table 3-4. Starter Spins But Does Not Engage**

| SOURCE OF PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Battery | Voltage drop due to discharged battery. | Charge battery. |
| | Short-circuit or open between electrodes. | Replace battery. |
| | Poor contact condition of battery terminal(s). | Clean and retighten. |
| Starter motor | Pinion gear teeth worn out. | Replace starter clutch assembly. |
| Gear teeth on clutch shell and sprocket. | Excessively worn teeth. | Replace clutch shell and sprocket. |
| Starter clutch | Starter clutch failure. | Replace starter clutch assembly. |

**Table 3-5. Starter Does Not Stop Running**

| SOURCE OF PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Start switch or start relay | Unopened contacts. | Replace start switch or start relay. |
| | Poor return caused by sticky switch or relay contacts. | Replace start switch or start relay. |
| Starter solenoid | Coil shorted. | Replace starter solenoid assembly. |
| | Contact plate melted and stuck. | Replace starter solenoid assembly. |

## STARTER TESTING

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 3-6. Starter Testing Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to voltage at starter solenoid |
| Start switch malfunction |
| Short to voltage on start relay supply circuit |
| Start relay malfunction |

### 1. Starting System Operational Test

1. With IGN ON, transmission in neutral, and the engine stop switch in the RUN position, press the start switch.
2. Does the starter spin?
   a. **Yes, starter spins, but does not engage.** See 3.2 STARTING SYSTEM, Starter Spins But Does Not Engage.
   b. **Yes, starter stalls or spins too slowly.** See 3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly.
   c. **Yes, starter runs on.** Go to Test 3.
   d. **No.** Go to Test 2.

### 2. Audible Noise Test

1. While listening for audible clicking noises from the start relay and starter solenoid, press the start switch.
2. Is there a click?
   a. **Yes, starter solenoid clicks.** See 3.2 STARTING SYSTEM, Starter Solenoid Clicks.
   b. **Yes, start relay clicks.** See 3.2 STARTING SYSTEM, Start Relay Clicks.
   c. **No.** See 3.2 STARTING SYSTEM, Nothing Clicks.

### 3. Starter Solenoid Test

1. Disconnect starter solenoid [128].
2. Does starter stop?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace starter solenoid assembly. **(5845)**

### 4. Start Switch Circuit Test

1. Turn IGN OFF, remove start relay.
2. Turn IGN ON. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) test for voltage at fuse block [61B] socket terminal D (BK/R) wire.
3. Is battery voltage present?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 7.

### 5. Start Switch Circuit Short to Voltage Test

1. Turn IGN OFF, disconnect right hand controls [22].
2. Turn IGN ON, test for voltage at [22B] terminal 6.
3. Is voltage present?
   a. **Yes.** Repair short to voltage between [22B] terminal 6 and [61B] socket terminal D (BK/R) wire. **(5041)**
   b. **No.** Go to Test 6.

### 6. Start Switch Test

1. Test for continuity between [22A] terminal 4 (W/BK) wire and terminal 6 (BK/R) wire.
2. Is continuity present?
   a. **Yes.** Replace start switch. **(5818)**
   b. **No.** Repair short to voltage on [22A] terminal 6 (BK/R) wire. **(5041)**

### 7. Start Relay Test

1. Perform relay test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
2. Is the start relay good?
   a. **Yes.** Perform wiggle test to locate short to voltage between fuse block [61B] socket terminals C (GN) wire or J (R/BK) wire. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. **(5041)**
   b. **No.** Replace start relay. **(5832)**

## NOTHING CLICKS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 3-7. Nothing Clicks Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Open fuse |
| Open ignition switch feed circuit |
| Start switch malfunction |
| Start relay malfunction |
| Ignition switch malfunction |
| Open ignition circuit |
| Open start switch circuit |
| Neutral switch malfunction |
| Open neutral circuit |
| Clutch switch malfunction |
| Open clutch switch circuit |
| Engine stop switch malfunction |
| Open ignition circuit |
| Open security circuit |

*NOTE*

*With the key fob present (if equipped), verify the vehicle is in neutral. Place the engine stop switch in the RUN position.*

### 1. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

### 2. Fuse Test

1. Verify all fuses are good.
2. Are all fuses good?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace fuse and repair circuit accordingly. If problem is still present, then continue with tests. Go to Test 3.

### 3. Ignition Circuit Test

1. Turn IGN ON.
2. Do odometer, headlamp and tail lamps illuminate?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 4.

### 4. Ignition Switch Supply Voltage Test

1. With IGN OFF, disconnect main fuse [5].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test battery voltage at main fuse [5A] (R) wire.
3. Is battery voltage present?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open between main fuse and battery terminal (+). **(5041)**

### 5. Ignition Switch Test

1. With IGN ON, test continuity between [5B] and fuse block [61B] socket terminal A.
2. Is continuity present?
   a. **Yes.** Go to Test 6.
   b. **No.** Check for open in wiring from terminal A of [61B] to ignition switch, if wiring is good then replace ignition switch. **(7287)**

### 6. Start Switch Circuit Voltage Test

1. With IGN OFF, remove start relay.
2. Turn IGN ON.
3. While pressing the start switch, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test battery voltage at fuse block [61B] socket terminal D (BK/R) wire.
4. Is battery voltage present?
   a. **Yes.** Go to Test 9.
   b. **No.** Go to Test 7.

### 7. Start Switch Test

1. Turn IGN OFF.
2. Disconnect right hand controls [22].
3. With start switch pressed, test continuity between [22A] terminals 6 (BK/R) wire and 4 (W/B) wire.
4. Is continuity present?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace the start switch. **(5818)**

### 8. Start Switch Circuit Continuity Test

1. Test continuity between [22B] terminal 6 and [61B] socket terminal D (BK/R) wire.
2. Is continuity present?
   a. **Yes.** Go to Test 16.
   b. **No.** Repair open between [22B] terminal 6 and [61B] socket terminal D (BK/R) wire. **(5041)**

### 9. Start Relay Control Circuit Test

1. Test continuity between [61B] socket terminal I (TN/GN) wire and ground.

2. Is continuity present?
   a. **Yes.** Replace start relay. If problem is still present, see 3.2 STARTING SYSTEM, Start Relay Clicks. **(5832)**
   b. **No.** Go to Test 10.

## 10. Start Relay Control Circuit Open Test

1. Turn IGN OFF.
2. Disconnect TSM, TSSM or HFSM [30].
3. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and [30A]. See 1.2 DIAGNOSTIC TOOLS.
4. Test continuity between [61B] socket terminal I and BOB terminal 9 (TN/GN) wire.
5. Is continuity present?
   a. **Yes.** Go to Test 11.
   b. **No, without anti-theft tracking module.** Repair open between [61B] socket terminal I and TSM, TSSM or HFSM [30B] terminal 9 (TN/GN) wire. **(5041)**
   c. **No, with anti-theft tracking module.** Go to Test 17.

## 11. TSM, TSSM or HFSM Ground Test

1. Test continuity between BOB terminal 12 (BK) wire and ground.
2. Is continuity present?
   a. **Yes.** Go to Test 12.
   b. **No.** Repair open between [30B] terminal 12 and GND 1 (BK) wire. **(5041)**

## 12. Continuity at Neutral Switch Test

1. Verify transmission is in neutral.
2. Test resistance between BOB terminal 4 (TN) wire and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 15.
   b. **No.** Go to Test 13.

## 13. Neutral Switch Ground Circuit Test

1. Disconnect neutral switch jumper [136].
2. Test continuity between BOB terminal 4 and [136B] (TN) wire.
3. Is continuity present?
   a. **Yes.** Go to Test 14.
   b. **No.** Repair open in (TN) wire. **(5041)**

## 14. Neutral Switch Wire Test

1. Test continuity between [136A] and [131B] (TN) wire.
2. Is continuity present?
   a. **Yes.** Replace neutral switch. **(5157)**
   b. **No.** Repair open between [136A] and [131B] (TN) wire.

## 15. Start Relay Coil Control Circuit Short to Voltage Test

1. Remove start relay and turn IGN ON.
2. Test for battery voltage on breakout box terminal 9.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage between TSM, TSSM or HFSM [30B] terminal 9 and [62B] socket terminal I on (TN/GN) wire. **(5041)**
   b. **No.** Replace TSM, TSSM or HFSM. **(6757)**

## 16. Engine Stop Switch Voltage Test

1. Test voltage between [22B] terminal 3 and ground.
2. Is battery voltage present?
   a. **Yes.** Replace engine stop switch. **(5818)**
   b. **No.** Repair open between ignition fuse and [22B] (GY) wire. **(5041)**

## 17. Relay Enable Circuit Continuity Test

1. Disconnect the anti-theft tracking module.
2. Test continuity between [61B] socket terminal I and anti-theft tracking module [266B] terminal C (TN/GN) wire.
3. Is continuity present?
   a. **Yes.** Go to Test 18.
   b. **No.** Repair open in (TN/GN) wire. **(5041)**

## 18. Anti-Theft Tracking Module Test

1. Test for continuity between breakout box terminal 9 and [266B] terminal D (TN/GN) wire.
2. Is continuity present?
   a. **Yes.** Replace the anti-theft tracking module. **(6756)**
   b. **No.** Repair open in (GN) wire. **(5041)**

# START RELAY CLICKS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 3-8. Start Relay Clicks Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Starter solenoid malfunction |
| Open starter solenoid control circuit |
| Open starter solenoid ground circuit |

## 1. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

## 2. Starter Solenoid Control Coil Voltage Test

1. With IGN OFF, disconnect starter solenoid [128].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test battery voltage on [128B] terminal 1 (GN) wire.
4. Is battery voltage present when start switch is pressed?
   a. **Yes.** Replace starter solenoid assembly. **(5845)**
   b. **No.** Go to Test 3.

## 3. Starter Solenoid Control Coil Continuity Test

1. Turn IGN OFF and remove start relay.
2. Test continuity between [128B] terminal 1 and fuse block [61B] socket terminal C (GN) wire.
3. Is continuity present?
   a. **Yes.** See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics. If relay tests good, then continue with tests. Go to Test 4.
   b. **No.** Repair open between [128B] terminal 1 and [61B] socket terminal C (GN) wire. **(5041)**

## 4. Start Solenoid Wiring Inspection Test

1. Inspect for corrosion or damage to the wiring from [128A] to starter solenoid.
2. Are there any problems?
   a. **Yes.** Repair damage or replace starter solenoid assembly.
   b. **No.** Go to Test 5.

## 5. Starter Solenoid Test

1. With IGN ON, press the start switch.
2. Does starter solenoid click?
   a. **Yes.** See 3.2 STARTING SYSTEM, Starter Solenoid Clicks.
   b. **No.** Repair open in [61B] socket terminal J (R/BK) wire. **(5041)**

# STARTER SOLENOID CLICKS

**Table 3-9. Starter Solenoid Clicks Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Starter malfunction |
| Starter solenoid malfunction |
| Open battery cable |
| Open starter cable |
| Mechanical binding |

## 1. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery. Attempt to start engine. If starter solenoid continues to click and starter does not engage, then continue with tests. Go to Test 2.

## 2. Starter Voltage Test

1. With IGN ON, test battery voltage at starter solenoid terminal 2 (BK) wire.
2. Is battery voltage present when start switch is pressed?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 4.

## 3. Starter Ground Test

1. Remove starter attaching bolts.
2. Clean bolts and starter base, install starter bolts.
3. Does engine crank?
   a. **Yes, engine cranks at normal speed.** Repair complete.
   b. **Yes, engine cranks, but at a slower speed.** See 3.3 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
   c. **No.** Replace starter. **(5817)**

## 4. Starter Solenoid Voltage Drop Starter Side Test

1. Perform voltage drop test from battery (+) terminal to starter solenoid terminal 2 (BK) wire.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 6.

## 5. Starter Solenoid Battery Side Voltage Drop Test

1. Perform voltage drop test from battery (+) terminal to starter solenoid terminal 1 (BK) wire.

2. Is voltage drop greater than 1.0V?
   a. **Yes.** Repair or replace (BK) wire from starter solenoid terminal 1 to battery (+) terminal. **(5041)**
   b. **No.** Replace starter solenoid assembly. **(5845)**

## 6. Starter Ground Circuit Voltage Drop Test

1. Perform voltage drop test from battery (-) terminal to starter attaching bolts.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Repair or replace (BK) wire from battery (-) terminal or clean ground connections. **(5041)**
   b. **No.** Go to Test 7.

## 7. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See 3.3 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
2. Perform Starter Motor Free Running Current Draw Test (on bench). See 3.4 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Are test results within range?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace starter. **(5817)**

## 8. Mechanical Binding Test

1. Remove spark plugs and place transmission in 5th gear.
2. Raise vehicle.
3. Rotate rear wheel.
4. Check for engine binding in the primary and/or crankshaft or starter clutch.
5. Is engine binding?
   a. **Yes.** Repair as needed. (Use appropriate code).
   b. **No.** Replace starter solenoid assembly. **(5845)**

# STARTER SPINS BUT DOES NOT ENGAGE

**Table 3-10. Starter Spins But Does Not Engage Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Pinion gear |
| Starter clutch |
| Clutch shell and sprocket |

## 1. Pinion Gear and Clutch Shell Test

1. Remove primary cover.
2. Inspect for damage to starter pinion gear and clutch shell and sprocket.
3. Is damage present?
   a. **Yes.** Replace the clutch assembly or clutch shell and sprocket. **(5825)**
   b. **No.** Replace the starter clutch assembly. **(5837)**

# STARTER STALLS OR SPINS TOO SLOWLY

**Table 3-11. Starter Stalls or Spins Too Slowly Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Starter malfunction |
| Starter solenoid malfunction |
| Poor connections at starter ground |
| Open battery cable |
| Open starter cable |
| ACR malfunction (if equipped) |

## 1. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery. If symptom continues, then continue with tests. Go to Test 2.

## 2. Starter Stud Voltage Drop Test

1. Perform voltage drop test from battery (+) terminal to starter solenoid terminal 2 (BK) wire. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 3.

## 3. Starter Ground Circuit Voltage Drop Test

1. Perform voltage drop test between battery (-) terminal and starter attaching bolts.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Clean ground connections. **(5041)**
   b. **No.** Go to Test 4.

## 4. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See 3.3 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
2. Perform Starter Motor Free Running Current Draw Test (on bench). See 3.4 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Are test results within range?
   a. **Yes.** With the spark plugs removed and the transmission in 5th gear, rotate rear wheel. Check for engine, primary and/or crankshaft bind. (Use appropriate code.)
   b. **No.** Replace starter. **(5817)**

## 5. Starter Solenoid Voltage Drop Starter Side Test

1. Perform voltage drop test between battery (+) terminal to starter solenoid terminal 1.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Repair or replace connection between battery (+) terminal and starter solenoid terminal 1 (R) wire. **(5041)**
   b. **No.** Replace starter solenoid assembly. **(5845)**

# TESTING STARTER ON MOTORCYCLE 3.3

## STARTER CURRENT DRAW TEST

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

*NOTES*

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

Check starter current draw with an induction ammeter before disconnecting battery. Proceed as follows:

1. Verify that transmission is in neutral and engine stop switch is in OFF position.
2. Remove start relay.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect patch cord to fuse block [61B] socket terminals C and J.
4. Clamp induction ammeter over positive starter cable to starter solenoid.

*NOTE*

*In next step with engine stop switch in OFF position and purple male probes connected to the [61B] terminals C and J in place of the start relay, starter will turn but engine will not start. This configuration also prevents diagnostic trouble codes from being set.*

5. With IGN ON, read the ammeter. Disregard initial high current reading which is normal when engine is first turned over.
   a. Typical starter current draw will range between 160-200A.
   b. If starter current draw exceeds 250A, then the problem may be in the starter or starter drive. See 3.4 TESTING STARTER ON BENCH, Free Running Current Draw Test.

# TESTING STARTER ON BENCH 3.4

## FREE RUNNING CURRENT DRAW TEST

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.
2. See Figure 3-5. Attach one heavy jumper cable (6 gauge minimum).
   a. Connect one end to the starter mounting flange.
   b. Connect the other end to the battery (-) terminal of a fully charged battery.
3. Connect a second heavy jumper cable (6 gauge minimum).
   a. Connect one end to the battery (+) terminal of the battery.
   b. Connect the other end to the battery terminal on the starter. Place an induction ammeter over cable.

**⚠CAUTION**

**Keep fingers and clothing away from starter gear to prevent personal injury. (00613b)**

4. Connect a smaller jumper cable (14 gauge minimum).
   a. Connect one end to the positive (+) terminal of the battery.
   b. Connect the other end to the solenoid relay terminal.
5. Check ammeter reading.
   a. Ammeter should show 90A max.
   b. If reading is higher, replace starter.
   c. If starter current draw on vehicle was over 200A and this test was within specification, there may be a problem with engine or primary drive.

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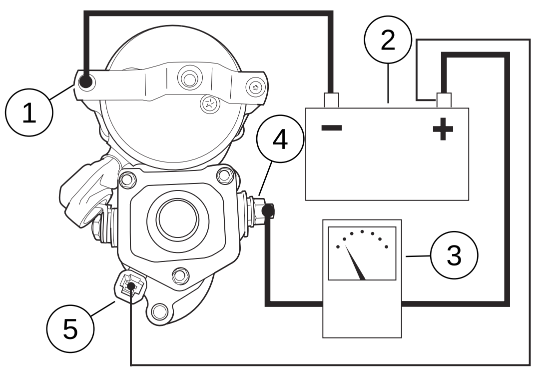


1. **Mounting flange**
2. **Battery**
3. **Induction ammeter**
4. **Battery terminal**
5. **Relay terminal**

**Figure 3-5. Free Running Current Draw Test**

## STARTER SOLENOID

Do not disassemble solenoid. Before testing, disconnect field wire from solenoid motor terminal as shown in Figure 3-6.

Perform each test for only 3-5 seconds to prevent damage to solenoid.

Perform the solenoid Pull-in, Hold-in and Return tests 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 3-6. Using a 12V 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 solenoid assembly.

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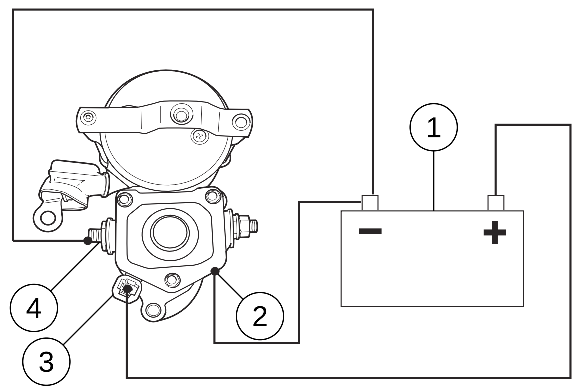


1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

**Figure 3-6. Pull-In Test**

## SOLENOID HOLD-IN TEST

1. See Figure 3-7. With test leads still connected in the manner specified in the previous 3.4 TESTING STARTER ON BENCH, Solenoid Pull-In Test, disconnect solenoid motor terminal/battery negative test lead 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 solenoid assembly.

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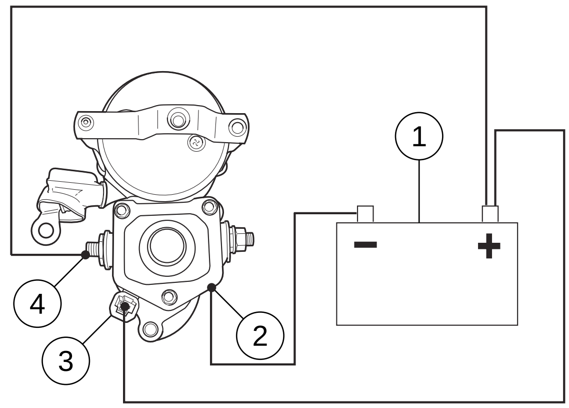


1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

**Figure 3-7. Hold-In Test**

## SOLENOID RETURN TEST

1. See Figure 3-8. With test leads still connected in the manner specified at the end of 3.4 TESTING STARTER ON BENCH, Solenoid Hold-In Test, disconnect solenoid relay terminal/positive battery post test lead at either end.
2. Observe starter pinion.
   a. If starter shaft retracts, solenoid is working properly.
   b. If starter shaft does not retract, replace solenoid assembly.

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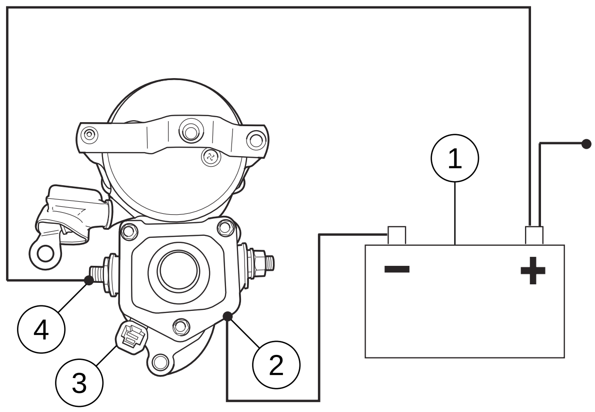



1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

**Figure 3-8. Return Test**

# CHARGING SYSTEM 3.5

## DESCRIPTION AND OPERATION

The charging system is the source of electric current that supplies power to run the ignition, lights, accessories, and charge the battery. AC voltage is generated by an alternator assembly driven by the crankshaft. A rotor supplied with a magnetic field spins around a stator. A rectifier (located in the regulator) converts the voltage from AC to DC. A regulator ensures that the output voltage is properly matched to the battery voltage as engine speed varies. Even though the alternator provides additional voltage at all engine speeds, it is not recommended to idle the vehicle for long periods of time.

### Alternator

The alternator consists of two main components:

- The rotor which mounts to the primary side of the crankshaft.
- The stator which is attached to the crankcase half.

### Voltage Regulator

See Figure 3-9. The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating.

The voltage regulator has a high temperature protection shutdown circuit that will turn off the charging system if the regulator reaches an over temperature condition. If this occurs, the charging system will turn off until the regulator temperature cools to a safe operating temperature, at which time the regulator will resume normal operation. This sequence will repeat if the excessive temperatures are again detected.

## TROUBLESHOOTING

### Battery

Test for a weak or dead battery. Battery must be fully charged in order to perform a conductance test, load test or starting or charging tests. See 3.1 BATTERY TESTING.

### Wiring

The stator connections must be clean and tight.

Check for corroded or loose connections in the charging system circuit.

### Voltage Regulator Inspection

The voltage regulator must have clean, tight connections for proper operation. Verify both AC and DC connectors are fully inserted and locked with the regulator latch.

### Job/Time Code Values

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

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

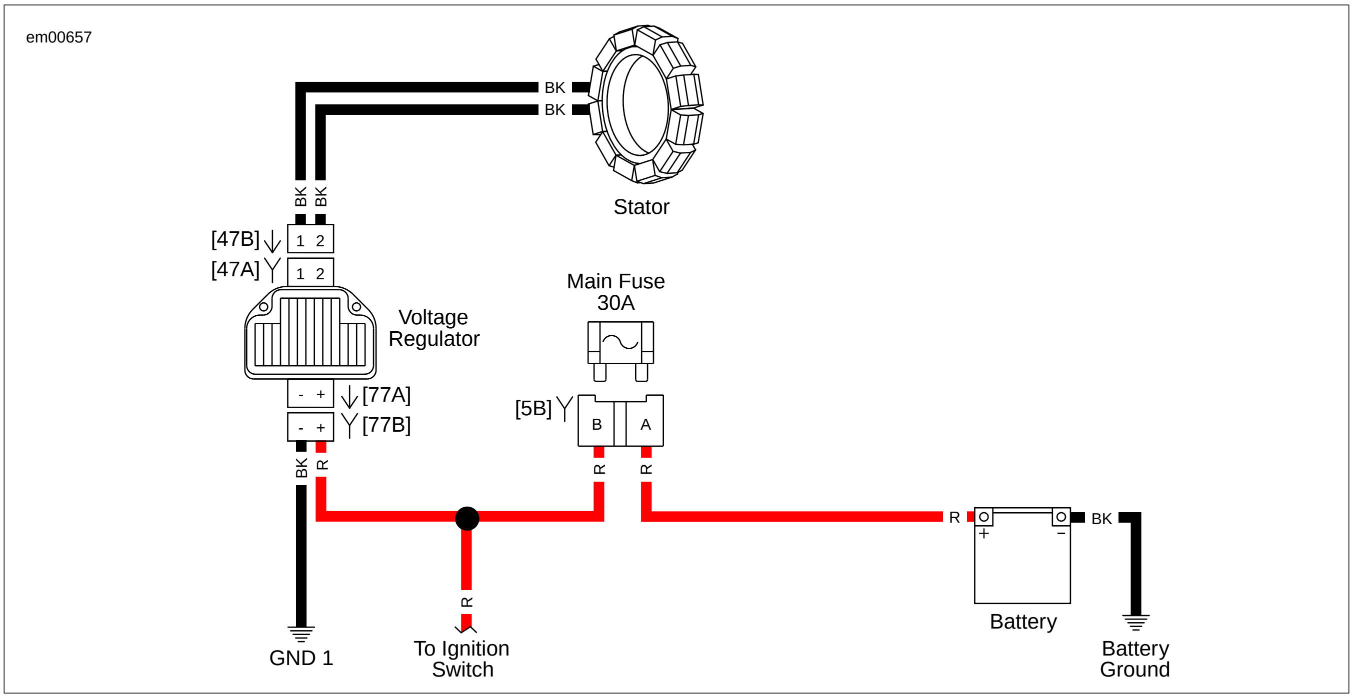



**Figure 3-9. Charging System Circuit**

## LOW OR NO CHARGING

**Table 3-12. Low or No Charging Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Stator malfunction |
| Rotor malfunction |
| Voltage regulator malfunction |
| Open voltage regulator circuit |
| Stator shorted to ground |
| AC wire shorted to ground |

### 1. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery. Verify repair.

*NOTE*

*A discharged battery may show a reading under 13V even though the charging system is working properly.*

### 2. Off Idle Voltage Test

1. With vehicle in neutral, start engine and run at 3000 rpm.
2. Test battery voltage.
3. Is voltage above 13V?
   a. **Yes.** Charging system working properly.
   b. **No.** Go to Test 3.

### 3. AC Output Test

1. Perform an AC output test. See 3.5 CHARGING SYSTEM, Battery Charging Tests.
2. Did the output test pass?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 4.

### 4. Stator Test

1. Perform stator test. See 3.5 CHARGING SYSTEM, Battery Charging Tests.
2. Is the stator good?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace stator. **(5309)**

### 5. Rotor Inspection Test

1. Inspect rotor for damage.
2. Inspect for loose rotor fastener and worn splines.
3. Verify that stator bolts have not backed out and contacted the rotor.
4. Is rotor in good condition?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace rotor. **(5319)**

### 6. Voltage Regulator Power Circuit Test

1. With IGN OFF, disconnect voltage regulator [77].
2. Test continuity between [77B] terminal + and main fuse [5B].
3. Is continuity present?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair or replace wire between [77B] terminal + and [5B]. **(5041)**

### 7. Voltage Regulator Ground Circuit Test

*NOTE*

*The voltage regulator ground must have a clean, tight connection for proper grounding.*

1. Test resistance between voltage regulator [77B] terminal - and ground.
2. Is resistance less than 0.5 Ohms?
   a. **Yes.** Replace voltage regulator. **(5316)**
   b. **No.** Repair or replace wire between [77B] terminal - and GND 1 (BK) wire. **(5041)**

## OVERCHARGING

**Table 3-13. Overcharging Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Voltage regulator malfunction |
| Open in GND 1 circuit |

### 1. Battery Voltage Test

1. With the vehicle in neutral, start engine and run at 3000 rpm, test battery voltage.
2. Is voltage above 15.5V?
   a. **Yes.** Go to Test 2.
   b. **No.** Charging system working properly.

### 2. Voltage Regulator Ground Circuit Test

*NOTE*

*The voltage regulator ground must have a clean, tight connection for proper grounding.*

1. With IGN OFF, disconnect voltage regulator [77].
2. Test resistance between voltage regulator [77B] terminal - and ground.
3. Is resistance less than 0.5 Ohms?
   a. **Yes.** Replace voltage regulator. **(5316)**
   b. **No.** Repair open wire between voltage regulator [77B] terminal - and GND 1 (BK) wire. **(5041)**

## LOW BATTERY AFTER EXTENDED IGN OFF

**Table 3-14. Low Battery After Extended IGN OFF Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Battery |
| Accessories improperly wired to stay on at all times |
| Excessive draw from electrical component with IGN OFF |
| Battery self-discharge and/or component draw because motorcycle was not operated for a long period |

### 1. Battery Test

1. Verify battery condition. See 3.1 BATTERY TESTING.
2. Is battery condition good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

### 2. Amp Draw Test

1. Perform milliampere draw test. See 3.5 CHARGING SYSTEM, Battery Charging Tests.
2. Did the test exceed maximum draw?
   a. **Yes.** Repair excessive draw and run test again. **(5308)**
   b. **No.** System is working properly.

## BATTERY RUNS DOWN DURING USE

**Table 3-15. Battery Runs Down During Use Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Excessive accessory draw |
| Accessories on when idling or low rpm riding for extended period |

### 1. Total Current Draw Test

1. Perform Total Current Draw and Output Test. See 3.5 CHARGING SYSTEM, Battery Charging Tests.
2. Does charging system exceed current draw by 3.5A?
   a. **Yes.** Go to Test 2.
   b. **No.** System accessory power requirements exceed charging system capability.

### 2. Battery Test

1. Perform a battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** System is working properly.
   b. **No.** Replace battery.

## BATTERY CHARGING TESTS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

### Milliampere Draw Test

*NOTE*

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

1. If vehicle is equipped with HFSM, enable service mode before performing test.
2. Disconnect the security siren (if equipped).
3. Remove main fuse.

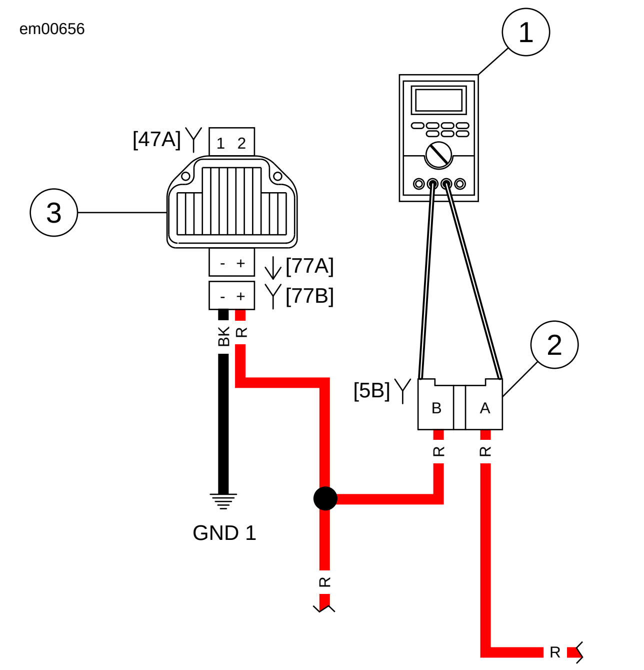
*NOTE*

*With IGN OFF, an initial current draw of up to 200 mA will occur directly after connecting meter. This should drop to the values shown in Table 3-16 in less than one minute.*

4. See Figure 3-10. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect ammeter to main fuse socket terminals. With this arrangement, you will pick up any drain.
5. With IGN OFF and all lights and accessories off, observe current reading.
   a. Add voltage regulator draw to appropriate value for TSM, TSSM or HFSM and ECM. If observed ammeter reading is less than listed in table, draw is within limits. Refer to Table 3-16.
   b. A higher reading indicates excessive current draw. Check all accessories for excessive drain.

**Table 3-16. Milliampere Draw Test**

| ITEM | MAXIMUM DRAW IN MILLI-AMPERES |
|---|---|
| Speedometer | 1.0 |
| Tachometer (if equipped) | 1.0 |
| Regulator | 1.0 |
| TSM (non security models) | 1.0 |
| TSSM (disarmed) | 3.0 |
| TSSM (armed) | 3.0 |
| TSSM or HFSM-Storage mode (armed or disarmed) | 1.0 |
| HFSM | 1.0 |
| ECM | 1.0 |
| Security siren (optional) | 20.0* |
| * Siren will draw for 2-24 hours from time motorcycle battery is connected and 0.05 mA once siren battery is charged. Disconnect siren during milliampere draw test. | |




1. **Ammeter**
2. **Main fuse socket**
3. **Voltage regulator**

**Figure 3-10. Milliampere Draw Test (Ignition Turned to OFF)**

## Total Current Draw and Output Test

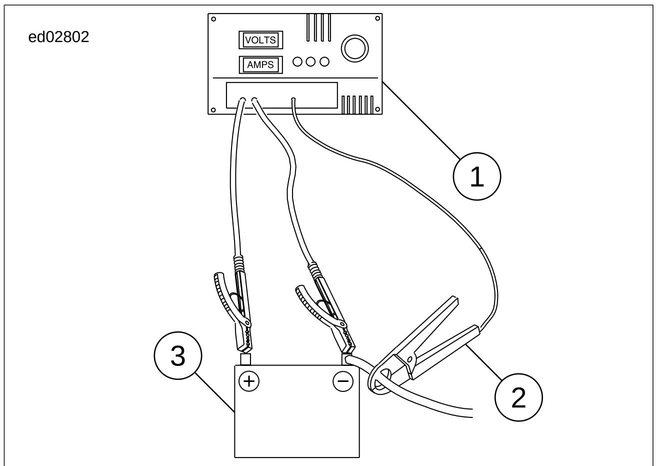
If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

*NOTE*

*If a load tester is unavailable, use an ammeter with current probe.*

**⚠WARNING**

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




1. **Load tester**
2. **Induction pickup**
3. **Battery**

**Figure 3-11. Check Current Draw (Ignition Switch On)**

1. See Figure 3-11. Connect load tester.
   a. Connect negative and positive leads to battery terminals.
   b. Place load tester induction pickup over battery negative cable.
2. With IGN OFF, disconnect voltage regulator [77].
3. Start engine.
4. Turn all continuously running lights and accessories ON (headlamp on high beam).
5. Run engine at 3000 rpm and make note of the current draw.
6. Turn engine OFF.
7. With IGN OFF, connect voltage regulator [77].
8. Remove the induction pickup from the battery negative cable.
9. Place induction pickup over positive regulator cable.
10. Start engine and run at 3000 rpm.

*NOTE*

*Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.*

11. Increase the load as required to obtain a constant 13.0V.
12. Current output should be 24-30A. Make note of current output.

*NOTE*

*Rider's habits may require output test at lower rpm.*

13. Compare both of these readings.
    a. The current output should exceed current draw by 3.5A minimum.
    b. If output does not meet specifications, there may be too many accessories for the charging system to handle.

## Stator Test

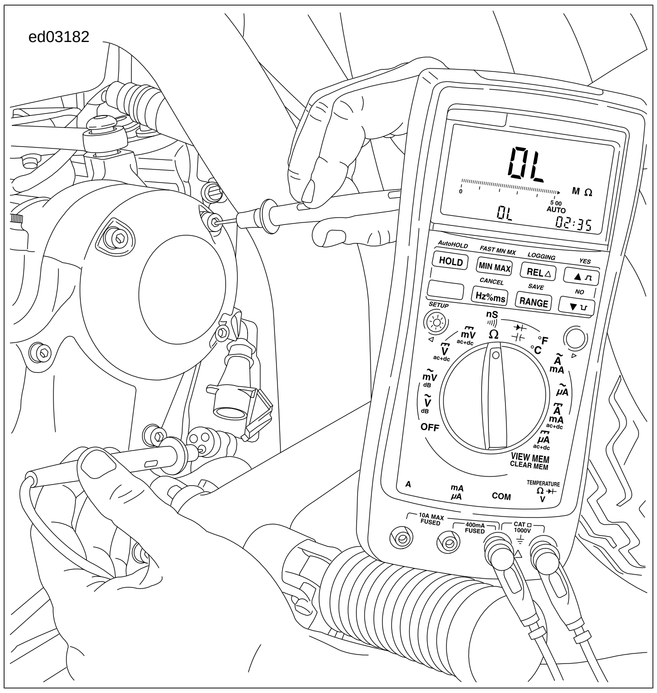



**Figure 3-12. Test for Grounded Stator (Typical)**

1. Turn IGN OFF.
2. See Figure 3-12. Connect an ohmmeter.
   a. Disconnect voltage regulator [47] from 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.
   a. A good stator will show no continuity (open circuit) between all stator sockets and ground.
   b. Any other reading indicates a grounded stator which must be replaced.
4. See Figure 3-13. Remove ground lead. Measure resistance across stator [47B] terminals 1-2.
   a. Resistance across all the stator terminals should be 0.1-0.3 Ohm.
   b. If the resistance is higher, the stator is damaged and must be replaced.
   c. If resistance is lower, the stator may have a turn-to-turn short and should be replaced.

*NOTE*

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

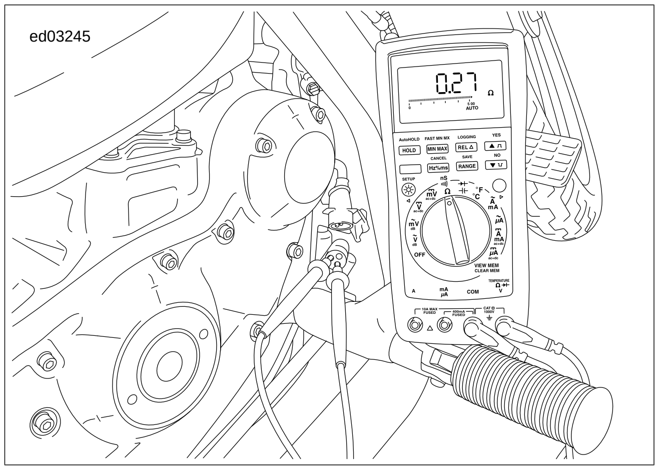



**Figure 3-13. Check for Stator Resistance (Typical)**

## AC Output Test

1. See Figure 3-14. Test AC output.
   a. Disconnect voltage regulator [47] from alternator stator wiring.
   b. Test for VAC across stator [47B] terminals 1 to 2.
   c. Run the engine at 2000 rpm. The VAC output should be 40-56 VAC (approximately 20-28 per 1000 ).
2. Compare test results to specifications.
   a. If the output is below specifications, charging problem could be a faulty rotor or stator.
3. Check the output again as previously described under Total Current Draw and Output Test.

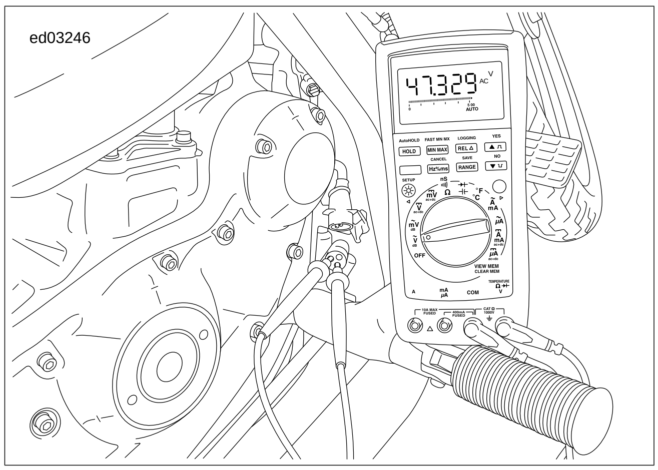



**Figure 3-14. Check Stator AC Voltage Output (Typical)**

# DTC B0563, P0562, P0563 3.6

## DESCRIPTION AND OPERATION

Battery voltage is monitored by several modules. The modules set DTCs if the battery voltage fails to meet the parameters.

### DTC B0563

Battery voltage is monitored by the TSM, TSSM or HFSM on terminal 1. DTC B0563 is displayed when the TSM, TSSM or HFSM exceeds 16.0V for more than 5.0 ±0.5 seconds.

### DTC P0562 and P0563

Battery voltage is monitored by the ECM on terminal 72.

- DTC P0562 is displayed when battery voltage is less than 12.2V at idle and voltage does not increase when engine speed is greater than 2000 rpm.
- DTC P0563 is displayed when battery voltage is greater than 15.0V for more than 4 seconds.

**Table 3-17. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B0563 | TSM, TSSM or HFSM voltage high |
| P0562 | ECM voltage low |
| P0563 | ECM voltage high |

## DIAGNOSTICS

### Diagnostic Tips

Any of the following conditions could cause these DTCs to set:

- The vehicle is placed on a battery charger, on fast charge, for a long period of time.
- The charging system is malfunctioning.
- There is excessive battery draw and/or extended idling in heavy traffic.
- A faulty system ground is present.

Low voltage generally indicates a loose wire, corroded connections, battery and/or a charging system problem.

High voltage DTC may set when the vehicle is placed on a battery charger, for a long period of time.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

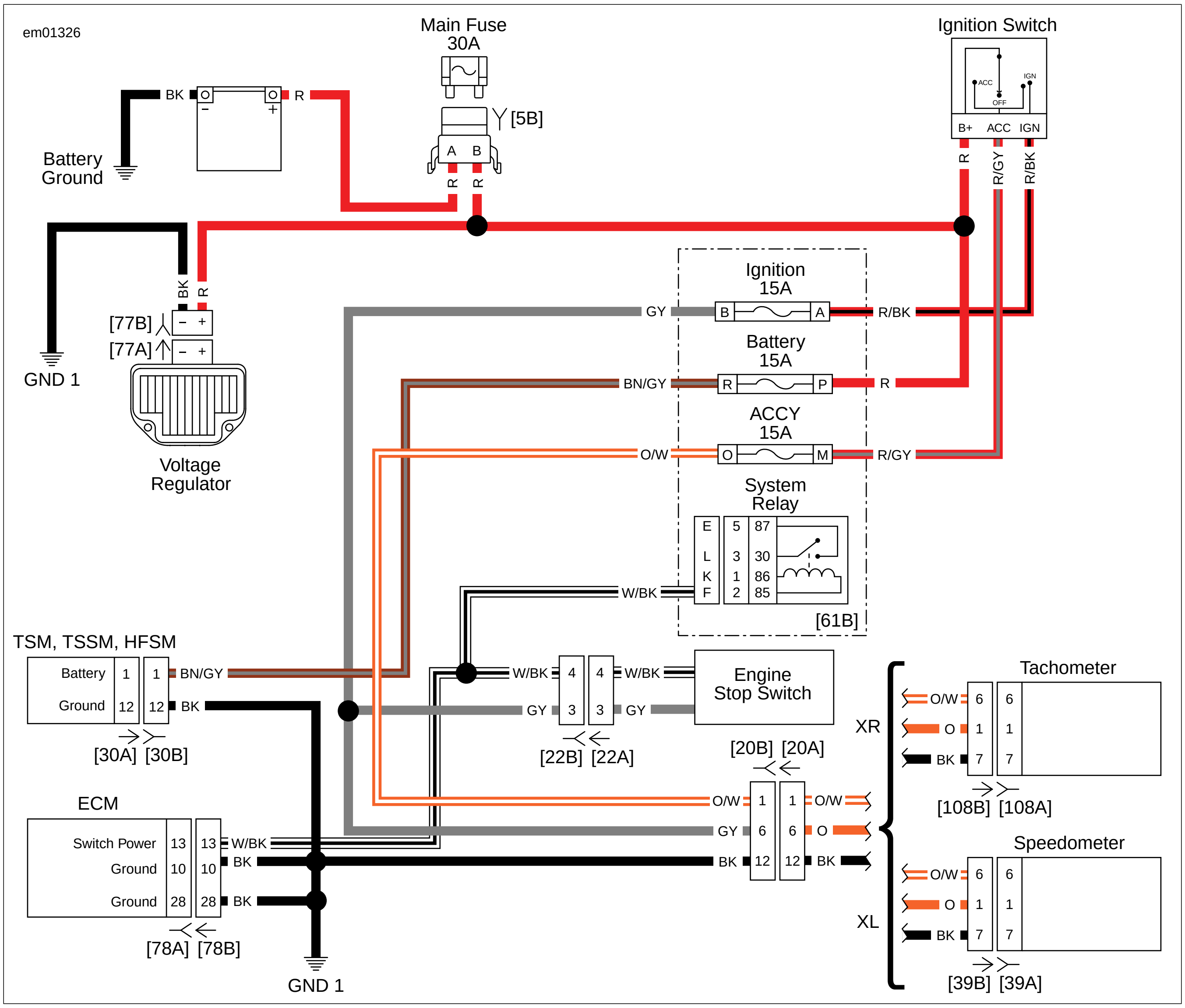



**Figure 3-15. High and Low Voltage Sensors**

## DTC P0562

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 3-18. DTC P0562 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Low battery |
| Ignition switch malfunction |
| Engine stop switch malfunction |
| Open ECM ground circuit |
| Open ECM switched power circuit |
| Open ignition circuit |

## 1. Battery Test

1. Perform a battery test. See [3.1 BATTERY TESTING](#).
2. Did battery pass test?
   a. **Yes.** [Go to Test 2.](#)
   b. **No.** Replace battery. Verify repair.

## 2. Charging System Test

1. Perform charging system test. See [3.5 CHARGING SYSTEM, Low or No Charging](#).
2. Is charging system working properly?
   a. **Yes.** [Go to Test 3.](#)
   b. **No.** Repair charging system.

## 3. ECM Switched Voltage Test

1. Turn IGN OFF.
2. Disconnect ECM [78].
3. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78A] and [78B]. See [1.2 DIAGNOSTIC TOOLS](#).

4. With engine stop switch in the RUN position and transmission in neutral, turn the IGN ON.
5. Test voltage between terminals BOB 13 and 28.
6. Is battery voltage present?
   a. **Yes.** System is working properly.
   b. **No.** Go to Test 4.

## 4. ECM Switched Voltage Drop Test

1. Perform a voltage drop test between battery (+) terminal and BOB terminal 13. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 5.

## 5. ECM Ground Circuit Voltage Drop Test

1. Perform a voltage drop test between BOB terminals 10 and 28 and battery (-) terminal.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Repair wiring between ECM [78B] terminals 10 and 28 and battery negative.
   b. **No.** Problem may be intermittent. Locate and repair bad connection. Perform 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

## 6. ECM Switched Power Circuit Resistance Test

1. With IGN OFF, remove system relay.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal 13 and fuse block [61B] socket terminal F (W/BK) wire.
3. Is resistance greater than 1 Ohm?
   a. **Yes.** Repair (W/BK) wire between ECM [78B] terminal 13 and [61B] socket terminal F.
   b. **No.** Go to Test 7.

## 7. Switched Power Circuit Resistance Test

1. Disconnect right hand controls [22].
2. Test resistance between [22B] terminal 4 and [61B] socket terminal F (W/BK) wire.
3. Is resistance greater than 1 Ohm?
   a. **Yes.** Repair (W/BK) wire between [22B] terminal 4 and [61B] socket terminal F.
   b. **No.** Go to Test 8.

## 8. Ignition Circuit Resistance Test

1. Test resistance between ignition fuse [61B] socket terminal B and [22B] terminal 3 (GY) wire.
2. Is resistance greater than 1 Ohm?
   a. **Yes.** Repair (GY) wire between [61B] socket terminal B and [22B] terminal 3.
   b. **No.** Go to Test 9.

## 9. Engine Stop Switch Test

1. Test resistance between [22A] terminals 4 (GY) wire and 3 (W/BK) wire.
2. Is resistance greater than 1 Ohm?
   a. **Yes.** Replace the engine stop switch assembly.
   b. **No.** Go to Test 10.

## 10. Ignition Circuit Voltage Drop Test

1. With IGN ON, perform a voltage drop test between battery (+) terminal and [61B] terminal A. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 11.
   b. **No.** Go to Test 13.

## 11. Ignition Circuit Resistance Test

1. With IGN OFF, remove main fuse [5].
2. Turn IGN ON.
3. Test resistance between main fuse [5B] terminal B and [61B] socket terminal A.
4. Is resistance greater than 1 Ohm?
   a. **Yes.** Replace ignition switch or repair wire between main fuse [5B] terminal B and [61B] socket terminal A.
   b. **No.** Go to Test 12.

## 12. Ignition Switch Battery Circuit Voltage Drop Test

1. Perform a voltage drop test between battery (+) terminal and [5B] terminal A (R) wire.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Replace main fuse. Go to Test 13.
   b. **No.** Repair wire between battery terminal (+) and main fuse [5B] terminal A.

## 13. Repair Validation Test

1. Clear DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does code set?
   a. **Yes.** Replace ECM.
   b. **No.** System working properly.

## DTC B0563, P0563

**Table 3-19. DTC B0563, P0563 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Charging system malfunction |

### 1. Charging System Test

1. Perform charging system tests. See 3.5 CHARGING SYSTEM.
2. Is charging system good?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair charging system.

### 2. Repair Validation Test

1. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does code set?
   a. **Yes, DTC B0563.** Replace TSM, TSSM or HFSM.
   b. **Yes, DTC P0563.** Replace ECM.
   c. **No.** System working properly.

# DTC B1006, B1007 3.7

## DESCRIPTION AND OPERATION

Battery voltage is constantly monitored by the speedometer (XL) and tachometer (XR). If the battery voltage fails to meet normal operating parameters, a DTC is set.

### DTC B1006 and B1007

The speedometer (XL) and tachometer (XR) monitors terminal 1 for ignition power, and terminal 6 for accessory power.

- DTC B1006 is displayed when accessory line voltage is greater than 16.0V for longer than 5 seconds.
- DTC B1007 is displayed when ignition line voltage is greater than 16.0V for longer than 5 seconds.

*NOTE*

*ECM, ECU, and/or TSM, TSSM or HFSM may also set a battery voltage DTC.*

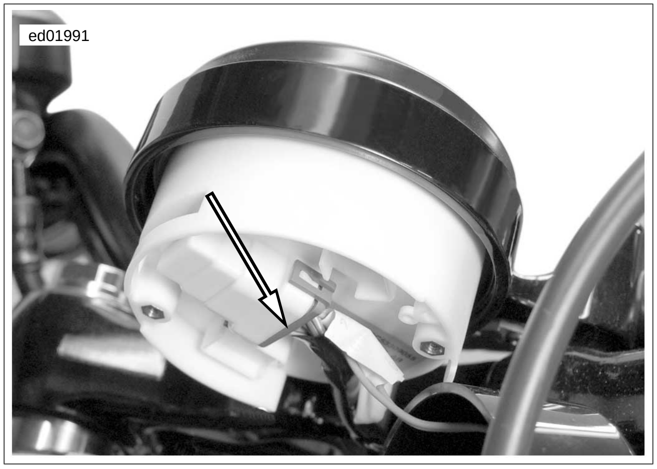
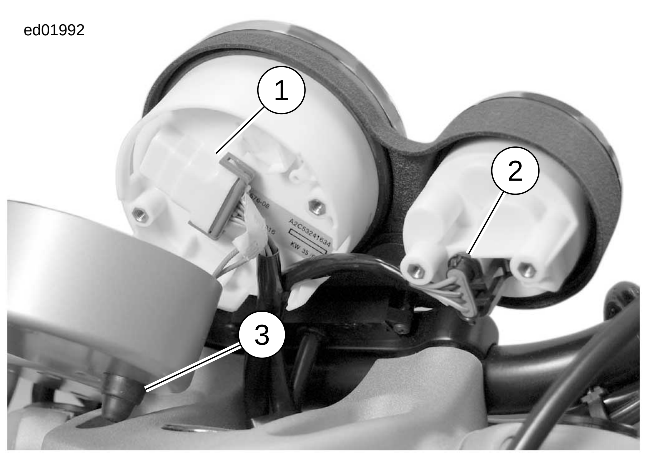



**Figure 3-16. Speedometer [39]: XL**




1. **Tachometer [108]**
2. **Speedometer [39]**
3. **Trip odometer reset switch**

**Figure 3-17. Instruments: XR**

**Table 3-20. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1006 | Accessory line overvoltage |
| B1007 | Ignition line overvoltage |

### Diagnostic Tips

Voltage high DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.

## DTC B1006, B1007

**Table 3-21. DTC B1006, B1007 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Charging system malfunction |

### 1. Charging System Test

1. Perform charging system tests. See 3.5 CHARGING SYSTEM.
2. Is charging system good?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair charging system.

### 2. Repair Validation Test

1. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does code reset?
   a. **Yes, XL.** Replace speedometer.
   b. **Yes, XR.** Replace tachometer.
   c. **No.** System working properly.

# NOTES

TABLE OF CONTENTS

# NOTES

## DESCRIPTION AND OPERATION

The instruments on the XL and XR look significantly different but do many of the same functions:

- The XL has only a speedometer, which contains the check engine lamp, low fuel lamp, battery lamp, security lamp and the sixth gear indicator, which is not used.
- The XR has a speedometer that displays vehicle speed in a digital output, and a tachometer. All the functions, including the indicators, the odometer and the trip odometer reset switch, are located in the tachometer.

### Trip Odometer Reset Switch Operation

Pressing the trip odometer reset switch provides the following capabilities:

- Change the odometer display between mileage, trip and fuel range values (press and immediately release).
- Reset the trip odometer (press and hold 2-3 seconds).
- Gain access to self-diagnostic mode and clear diagnostic codes. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

The odometer mileage is permanently stored and will not be lost when electrical power is turned off or disconnected. The trip odometer reset switch allows switching between the odometer, trip odometer and fuel range displays.

To zero the trip odometer, have the odometer display visible, press and keep the trip odometer reset switch depressed. The trip odometer mileage will be displayed for 2-3 seconds and then the trip mileage will return to zero miles.

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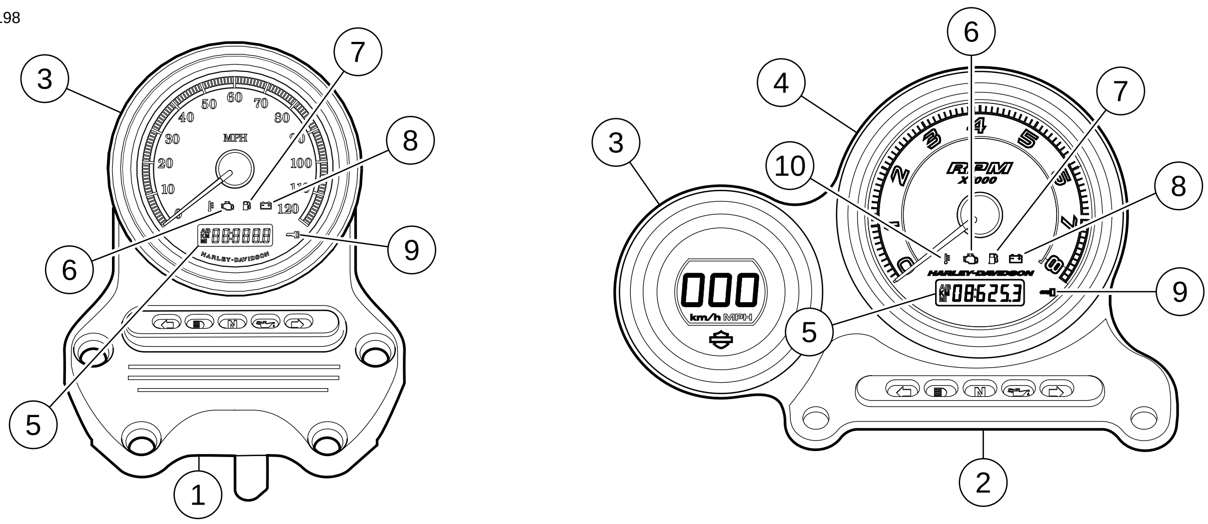



1. **Instruments: XL models**
2. **Instruments: XR 1200X**
3. **Speedometer**
4. **Tachometer: XR 1200X**
5. **Odometer**
6. **Check engine lamp**
7. **Low fuel lamp**
8. **Battery lamp**
9. **Security system lamp**
10. **Temperature lamp**

**Figure 4-1. Instruments**

### Selecting Instrument Units: XR Models

The instrument units can be displayed in miles or kilometers.

1. Turn the ignition switch to the ACC or ON position.
2. Press the trip odometer reset switch to select the odometer display screen.
3. Press and hold the trip odometer reset switch until the units change (miles/kilometers).
4. To change the units again, release trip odometer reset switch, then press and hold until units change again.

## SPEEDOMETER THEORY OF OPERATION

The speed sensor is mounted on the right side of transmission case. The sensor circuitry is a Hall-Effect sensor that is triggered by the gear teeth of 5th gear on the transmission mainshaft.

The output from the sensor is a series of pulses that are interpreted by ECM circuitry, converted into serial data then sent to the speedometer. The speedometer converts the data to control the position of the speedometer needle (XL) or the digital speedometer display (XR). It also provides input to the TSM, TSSM or HFSM for turn signal cancellation.

## TACHOMETER THEORY OF OPERATION

The tachometer receives serial data from the ECM. The ECM converts the signal from the CKP to serial data and sends it to the tachometer. The tachometer interprets the serial data and converts it into tachometer needle movement.

## INSTRUMENT DIAGNOSTICS

The speedometer and tachometer monitor direct inputs from sensors and switches, along with receiving information from the ECM over the serial data circuit. They set codes when the parameters for the inputs are out of range. These codes begin with a B prefix to separate them from other types of codes.

**Table 4-1. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1004 | Fuel level sensor low |
| B1005 | Fuel level sensor high/open |
| B1006 | Speedometer accessory voltage high |
| B1007 | Speedometer ignition voltage high |
| B1008 | Trip switch closed |

Some sensors and switches send direct inputs to the instruments and do not have DTCs associated with them. Therefore, symptoms may occur indicating a fault without any DTCs present.

# DTC B1004, B1005 4.2

## DESCRIPTION AND OPERATION

The fuel level is monitored by the speedometer [39] (XL) or tachometer [108] (XR) at terminal 9 (Y/W) wire.

- If the voltage on terminal 9 exceeds the lower limit for greater than or equal to 15 seconds a DTC B1004 will be set and the low fuel warning lamp will illuminate.
- If the voltage on terminal 9 exceeds the upper limit (or is open) for greater than or equal to 15 seconds a DTC B1005 will set and the low fuel warning lamp will illuminate.

**Table 4-2. Code Description**

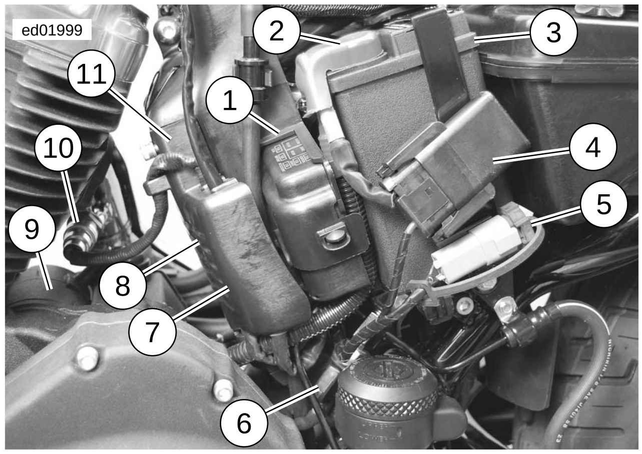
| DTC | DESCRIPTION |
|---|---|
| B1004 | Fuel level sensor or wiring shorted low |
| B1005 | Fuel level sensor or wiring high/open |

Voltage is supplied to the low fuel switch on the (Y/W) wire from the instruments. Voltage is also supplied to the fuel sender resistor assembly [200]. When the fuel level drops below a certain amount, the low fuel switch closes. Refer to Table 4-3.

**Table 4-3. Low Fuel Level Quantity**

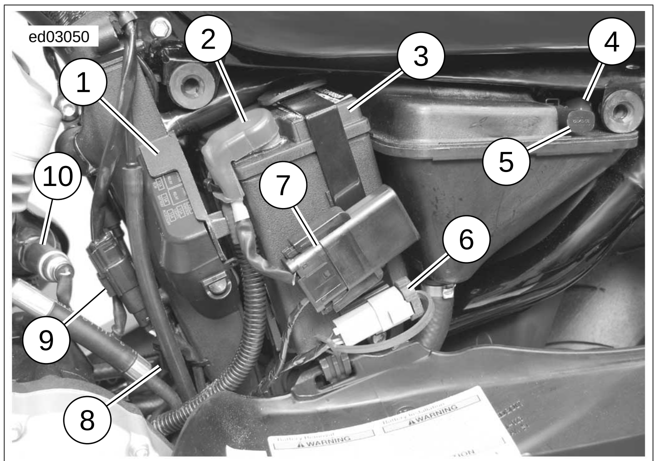
| MODEL | CAPACITY |
|---|---|
| XR 1200X | 0.50 gal (1.89 L) |
| XL 1200X, XL 1200V | 0.65 gal (2.46 L) |
| XL 883R, XL 883N | 0.80 gal (3.03 L) |
| XL 883L, XL1200C, CP, CA, CB | 1.00 gal (3.79 L) |

Voltage then flows through the switch to the fuel sender resistor assembly on the (Y/R) wire. This causes the voltage from the instruments to flow through only part of the resistance. The change in resistance signals the instruments to turn on the low fuel indicator lamp.




1. **Fuel block [61]**
2. **Positive battery cable**
3. **Battery**
4. **Main fuse [5]**
5. **DLC [91]**
6. **Rear stop lamp switch (XL models) [121]**
7. **Fuel pump and low fuel switch [141]**
8. **Rear O2 sensor [137]**
9. **Starter**
10. **Rear O2 sensor**
11. **ECM**

**Figure 4-2. Under Left Side Cover: XL**




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **P&A battery [160]**
5. **Fuel sender resistor assembly [200]**
6. **DLC [91]**
7. **Main fuse [5]**
8. **Rear O2 sensor [137]**
9. **Fuel pump and low fuel switch [141]**
10. **Rear O2 sensor**

**Figure 4-3. Under Left Side Cover: XR**

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

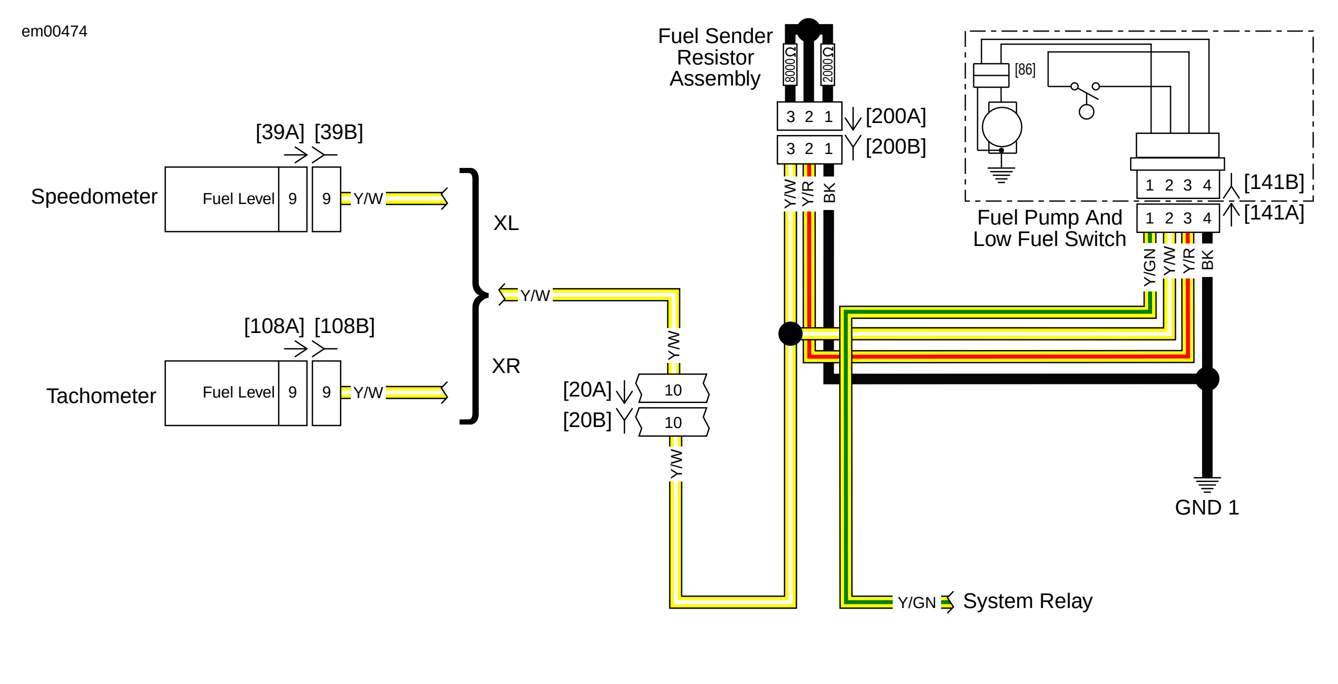



**Figure 4-4. Fuel Sensor Circuit**

## DTC B1004

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 4-4. DTC B1004 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Instrument malfunction |
| Short to ground in fuel level sender circuit |
| Fuel pump and sender assembly malfunction |
| Open fuel level sender circuit |
| Short to ground in accessory power circuit |
| Ignition switch malfunction |
| Open ignition accessory circuit |

### 1. Low Fuel Lamp Circuit Resistance Test

1. Disconnect the speedometer [39] (XL) or tachometer [108] (XR).
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to connector [39] (XL) or [108] (XR). Connect BREAKOUT BOX (Part No. HD-42682) leaving the speedometer [39A] or tachometer [108A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Measure resistance between breakout box terminal 9 and ground.
4. Is resistance greater than 50 Ohms?
   a. **Yes.** Replace the speedometer (XL) or tachometer (XR).
   b. **No.** Go to Test 2.

### 2. Fuel Pump and Sender Assembly Test

1. Disconnect the fuel pump and low fuel switch [141].
2. Measure resistance between breakout box terminal 9 and ground.
3. Is resistance greater than 50 Ohms?
   a. **Yes.** Replace the fuel pump and low fuel switch.
   b. **No.** Go to Test 3.

### 3. Fuel Sender Resistor Assembly Test

1. Disconnect the fuel sender resistor assembly [200].
2. Measure resistance between breakout box terminal 9 and ground.
3. Is resistance greater than 50 Ohms?
   a. **Yes.** Replace the fuel sender resistor assembly.
   b. **No.** Repair short to ground in (Y/W) wire.

## DTC B1005

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 4-5. DTC B1005 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open ground circuit |
| Short to voltage in fuel level sensor circuit |
| Open fuel level sensor circuit |
| Instrument malfunction |
| Fuel sender resistor assembly malfunction |

### 1. Low Fuel Lamp Circuit Voltage Test

1. Disconnect the speedometer [39] (XL) or tachometer [108] (XR).
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to connector [39] (XL) or [108] (XR). Connect BREAKOUT BOX (Part No. HD-42682) leaving the speedometer [39A] or tachometer [108A] disconnected.
3. With IGN ON, test for voltage between breakout box terminal 9 and ground.
4. Is voltage present?
   a. **Yes.** Repair short to voltage in (Y/W) wire.
   b. **No.** Go to Test 2.

### 2. Fuel Sender Resistor Assembly Test

1. Disconnect the fuel level sender resistor assembly [200].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), measure resistance at [200A] between terminals 1 and 3.
3. Is resistance between 9600-10,400 Ohms?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace the fuel sender resistor assembly.

### 3. Low Fuel Lamp Circuit Continuity Test

1. Test for continuity between breakout box terminal 9 and fuel level sender resistor [200B] terminal 3.
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (Y/W) wire.

### 4. Ground Circuit Continuity Test

1. Test for continuity between fuel level sender resistor [200B] terminal 1 and ground.
2. Is continuity present?
   a. **Yes.** Replace speedometer (XL) or tachometer (XR).
   b. **No.** Repair open in (BK) wire between terminal 3 and ground.

# DTC B1008 4.3

## DESCRIPTION AND OPERATION

### Trip Odometer Reset Switch Closed

Code B1008 will be set if trip odometer reset switch terminals are closed for more than 2 minutes.

**Table 4-6. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1008 | Trip odometer reset switch closed |

## DTC B1008

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45928 | TERMINAL REMOVER |

**Table 4-7. DTC B1008 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Trip odometer reset switch boot malfunction |
| Instrument malfunction |
| Trip odometer reset switch malfunction |

### 1. Rubber Boot Test

1. Remove the speedometer (XL) or tachometer (XR).
2. Remove rubber boot.
3. With the speedometer (XL) or tachometer (XR) connected, clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
4. Did DTC B1008 set? This code may take up to 2 minutes to set.
   a. **Yes.** Go to Test 2.
   b. **No.** Replace boot.

### 2. Trip Odometer Reset Switch Test

1. Disconnect speedometer [39]. Using TERMINAL REMOVER (Part No. HD-45928), remove terminal 11 from [39B]. Reconnect [39].
2. Turn IGN ON and observe the check engine lamp.
3. Is the DTC current? See 2.1 INITIAL DIAGNOSTICS, Check Engine Lamp.
   a. **Yes.** Replace speedometer (XL) or tachometer (XR).
   b. **No.** Replace the trip odometer reset switch.

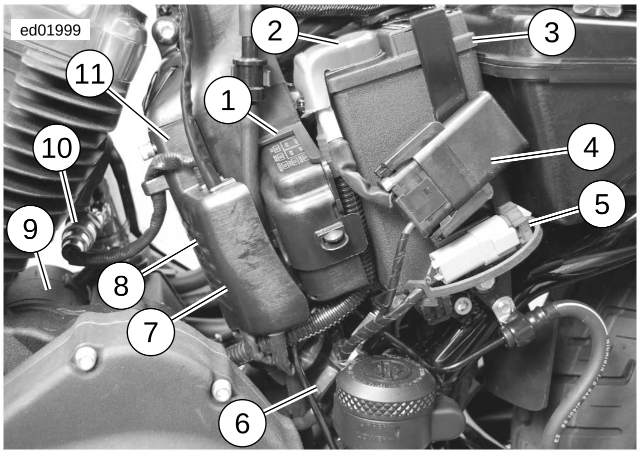
# NO INSTRUMENT POWER 4.4

## DESCRIPTION AND OPERATION

See Figure 4-5. The speedometer (XL) or tachometer (XR) receives battery power at terminal 5 and ignition power at terminal 1. This is supplied through the battery fuse and the ignition fuse located in fuse block [61]. Accessory power is supplied through the ACCY fuse at terminal 6.

The speedometer (XL) or tachometer (XR) goes through an initialization sequence every time power is removed and re-applied to terminal 1. The visible part of this sequence is the illumination of check engine lamp, security lamp, backlighting, odometer and fuel level. With IGN ON, the check engine lamp and security lamp will illuminate for 4 seconds and then (if parameters are normal) go out.

Loss of power on any of the inputs will change the instruments behavior. Refer to Table 4-8.




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **Main fuse [5]**
5. **DLC [91]**
6. **Rear stop lamp switch (XL models) [121]**
7. **Fuel pump and low fuel switch [141]**
8. **Rear O2 sensor [137]**
9. **Starter**
10. **Rear O2 sensor**
11. **ECM**

**Figure 4-5. Under Left Side Cover: XL**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

**Table 4-8. Function Chart - Loss of Input**

| TERMINAL 5 (BATTERY) | TERMINAL 1 (IGN) | TERMINAL 6 (ACC) | TERMINAL 7 (GND) |
|---|---|---|---|
| Instrument is non-functional | Will not "WOW" | Will not "WOW" | Instrument completely non-functional |
| | Needles freeze | Instruments non-functional in ACC position. | Other features non-functional or erratic |
| | Check engine lamp, battery lamp, and security lamp are non-functional backlighting same as ACC position. | Diagnostic mode works | Diagnostics absent |

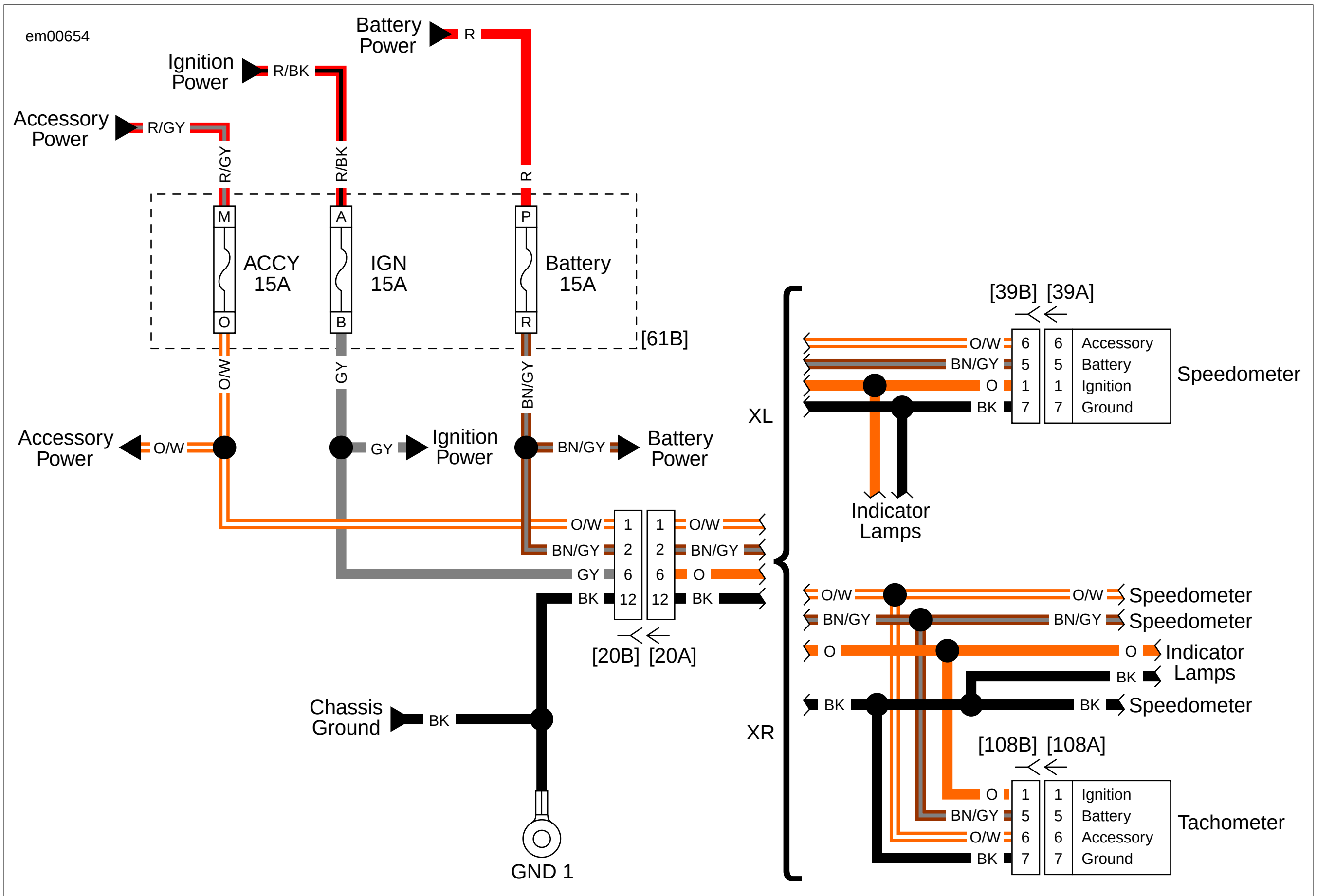



**Figure 4-6. Instruments Power Circuit Diagram**

## SPEEDOMETER (XL) OR TACHOMETER (XR) INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 4-9. Speedometer (XL) or Tachometer (XR) Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Instrument malfunction |
| Open accessory circuit |
| Open battery circuit |
| Open ignition circuit |
| Short to ground in cooling fan circuit |
| Ignition switch malfunction |
| Short to ground in ignition circuit |
| Open ground circuit |
| Short in accessory circuit |

## 1. Battery and Ignition Function Test

1. Turn IGN ON.
2. Does the instrument have full function?
   a. **Yes.** Go to Test 2.
   b. **No, check engine lamp, battery lamp and security lamp are inoperative but backlighting is functional.** Go to Test 8.
   c. **No, instrument does not operate at all.** Go to Test 4.

## 2. Accessory Function Test

1. Turn IGN to ACC.
2. Does the instrument have full ACC function?
   a. **Yes.** Concern is intermittent, perform a wiggle test to test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 3.

## 3. Accessory Fuse Test

1. With IGN OFF, connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to speedometer [39] (XL) or tachometer [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] (XL) or [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.

2. Turn IGN ON.
3. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage at breakout box terminal 6.
4. Is battery voltage present?
   a. **Yes.** Replace the speedometer (XL) or tachometer (XR). **(7311)**
   b. **No.** Repair open in (O/W) wire. **(5043)**

## 4. Battery Fuse Test

1. Inspect the battery fuse.
2. Is the fuse good?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 7.

## 5. Battery Circuit to Battery Fuse Test

1. Test for voltage at fuse block [61B] socket terminal P.
2. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open between battery fuse and main fuse (R) wire. **(5041)**

## 6. Battery Circuit to Instrument Test

1. With IGN OFF, connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to speedometer [39] (XL) or tachometer [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] (XL) and [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Install battery fuse in fuse block.
3. Test for voltage at breakout box terminal 5.
4. Is battery voltage present?
   a. **Yes.** Go to Test 13.
   b. **No.** Repair open between [39B] terminal 5 and [61B] socket terminal R (BN/GY) wire. **(5041)**

## 7. Instrument Battery Circuit Short to Ground Test

1. With IGN OFF, connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to speedometer [39] (XL) or tachometer [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] (XL) and [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminal 5 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (BN/GY) wire. **(5041)**
   b. **No.** Concern is intermittent, perform a wiggle test to test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. Replace the battery fuse.

## 8. Ignition Circuit Test

1. Turn IGN OFF for at least 15 seconds.
2. Turn IGN ON and the engine stop switch to RUN.
3. Does the fuel pump run and then shut off?
   a. **Yes.** Go to Test 9.
   b. **No.** Go to Test 10.

## 9. Instrument Power Circuit Test

1. With IGN OFF, disconnect speedometer [39] (XL) or tachometer [108] (XR).
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39] (XL) or [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] (XL) or [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON, test for voltage between breakout box terminal 1 and ground.
4. Is battery voltage present?
   a. **Yes.** Replace speedometer (XL) or tachometer (XR). **(7311)**
   b. **No.** Repair open in (GY) or (O) ignition wire. **(5041)**

## 10. Ignition Fuse Test

1. Inspect the ignition fuse.
2. Is the fuse good?
   a. **Yes.** Go to Test 11.
   b. **No.** Go to Test 12.

## 11. Ignition Power to Ignition Fuse Test

1. With IGN ON, test for battery voltage between fuse block [61B] socket terminal A and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (GY) wire. **(5041)**
   b. **No.** Inspect wiring from ignition fuse to ignition switch for an open or damaged condition. If the wiring is good replace the ignition switch. **(7287)**

## 12. Ignition Power Short to Ground Test

1. Test for continuity between fuse block [61B] socket terminal B and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GY) or (O) wire. Replace ignition fuse. **(5041)**
   b. **No.** Replace the ignition fuse and verify operation. **(6729)**

## 13. Ground Circuit Test

1. With IGN OFF, disconnect speedometer [39] (XL) or tachometer [108] (XR).
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39] (XL) or [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapter,

leaving [39A] (XL) and [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.

3. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box terminal 7 and GND 1.
4. Is continuity present?
   a. **Yes.** Replace the speedometer (XL) or tachometer (XR). **(7311)**
   b. **No.** Repair open in (BK) wire. **(5041)**

## SPEEDOMETER INOPERATIVE: XR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-10. Speedometer Inoperative Diagnostic Faults: XR**

| POSSIBLE CAUSES |
|---|
| Open battery circuit |
| Open accessory circuit |
| Open serial data circuit |
| Open ground circuit |

### 1. Speedometer Function Test

1. Turn IGN ON.
2. Does the speedometer illuminate and display 0?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

### 2. Speedometer Display Test

1. Operate the vehicle.
2. Does the speedometer display vehicle speed correctly?
   a. **Yes.** Concern is intermittent, perform a wiggle test to test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 3.

### 3. Serial Data Circuit Test

1. Turn IGN OFF.
2. Disconnect speedometer [39] and tachometer [108].
3. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [39B] terminal C and [108B] terminal 2.
4. Is continuity present?
   a. **Yes.** Replace the speedometer. **(6765)**
   b. **No.** Repair open in (LGN/V) wire between [39] and [108]. **(5041)**

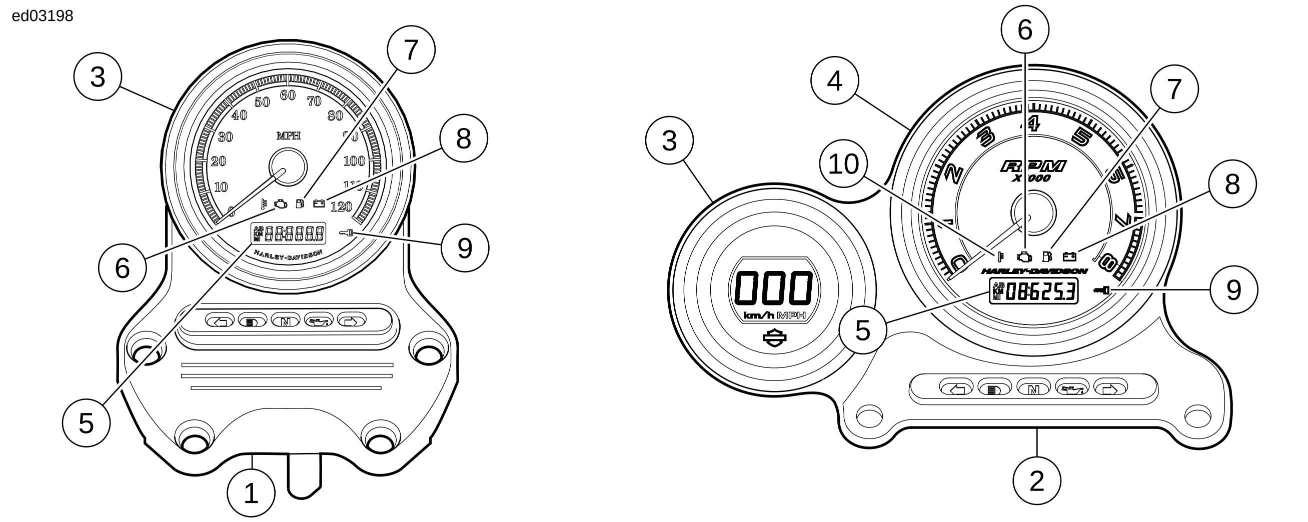
### 4. Battery Power Circuit Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Turn IGN ON.
4. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [39] terminal A and D and between terminals B and D.
5. Is battery voltage present on either terminals?
   a. **Yes, between A and D only.** Repair open in (BN/GY) wire at [39] terminal B. **(5041)**
   b. **Yes, between B and D only.** Repair open in (O/W) wire at [39] terminal A. **(5043)**
   c. **Yes, on both terminals.** Replace the speedometer. **(6765)**
   d. **No.** Repair open in (BK) wire between [39] terminal D and ground. **(5041)**

# INDICATOR LAMPS 4.5

## DESCRIPTION AND OPERATION

See Figure 4-7. The battery, check engine, security and low fuel indicators are located in the speedometer (XL) or tachometer (XR). The other indicators are located separately from the speedometer or tachometer.




1. **Instruments: XL models**
2. **Instruments: XR 1200X**
3. **Speedometer**
4. **Tachometer: XR 1200X**
5. **Odometer**
6. **Check engine lamp**
7. **Low fuel lamp**
8. **Battery lamp**
9. **Security system lamp**
10. **Temperature lamp**

**Figure 4-7. Instruments**

**Table 4-11. Indicator Lamp Wiring**

| INDICATOR LAMP | CONNECTION |
|---|---|
| Check engine | Serial data |
| Security | Serial data |
| Battery | Serial data |
| Oil pressure | Ground through switch |
| Neutral | Ground through switch |
| High beam | 12V when active |
| Right/left turn | 12V when active |
| Low fuel | Designated circuit |
| Temperature (XR) | Serial data |

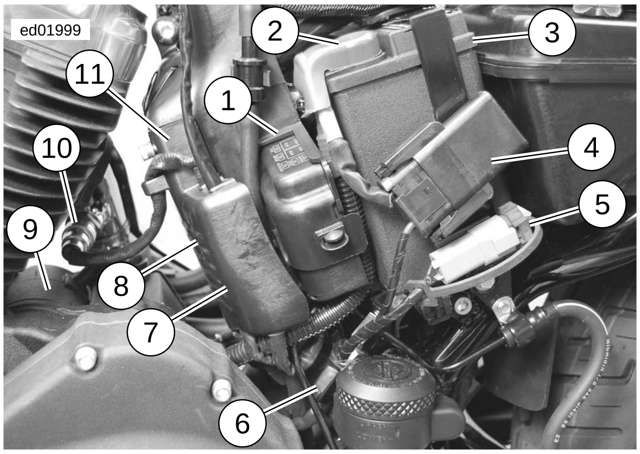
### Low Fuel Indicator

The low fuel indicator is controlled at terminal 9 (Y/W) of the speedometer (XL) or tachometer (XR). The speedometer or tachometer sends voltage on the (Y/W) wire to the low fuel switch and the fuel sender resistor pack. When the fuel drops below a given amount, refer to Table 4-12.

**Table 4-12. Low Fuel Level Quantity**

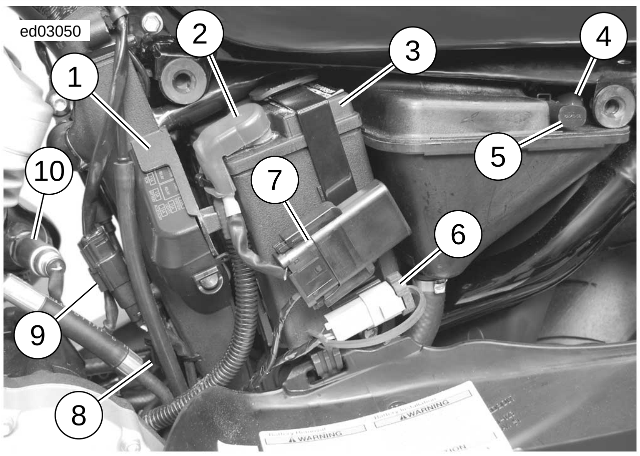
| MODEL | CAPACITY |
|---|---|
| XR 1200X | 0.50 gal (1.89 L) |
| XL 1200X, XL 1200V | 0.65 gal (2.46 L) |
| XL 883R, XL 883N | 0.80 gal (3.03 L) |
| XL 883L, XL1200C, CP, CA, CB | 1.00 gal (3.79 L) |

The low fuel switch closes and allows voltage to terminal 2 of the fuel sender resistor pack. This change in resistance in the circuit signals low fuel lamp to illuminate. The low fuel indicator also illuminates when DTC B1004 or B1005 is present.




1. Fuse block [61]
2. Positive battery cable
3. Battery
4. Main fuse [5]
5. DLC [91]
6. Rear stop lamp switch (XL models) [121]
7. Fuel pump and low fuel switch [141]
8. Rear O2 sensor [137]
9. Starter
10. Rear O2 sensor
11. ECM

**Figure 4-8. Under Left Side Cover: XL**

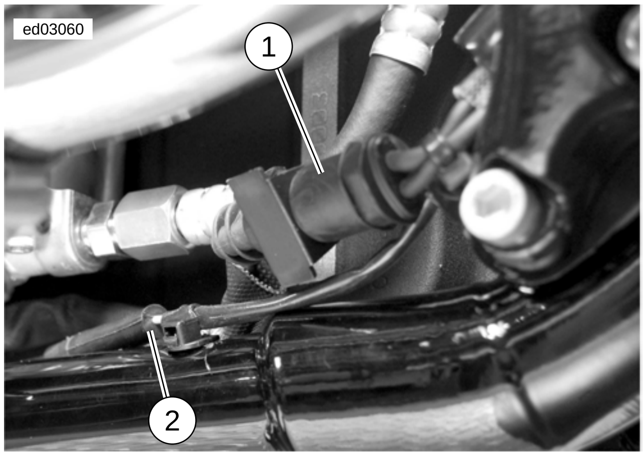



1. Fuse block [61]
2. Positive battery cable
3. Battery
4. P&A battery [160]
5. Fuel sender resistor assembly [200]
6. DLC [91]
7. Main fuse [5]
8. Rear O2 sensor [137]
9. Fuel pump and low fuel switch [141]
10. Rear O2 sensor

**Figure 4-9. Under Left Side Cover: XR**

## Neutral Indicator

See Figure 4-10. The neutral indicator is controlled through the (TN) wire connected to the TSM, TSSM or HFSM and the neutral switch. When the transmission is in neutral, the neutral switch closes and illuminates the neutral indicator.

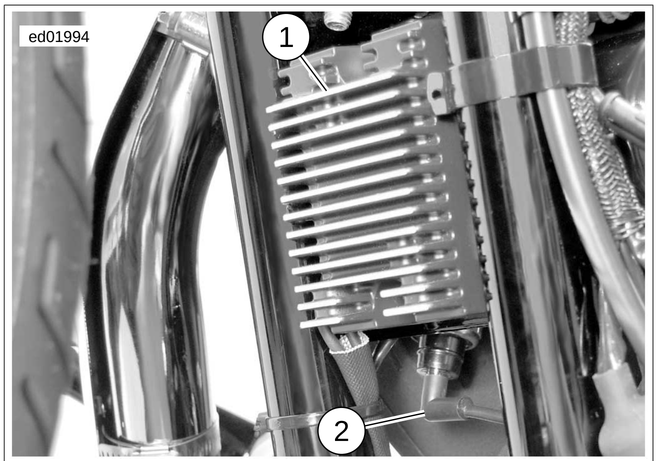



1. Voltage regulator to stator [47]
2. Neutral switch [136]

**Figure 4-10. Lower Right Front**

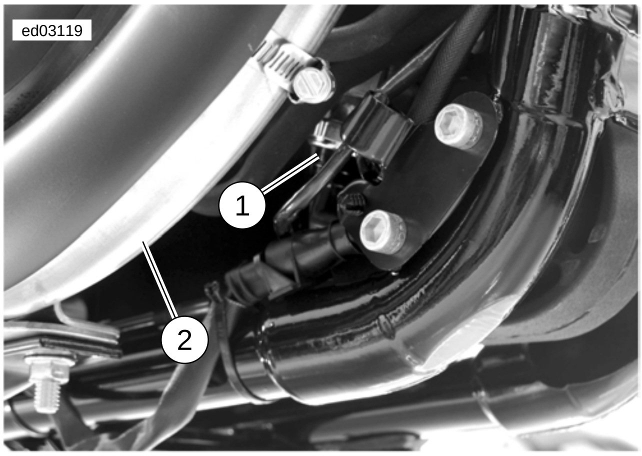
## Oil Pressure Indicator

See Figure 4-11 and Figure 4-12. The oil pressure indicator is connected to the oil pressure switch. The switch closes when oil pressure is low and illuminates the oil pressure indicator. This is why the oil pressure indicator is illuminated with the IGN ON and the engine OFF.




1. Voltage regulator
2. Oil pressure switch [120]

**Figure 4-11. Voltage Regulator: XL**




1. **Oil pressure switch [120]**
2. **Exhaust pipe**

**Figure 4-12. Oil Pressure Switch: XR**

## Temperature Lamp: XR

The red temperature lamp indicates extreme high temperatures. Stop the engine immediately and allow the engine to cool down. Check for engine temperature DTCs if this indicator lamp is illuminated.

## Turn Signal Indicators

The turn signal indicators are controlled by the TSM, TSSM or HFSM. When the TSM, TSSM or HFSM receives an input from the left or right turn signal switch it flashes the correct turn signals including the turn signal indicators.

- When the left turn signal switch is pressed voltage is supplied on the (V) wire to the left turn signals including the turn signal indicator.
- When the right turn signal switch is pressed, voltage is supplied on the (BN) wire to the right turn signals including the indicator.

## High Beam Indicator

This circuit is powered when the headlamp switch is placed in the high beam position. In the high position, voltage is supplied to the (W) wire and the high beam headlamps. This wire also supplies power to the high beam indicator, causing it to illuminate.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

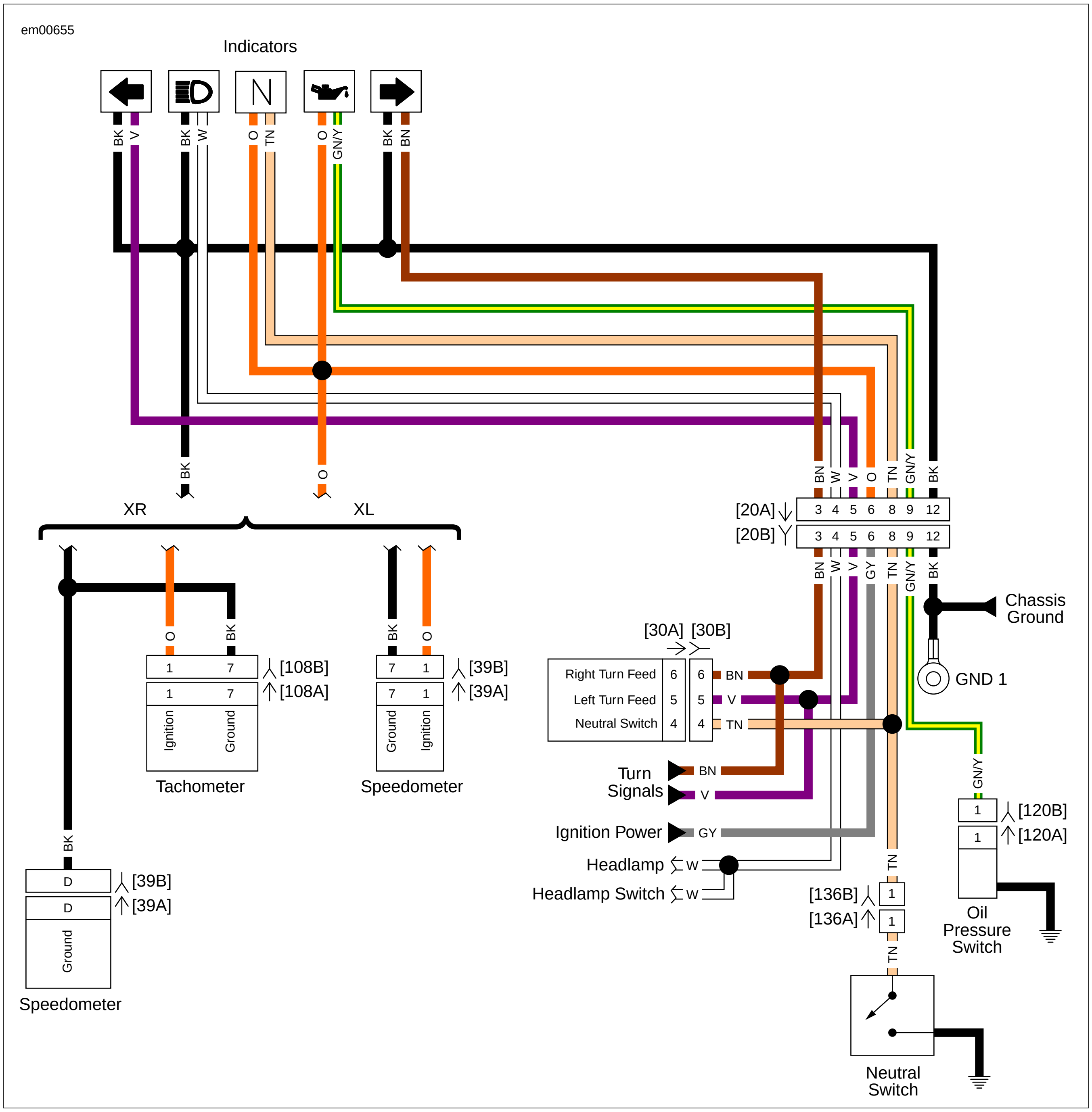



**Figure 4-13. Indicator Lamps**

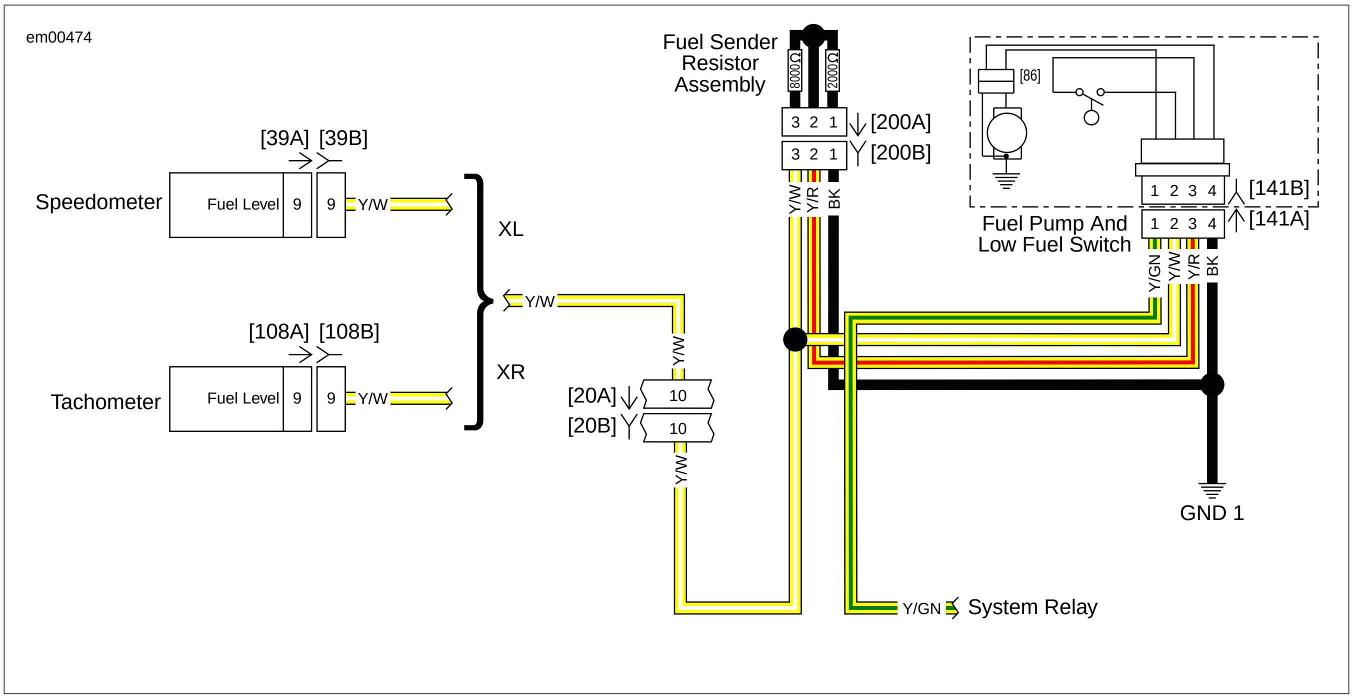



**Figure 4-14. Fuel Sensor Circuit**

## LOW FUEL LAMP ALWAYS ON

**Table 4-13. Low Fuel Lamp Always On Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Fuel level circuit DTC is set |
| Fuel sender resistor assembly malfunction |
| Fuel pump and sender assembly malfunction |
| Instrument malfunction |

### 1. DTC Test

1. Check for DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Are any DTCs present?
   a. **Yes.** Diagnose DTCs first. Refer to Table 2-2.
   b. **No.** Go to Test 2.

### 2. Fuel Level Test

1. Verify the fuel tank is at least half full.
2. Is the fuel tank at least half full?
   a. **Yes.** Go to Test 3.
   b. **No.** Fill with fuel and perform a road test. If the indicator is still illuminated, then continue with tests. Go to Test 3.

### 3. Low Fuel Switch Test

1. Disconnect the fuel pump and low fuel switch [141].
2. Turn IGN ON.
3. Does the low fuel indicator turn off and stay off?
   a. **Yes.** Replace the fuel level sensor. **(6035)**
   b. **No.** Go to Test 4.

### 4. Fuel Sender Resistor Assembly Test

1. Disconnect the fuel sender resistor assembly [200].
2. Does the low fuel indicator turn off?
   a. **Yes.** Replace the fuel level sender resistor assembly.
   b. **No.** Replace the speedometer (XL) or tachometer (XR).

## LOW FUEL LAMP INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |
| HD-46601 | BREAKOUT BOX ADAPTERS |

**Table 4-14. Low Fuel Lamp Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open low fuel switch circuit |
| Instrument malfunction |
| Fuel pump and sender malfunction |
| Fuel sender resistor assembly malfunction |

### 1. Low Fuel Switch Test

1. Disconnect the fuel pump and low fuel switch [141].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [141] terminals 2 and 3 together.

3. Turn IGN ON.
4. Does the low fuel indicator illuminate?
   a. **Yes.** Replace the fuel level sensor. **(6035)**
   b. **No.** Go to Test 2.

## 2. Low Fuel Switch Circuit Test

1. Test for voltage between [141A] terminal 2 and ground.
2. Is voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 4.

## 3. Fuel Sender Resistor Assembly Test

1. Turn IGN OFF.
2. Disconnect the fuel sender resistor assembly [200].
3. Test for continuity between [141A] terminal 3 and [200B] terminal 2.
4. Is continuity present?
   a. **Yes.** Replace the fuel sender resistor assembly. **(6083)**
   b. **No.** Repair open in between [200B] terminal 2 and [141A] terminal 3 (Y/R) wire. **(5041)**

## 4. Low Fuel Switch Circuit Continuity Test

1. Turn IGN OFF.
2. Disconnect the speedometer [39] (XL) or the tachometer [108] (XR).
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39] (XL) or [108] (XR). Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] (XL) or [108A] (XR) disconnected. See 1.2 DIAGNOSTIC TOOLS.
4. Test for continuity between breakout box terminal 9 and [141A] terminal 2.
5. Is continuity present?
   a. **Yes.** Replace the speedometer (XL) or tachometer (XR). **(6765)**
   b. **No.** Repair open in (Y/W) wire. **(5041)**

# OIL PRESSURE LAMP ALWAYS ON

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-15. Oil Pressure Lamp Always On Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in oil pressure circuit |
| Indicator malfunction |
| Mechanical issue |
| Oil pressure switch malfunction |

## 1. Oil Pressure Lamp Function Test

1. Turn IGN ON with the engine OFF.
2. Does the oil pressure lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative.

## 2. Engine Running Test

1. Start the engine.
2. Does the oil pressure lamp turn OFF and stay off?
   a. **Yes.** Oil pressure lamp is operating properly. Test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 3.

## 3. Oil Pressure Sensor Test

1. Disconnect the oil pressure sensor [120].
2. Does the oil pressure lamp turn OFF?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 4.

## 4. Oil Pressure Circuit Test

1. With IGN OFF, disconnect the instruments [20].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [20B] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground between [20B] terminal 9 and [120B] terminal 1 (GN/Y) wire. **(5041)**
   b. **No.** Repair or replace the indicator harness. **(5191)**

## 5. Mechanical Test

1. Inspect the engine for any issues that may affect oil pressure.
2. Was the problem found?
   a. **Yes.** Repair as needed.
   b. **No.** Replace the oil pressure switch. **(5161)**

# OIL PRESSURE LAMP INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-16. Oil Pressure Lamp Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Oil pressure switch malfunction |
| Open oil pressure circuit |
| Indicator malfunction |

## 1. Oil Pressure Lamp Function Test

1. Turn IGN ON with the engine OFF.
2. Does the oil pressure lamp illuminate?
   a. **Yes.** Test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 2.

## 2. Oil Pressure Switch Test

1. Disconnect the oil pressure sensor [120].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect [120B] terminal 1 to ground.
3. Does the oil pressure lamp turn ON?
   a. **Yes.** Replace oil pressure switch. **(5161)**
   b. **No.** Go to Test 3.

## 3. Oil Pressure Circuit Test

1. With IGN OFF, disconnect the instruments [20].
2. Test for continuity between [20B] terminal 9 and [120B] terminal 1.
3. Is continuity present?
   a. **Yes.** Repair or replace the indicator harness. **(5191)**
   b. **No.** Repair open between [39B] terminal 9 and [120] (GN/Y) wire. **(5041)**

## NEUTRAL LAMP ALWAYS ON

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-17. Neutral Lamp Always On Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Neutral switch malfunction |
| Short to ground in neutral circuit |
| Indicator malfunction |

## 1. Neutral Lamp Function Test

1. With the vehicle in neutral, turn IGN ON with the engine OFF.
2. Does the neutral lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 4.5 INDICATOR LAMPS, Neutral Lamp Inoperative.

## 2. Transmission Operation Test

1. Shift the transmission out of neutral.
2. Does the neutral lamp turn OFF and stay off?
   a. **Yes.** Neutral lamp is operating properly. Test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 3.

## 3. Neutral Switch Test

1. Disconnect the neutral switch [136].
2. Does the neutral lamp turn OFF?
   a. **Yes.** Replace the neutral switch. **(5157)**
   b. **No.** Go to Test 4.

## 4. TSM, TSSM or HFSM Test

1. Disconnect the TSM, TSSM or HFSM [30].
2. Does the neutral lamp turn OFF?
   a. **Yes.** Replace the TSM, TSSM or HFSM. **(6845)**
   b. **No.** Go to Test 5.

## 5. Neutral Switch Circuit Test

1. Disconnect the instruments [20].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [20B] terminal 8 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (TN) wire. **(5041)**
   b. **No.** Repair or replace the indicator harness. **(5191)**

## NEUTRAL LAMP INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-18. Neutral Lamp Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Neutral switch malfunction |
| Open ground circuit |
| Open neutral switch circuit |
| Indicator malfunction |

## 1. Neutral Lamp Function Test

1. With the vehicle in neutral, turn IGN ON with the engine OFF.
2. Does the neutral lamp illuminate?
   a. **Yes.** Test for intermittent. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 2.

## 2. Neutral Switch Test

1. Disconnect the neutral switch [136].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump the (TN) wire to ground.
3. Does the neutral lamp turn ON?
   a. **Yes.** Replace the neutral switch. **(5157)**
   b. **No.** Go to Test 3.

## 3. Neutral Switch Power Circuit Open Test

1. With IGN OFF, disconnect the instruments [20].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [20B] terminal 8 and [136B] (TN) wire.
3. Is continuity present?
   a. **Yes.** Repair or replace the indicator harness. **(5191)**
   b. **No.** Repair open in (TN) wire between [20B] terminal 8 and neutral switch. **(5041)**

## HIGH BEAM INDICATOR LAMP INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-19. High Beam Indicator Lamp Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator malfunction |
| Open high beam indicator circuit |

## 1. High Beam Indicator Function Test

1. With IGN ON, operate the headlamp switch.
2. Do the high and low beam headlamps function correctly?
   a. **Yes.** Go to Test 2.
   b. **No.** See 5.4 HEADLAMPS.

## 2. High Beam Indicator Circuit Test

1. With IGN OFF, disconnect the instruments [20].
2. With the IGN ON and the headlamp switch in the high position and using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage at [20B] terminal 4.
3. Is voltage present?
   a. **Yes.** Repair or replace the indicator harness. **(5191)**
   b. **No.** Repair open in (W) wire between headlamp switch and [20B] terminal 4. **(5041)**

## TURN SIGNAL INDICATOR INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 4-20. Turn Signal Indicator Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator malfunction |
| Open turn signal circuit |

## 1. Turn Signal Function Test

1. With ignition ON, operate the turn signals.
2. Do the turn signals operate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 5.3 TURN SIGNALS.

## 2. Turn Signal Indicator Circuit Test

1. With IGN OFF, disconnect the instruments [20].
2. With the IGN ON and the turn signals activated and using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage at [20B] terminal 3 (right) and 5 (left).
3. Is voltage cycling on and off?
   a. **Yes.** Repair or replace the indicator harness. **(5191)**
   b. **No.** Repair open between [20B] terminal 3 (right), terminal 5 (left) and [30B] terminal 5 (left), terminal 6 (right). **(5041)**

TABLE OF CONTENTS

# NOTES

# ACCESSORIES 5.1

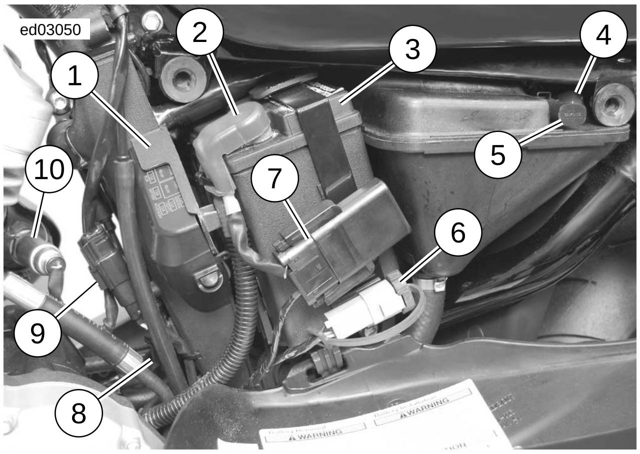
## DESCRIPTION AND OPERATION

The P&A battery circuit is connected to battery power after the 30 Amp main fuse. This circuit may supply power to additional systems on the motorcycle.

## COMPONENTS

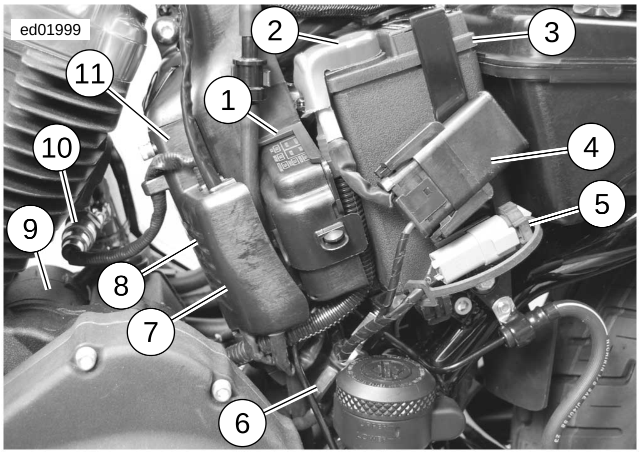
### P&A Connector

See Figure 5-1 and Figure 5-2. The P&A battery [160] is located under the left side cover. A cap is plugged into it to keep it from being accidentally exposed.




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **P&A battery [160]**
5. **Fuel sender resistor assembly [200]**
6. **DLC [91]**
7. **Main fuse [5]**
8. **Rear O2 sensor [137]**
9. **Fuel pump and low fuel switch [141]**
10. **Rear O2 sensor**

**Figure 5-1. Under Left Side Cover: XR**




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **Main fuse [5]**
5. **DLC [91]**
6. **Rear stop lamp switch (XL models) [121]**
7. **Fuel pump and low fuel switch [141]**
8. **Rear O2 sensor [137]**
9. **Starter**
10. **Rear O2 sensor**
11. **ECM**

**Figure 5-2. Under Left Side Cover: XL**

# HORN 5.2

## DESCRIPTION AND OPERATION

The horn is powered through the horn switch from the accessories fuse. The horn is grounded through GND 1. When the horn switch is pressed, battery voltage is applied to [122] terminal A, causing the horn to sound.

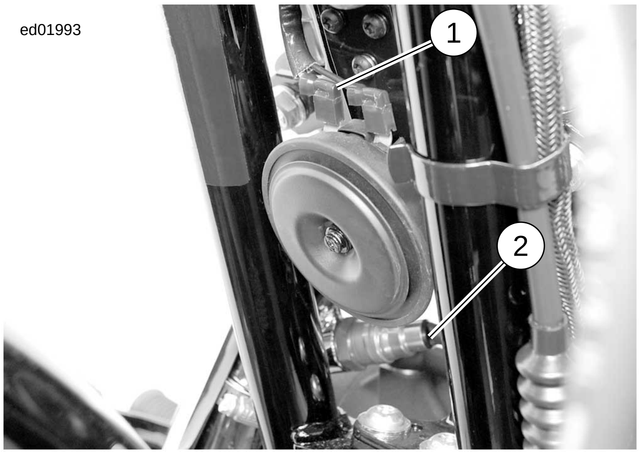
## COMPONENTS

### Horn Switch

The horn switch is a push button switch on the left handlebar controls.

### Horn

See Figure 5-3. The horn is located between the front frame tubes or on the left side of engine.




1. **Horn [122]**
2. **Front O2 sensor**

**Figure 5-3. Horn (Typical)**

## SYMPTOMS

The horn circuit does not set DTCs when there is a malfunction. Refer to Table 5-1 for troubleshooting.

**Table 5-1. Horn Symptoms**

| SYMPTOM | COMMON CAUSE |
|---|---|
| Horn always on | Short to voltage or a stuck switch |
| Horn inoperative | Open circuit, faulty horn or horn switch |

### Diagnostic Tips

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

The (O/W) wire from the fuse supplies battery voltage to several components. A short anywhere in the (O/W) wire causes the fuse to open immediately.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

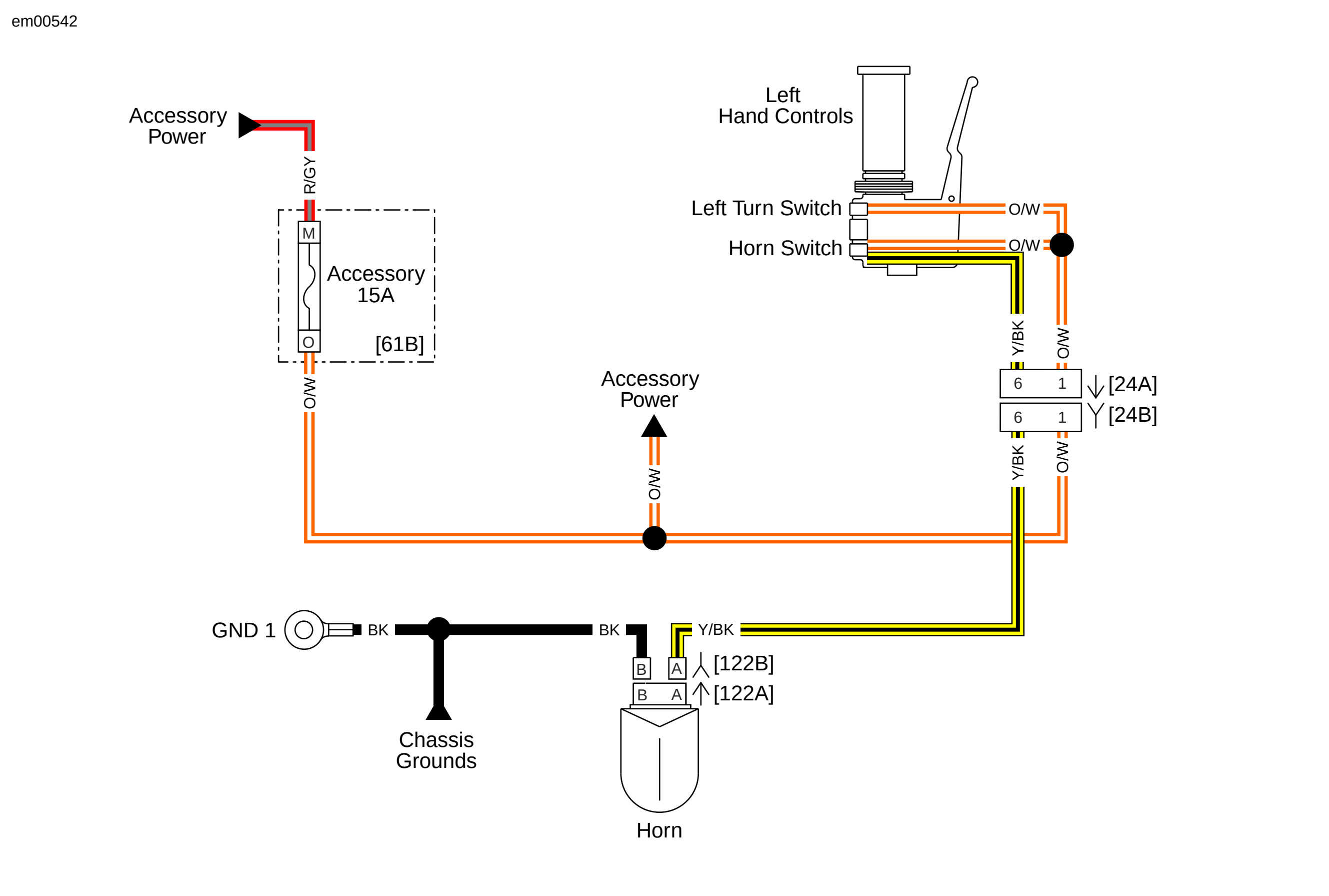



**Figure 5-4. Horn**

## HORN ALWAYS ON

**Table 5-2. Horn Always On Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to voltage in horn power circuit |
| Horn switch malfunction |

### 1. Horn Switch Test

1. Disconnect left hand controls [24].
2. Does the horn turn off?
   a. **Yes.** Replace the horn switch. **(5171)**
   b. **No.** Repair short to voltage in the (Y/BK) wire between horn and left hand controls. **(5041)**

## HORN INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-3. Horn Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open accessory circuit |
| Shorted accessory circuit |
| Horn malfunction |
| Open ground circuit |
| Horn switch malfunction |
| Open horn power circuit |

### 1. Accessory Circuit Open or Shorted Test

1. With the IGN ON, activate the front and rear brakes.
2. Does the tail/stop lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** Inspect the fuse. If fuse is good locate and repair open in (O/W) wire. If fuse is open repair short to ground in circuits that may affect the fuse. See diagnostic tips. **(5043)**

## 2. Horn Test

1. Disconnect the horn [122].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage at [122B] between terminals A and B.
3. Press the horn switch.
4. Is battery voltage present?
   a. **Yes.** Replace the horn. **(5765)**
   b. **No.** Go to Test 3.

## 3. Ground Circuit Open Test

1. Test for continuity between [122B] terminal B and ground.
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in the ground circuit. **(5041)**

## 4. Horn Switch Malfunction Test

1. Connect the horn [122].
2. Disconnect left hand controls [24].
3. With IGN ON, using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404) jumper [24B] terminals 1 and 6.
4. Does the horn sound?
   a. **Yes.** Replace the horn switch. **(5171)**
   b. **No.** Go to Test 5.

## 5. Horn Power Circuit Open Test

1. Test for voltage from [24B] terminal 1 (O/W) to ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (Y/BK) wire between [24B] and horn. **(5041)**
   b. **No.** Repair open (O/W) wire between [24B] and fuse block. **(5043)**

# TURN SIGNALS 5.3

## DESCRIPTION AND OPERATION

TSM, TSSM or HFSM receives battery power through the ignition. The operation functions the same way whether you have a TSM, a TSSM or a HFSM. The TSM communicates with the other modules on the vehicle through the serial data line. The turn signal switches are inputs to the TSM. When the turn signal switch is pressed the switch closes and power flows to TSM. This signals the TSM to supply voltage and control the flash rate to the turn signals and the turn signal indicator. If the turn signal switches are pressed at the same time and held down the TSM initiates the four-way flashers.

The TSM also monitors the position of the clutch and neutral switches to determine if it is safe to start the vehicle. The BAS is internal to the TSM and allows the TSM to determine if the vehicle is tipped over. If a tip over event occurs, the TSM sends a signal to the ECM to turn off the engine.

The TSM has three major functions:

- Controls the turn signals.
- Serves as the BAS.
- Monitors the clutch and neutral switches to prevent starter engagement.

### BAS Operation

The TSM, TSSM or HFSM uses an internal BAS to monitor vehicle position. Under normal driving conditions the TSM, TSSM or HFSM uses the BAS along with speed input provided from the ECM to know when to automatically cancel the turn signals after a turn. The TSM, TSSM or HFSM will disable turn signal lamps and starter activation and will send a message to the ECM to shut down the ignition and the fuel pump if the vehicle is tipped over. The odometer will display "tIP" when a tip-over condition is present.

### BAS Restart

To restart the vehicle after shutdown has occurred:

1. Return the vehicle to an upright position.
2. Cycle the IGN OFF-ON before restarting the vehicle.

## MANUAL CANCELLATION

If you want to stop the turn signals from flashing, briefly press the turn signal switch a second time.

If you are signalling to turn in one direction and you press the switch for the opposite turn signal, the first signal is cancelled and the opposite side begins flashing.

## AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM, TSSM or HFSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling above 7 mph (11 km/h) the directional will always cancel after 20 flashes if the system does not recognize any other input.
- If the vehicle speed drops to 7 mph (11 km/h) or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 mph (12.9 km/h) and will automatically cancel when the count total equals 20 as stated above.
- See Figure 5-5. The turn signals will cancel within two seconds upon turn completion. A sensor inside the TSM, TSSM or HFSM cancels the signal after the vehicle has been returned to an upright position.

*NOTE*

*The bank angle cancellation function has an automatic calibration feature. Ride the vehicle for 0.25 mile (0.4 km) at steady speeds (upright) to calibrate the system. Performance of bank angle function may not be optimal until this calibration is performed. This self-calibration is performed automatically every time the vehicle is started and ridden.*


1. **Left 45 degrees**
2. **Right 45 degrees**

**Figure 5-5. Tilting: TSM, TSSM or HFSM**

## FOUR-WAY FLASHING

Use the following method to activate the four-way flashers:

1. With the ignition switch ON and the security system disarmed (models with security only), press the left and right turn signal switches at the same time.
2. Turn the ignition switch OFF and arm the security system if present and desired. The four-way flashers will continue for two hours.
3. To cancel four-way flashing, disarm the security system if necessary, turn the ignition switch ON and press the left and right turn signal switches at the same time.

This system allows a stranded vehicle to be left in the four-way flashing mode and secured until help is found.

If the security system is disarmed while the four-way flashers are active, the lights will flash as follows:

1. TSSM or HFSM stops four-way flashing mode. Vehicle sits for 1 second with turn signals off.
2. TSSM or HFSM performs disarming confirmation (1 flash).
3. Vehicle sits for 1 second with turn signals off.
4. Vehicle restarts four-way flashing mode.

## Diagnostic Tips

- **TSM or TSSM Only:** DTC B1121 and B1122 will illuminate the security lamp. DTC B1141 will **not** illuminate the security lamp.
- **HFSM Only:** DTC B1121, B1122, B1123, B1124, B1125 and B1126 will illuminate the security lamp.
- **TSM, TSSM or HFSM:** When an over current or short-to-ground condition is detected, it will turn off the turn lamp outputs.
- If battery fuse is open and DTC B1123 or B1124 are set in history check for an intermittent short to ground in turn signal circuits (BN) or (V).

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

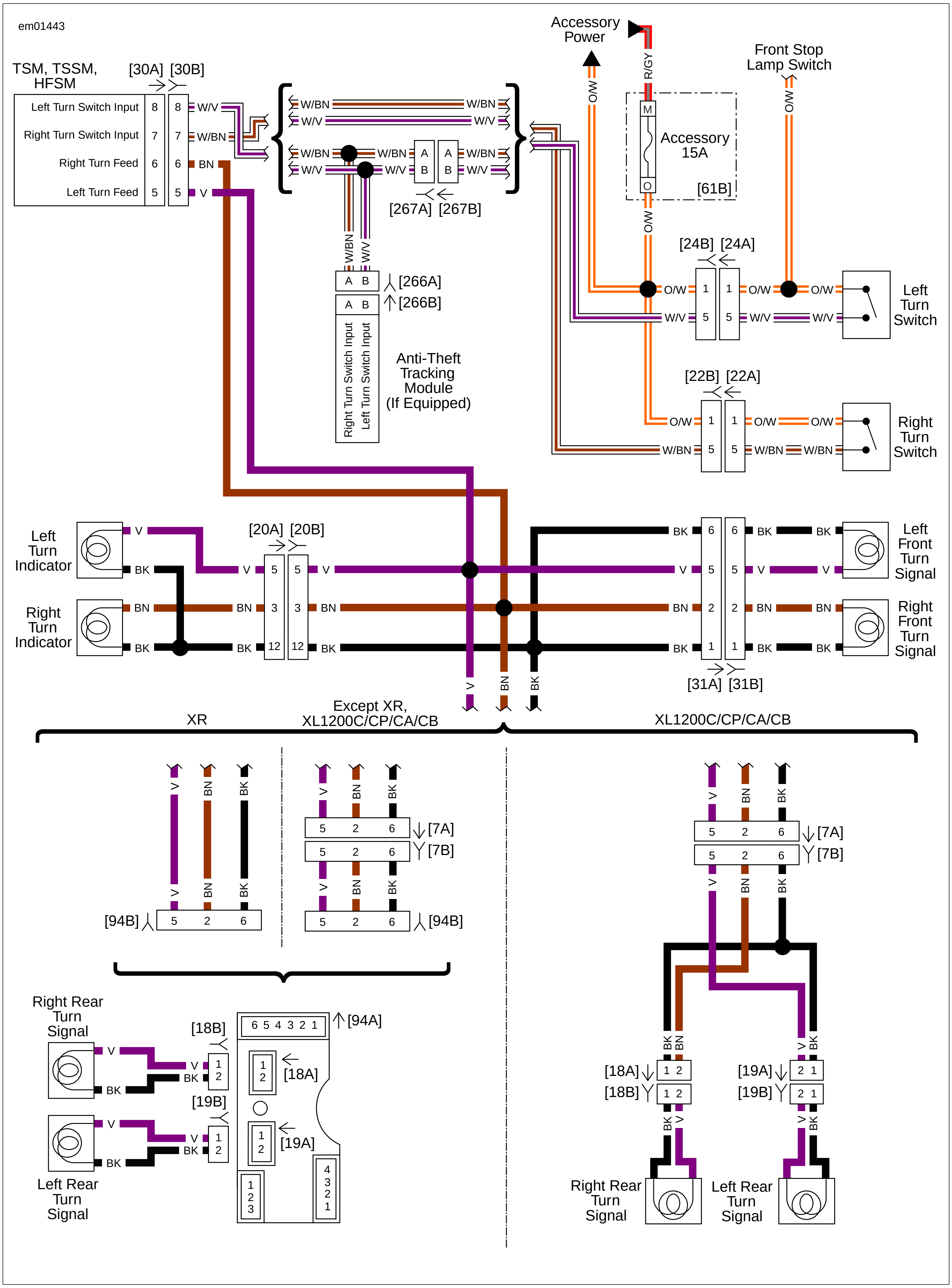



**Figure 5-6. Single Stop Lamp Turn Signal Circuit**

HOME

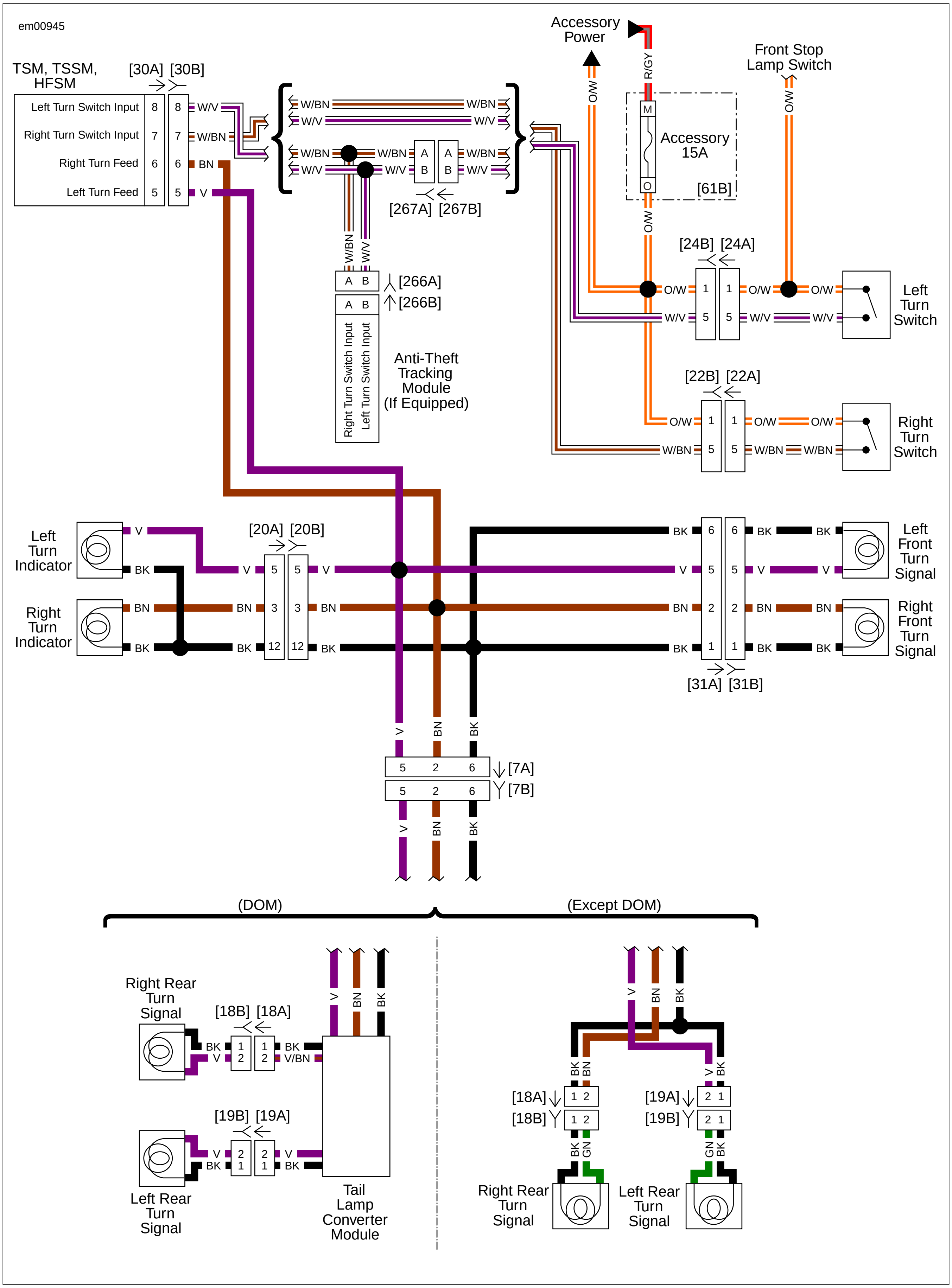



**Figure 5-7. Dual Stop Lamp Turn Signal Circuit**

## WILL NOT CANCEL UPON TURN COMPLETION, NO DTCS

**Table 5-4. Will Not Cancel Upon Turn Completion, No DTCs Diagnostic Faults**

| POSSIBLE CAUSES |
| --- |
| Improper configuration |

### 1. TSM, TSSM or HFSM Mounting Test

1. Verify TSM, TSSM or HFSM is mounted correctly.
2. Is TSM, TSSM or HFSM mounted properly?
   a. **Yes.** Go to Test 2.
   b. **No.** Mount correctly.

### 2. Correct Configuration Test

1. Check if TSM, TSSM or HFSM is configured correctly. See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS.
2. Proper configuration?
   a. **Yes.** Go to Test 3.
   b. **No.** Select proper vehicle configuration.

### 3. 4-Way Cancellation Test

1. Gain access to the vehicle's TSM, TSSM or HFSM.
2. See Figure 5-5. Position TSM, TSSM or HFSM in the same orientation it is mounted on the vehicle.
3. With IGN ON, turn on 4-way flashers by depressing both left and right turn signal switches at the same time.
4. Turn IGN OFF. The 4-way flashers should continue to flash.
5. Tilt the module greater than 45 degrees to the left.
6. Repeat steps 2-4 then tilt the module greater than 45 degrees to the right.
7. Do 4-way flashers cancel in both directions?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace TSM, TSSM or HFSM. **(6773)**

### 4. Turn Signals Cancel Test

1. Operate vehicle at a speed greater than 7 mph (11.2 km/h) in a straight line.
2. Activate either turn signal.
3. Turn signals should cancel after 20 flashes.
4. Do turn signals cancel?
   a. **Yes.** System operating properly.
   b. **No.** Go to Test 5.

### 5. Speedometer Test

1. Does speedometer register vehicle speed?
   a. **Yes.** Replace TSM, TSSM or HFSM. **(6791)**
   b. **No.** See 2.1 INITIAL DIAGNOSTICS.

## FLASH AT DOUBLE NORMAL RATE, NO DTCS

| PART NUMBER | TOOL NAME |
| --- | --- |
| 99861-02 | ELECTRICAL CONTACT LUBRICANT |

**Table 5-5. Flash at Double Normal Rate, No DTCs Diagnostic Faults**

| POSSIBLE CAUSES |
| --- |
| Incorrect lamps |
| Lamp malfunction |

*NOTE*

*Before troubleshooting this issue you should verify that the lamp loads have been learned by:*

- *Disconnect the negative battery cable for 1 minute. Reconnect negative battery cable.*
- *Turn IGN OFF-ON.*
- *Activate left turn lamps for 4 or more flashes.*
- *Activate right turn lamps for 4 or more flashes.*

### 1. Lamp Verification Test

1. Determine correct part number for all installed turn signal bulbs.
2. Verify correct parts are installed on vehicle.
3. Are the correct parts installed?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace with correct bulbs. **(6820)**

*NOTE*

*Depending on the model and destination, the rear turn signal lamps may use LEDs or conventional bulbs. If conventional bulbs are present inspect the bulbs and replace as needed. Replace the entire lamp if the LED fails.*

### 2. Bulb Corrosion Test

1. Check for corrosion on bulbs and/or sockets.
2. Is corrosion present?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 3.

### 3. Lamp Connection Terminal Corrosion Test

1. Check for corrosion on all lamp connection terminals.

2. Is corrosion present?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace TSM, TSSM or HFSM. **(6791)**

## 4. Verification Test

1. Clean corrosion from wires and terminals.
2. Do lamps flash at normal rate?
   a. **Yes.** System OK. **(6822)**
   b. **No.** Replace TSM, TSSM or HFSM. **(6791)**

## 5. Lamp Operation Test

1. Remove corrosion with a wire brush.
2. Install ELECTRICAL CONTACT LUBRICANT (Part No. 99861-02) in bulb sockets.
3. Do lamps flash at normal rate?
   a. **Yes.** System OK. **(6822)**
   b. **No.** Go to Test 6.

## 6. Lamp Assembly Test

1. Clean or replace bulb.
2. Do lamps flash at normal rate?
   a. **Yes.** System OK. **(6822)**
   b. **No.** Replace lamp assembly. **(6823)**

# BOTH TURN SIGNAL LAMPS ON ONE SIDE INOPERATIVE, NO DTCS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-6. Both Turn Signal Lamps on One Side Inoperative, No DTCs Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open on turn signal inputs |
| Open accessory circuit |
| Left turn signal switch malfunction |
| Right turn signal switch malfunction |

## 1. Left or Right Turn Signal Malfunction Test

1. With IGN ON, operate the left and right turn signals.
2. Are the right turn signals inoperative?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 5.

## 2. Right Turn Signal Circuit Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [30B] and TSM, TSSM or HFSM [30A]. See 1.2 DIAGNOSTIC TOOLS.
2. Turn IGN ON.
3. While pressing the right turn signal switch, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage on breakout box (gray) terminal 7.
4. Is battery voltage present when switch is pressed?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 3.

## 3. Right Turn Signal Switch Test

1. Disconnect right hand controls [22].
2. Test for voltage between [22B] terminal 1 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (O/W) wire. **(5041)**

## 4. Right Turn Signal Circuit Continuity Test

1. Turn IGN OFF.
2. Test for continuity between [22B] terminal 5 and breakout box (gray) terminal 7.
3. Is continuity present?
   a. **Yes.** Replace the right turn signal switch. **(6811)**
   b. **No.** Repair open in (W/BN) wire. **(5041)**

## 5. Left Turn Signal Circuit Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [30B] and TSM, TSSM or HFSM [30A]. See 1.2 DIAGNOSTIC TOOLS.
2. Turn IGN ON.
3. While pressing the left turn signal switch, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage on breakout box (gray) terminal 8.
4. Is battery voltage present when switch is pressed?
   a. **Yes.** Go to Test 9.
   b. **No.** Go to Test 6.

## 6. Left Turn Signal Switch Test

1. Disconnect left hand controls [24].
2. Test for voltage between [24B] terminal 1 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (O/W) wire. **(5043)**

## 7. Left Turn Signal Circuit Continuity Test

1. Turn IGN OFF.
2. Test for continuity between [24B] terminal 5 and breakout box (gray) terminal 8.
3. Is continuity present?
   a. **Yes.** Replace the right turn signal switch. **(6811)**
   b. **No.** Repair open in (W/V) wire. **(5041)**

## 8. Right Turn Signal Short to Voltage Test

1. Release the right turn signal switch.
2. Test for voltage on breakout box (gray) terminal 7.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (W/BN) wire.
   b. **No, without anti-theft tracking module.** Replace the TSM, TSSM or HFSM. **(6791)**
   c. **No, with anti-theft tracking module.** Go to Test 10.

## 9. Left Turn Signal Short to Voltage Test

1. Release the left turn signal switch.
2. Test for voltage on breakout box (gray) terminal 8.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (W/V) wire.
   b. **No, without anti-theft tracking module.** Replace the TSM, TSSM or HFSM. **(6791)**
   c. **No, with anti-theft tracking module.** Go to Test 10.

## 10. Anti-Theft Tracking Module Test

1. Disconnect anti-theft tracking module.
2. Press the inoperative turn signal switch.
3. Do the turn signals function properly?
   a. **Yes.** Replace the anti-theft tracking module. **(6791)**
   b. **No.** Replace the TSM, TSSM or HFSM. **(6791)**

# ONE TURN SIGNAL LAMP INOPERATIVE, NO DTCS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-7. One Turn Signal Lamp Inoperative, No DTCs Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open turn signal circuit |
| Open turn signal ground circuit |
| Inoperative turn signal |

## 1. Inoperative Signal Location Test

1. With IGN ON, operate the left and right turn signals.
2. Do all the turn signals operate on both sides?
   a. **Yes.** System operating properly.
   b. **No, right front turn signal inoperative.** Go to Test 2.
   c. **No, left front turn signal inoperative.** Go to Test 5.
   d. **No, right rear turn signal inoperative, except XL1200C/CP/CA/CB.** Go to Test 8.
   e. **No, right rear turn signal inoperative, XL200C/CP/CA/CB.** Go to Test 20.
   f. **No, left rear turn signal inoperative, except XL200C/CP/CA/CB.** Go to Test 11.
   g. **No, left rear turn signal inoperative, XL200C/CP/CA/CB.** Go to Test 25.

## 2. Right Front Turn Signal Bulb Test

1. Remove the right front turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace the bulb. **(6820)**

## 3. Right Front Turn Signal Circuit Test

1. Disconnect front turn signals [31].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect the FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [31A] between terminals 1 and 2.
3. Press the right turn signal switch.
4. Does the test light flash?
   a. **Yes.** Replace the right front turn signal. **(6823)**
   b. **No.** Go to Test 4.

## 4. Right Front Turn Signal Ground Circuit Test

1. Test for voltage between [31A] terminal 2 and ground.
2. Does the test light flash?
   a. **Yes.** Repair open in (BK) wire between [31A] terminal 1 and ground. **(5041)**
   b. **No.** Repair open in (BN) wire between [31A] terminal 2 and TSM, TSSM or HFSM. **(5041)**

## 5. Left Front Turn Signal Bulb Test

1. Remove the left front turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace the bulb. **(6820)**

## 6. Left Front Turn Signal Circuit Test

1. Disconnect front turn signals [31].

2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test light to [31A] between terminals 5 and 6.
3. Press the left turn signal switch.
4. Does the test light flash?
    a. **Yes.** Replace the left front turn signal. **(6823)**
    b. **No.** Go to Test 7.

## 7. Left Front Turn Signal Ground Circuit Test

1. Test for voltage between [31A] terminal 5 and ground.
2. Does the test light flash?
    a. **Yes.** Repair open in (BK) wire between [31A] terminal 6 and ground. **(5041)**
    b. **No.** Repair open in (V) wire between [31A] terminal 5 and TSM, TSSM or HFSM. **(5041)**

## 8. Right Rear Turn Signal Bulb Test

1. Remove the right rear turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
    a. **Yes.** Go to Test 9.
    b. **No.** Replace the bulb. **(6820)**

## 9. Right Rear Turn Signal Circuit Test

1. Disconnect rear lighting [94] (single stop lamp) or [7] dual stop lamps.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test light to [94B] or [7A] between terminals 2 and 6.
3. Press the right turn signal switch.
4. Does the test light flash?
    a. **Yes, single stop lamp.** Go to Test 14.
    b. **Yes, dual stop lamps.** Go to Test 16.
    c. **No.** Go to Test 10.

## 10. Right Rear Turn Signal Ground Circuit Test

1. Test for voltage between [94B] (single stop lamp) or [7A] (dual stop lamps) terminal 2 and ground.
2. Does the test light flash?
    a. **Yes.** Repair open in (BK) wire between terminal 6 and ground. **(5041)**
    b. **No.** Repair open in (BN) wire between terminal 2 and TSM, TSSM or HFSM. **(5041)**

## 11. Left Rear Turn Signal Bulb Test

1. Remove the left rear turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
    a. **Yes.** Go to Test 12.
    b. **No.** Replace the bulb. **(6820)**

## 12. Left Rear Turn Signal Circuit Test

1. Disconnect circuit board [94].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test light to [94A] or [7A] between terminals 5 and 6.
3. Press the left turn signal switch.
4. Does the test light flash?
    a. **Yes.** Go to Test 15.
    b. **No.** Go to Test 13.

## 13. Left Rear Turn Signal Ground Circuit Test

1. Test for voltage between [94B] (single stop lamp) or [7A] (dual stop lamps) terminal 5 and ground.
2. Does the test light flash?
    a. **Yes.** Repair open in (BK) wire between terminal 6 and ground. **(5041)**
    b. **No.** Repair open in (V) wire between terminal 5 and TSM, TSSM or HFSM. **(5041)**

## 14. Right Rear Turn Signal Test: Single Stop Lamp

1. Connect [94].
2. Disconnect right rear turn signal [18].
3. Turn on the right turn signal.
4. Test for voltage at [18A] between terminals 1 and 2.
5. Is voltage fluctuating on and off?
    a. **Yes.** Replace the right rear turn signal. **(6823)**
    b. **No.** Replace the circuit board. **(5215)**

## 15. Left Rear Turn Signal Test: Single Stop Lamp

1. Connect [94].
2. Disconnect left rear turn signal [19].
3. Turn on the left turn signal.
4. Test for voltage at [19A] between terminals 1 and 2.
5. Is voltage fluctuating on and off?
    a. **Yes.** Replace the left rear turn signal. **(6823)**
    b. **No.** Replace the circuit board. **(5215)**

## 16. Right Rear Turn Signal Test: Dual Stop Lamp

1. Connect [7].
2. Disconnect left rear turn signal [18].

3. Turn on the right turn signal.
4. Test for voltage at [18B] between terminals 1 and 2.
5. Is voltage fluctuating on and off?
    a. **Yes.** Replace the right rear turn signal. **(6823)**
    b. **No. (DOM).** Replace the tail lamp converter module. **(6809)**
    c. **No. (Except DOM).** Go to Test 17.

## 17. Right Rear Turn Signal Ground Test: Dual Stop Lamp

1. Test for voltage at [18B] between terminal 2 and ground.
2. Is voltage fluctuating on and off?
    a. **Yes.** Repair open in (BK) wire. **(5041)**
    b. **No.** Repair open in (BN) wire. **(5041)**

## 18. Left Rear Turn Signal Test: Dual Stop Lamp

1. Connect [7].
2. Disconnect right rear turn signal [19].
3. Turn on the left turn signal.
4. Test for voltage at [19B] between terminals 1 and 2.
5. Is voltage fluctuating on and off?
    a. **Yes.** Replace the left rear turn signal. **(6823)**
    b. **No. (DOM).** Replace the tail lamp converter module. **(6809)**
    c. **No. (Except DOM).** Go to Test 19.

## 19. Left Rear Turn Signal Ground Test: Dual Stop Lamp

1. Test for voltage at [19B] between terminal 2 and ground.
2. Is voltage fluctuating on and off?
    a. **Yes.** Repair open in (BK) wire. **(5041)**
    b. **No.** Repair open in (V) wire. **(5041)**

## 20. Right Rear Turn Signal Bulb Test

1. Turn IGN OFF.
2. Remove the right rear turn signal bulb.
3. Inspect the bulb.
4. Is the bulb good?
    a. **Yes.** Go to Test 21.
    b. **No.** Replace the bulb. **(6820)**

## 21. Right Rear Turn Signal Power [7] Circuit Test

1. Disconnect rear lighting [7].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage at [7A] terminal 2 (BN) wire.
3. Turn IGN ON and press the right turn signal switch.
4. Is voltage fluctuating?
    a. **Yes.** Go to Test 22.
    b. **No.** Repair open in (BN) wire. **(5041)**

## 22. Right Rear Turn Signal [7] Ground Test

1. Turn IGN OFF.
2. Test for continuity between [18B] terminal 6 (BK) wire and ground.
3. Is continuity present?
    a. **Yes.** Go to Test 23.
    b. **No.** Repair open in (BK) wire. **(5041)**

## 23. Right Rear Turn Signal [18] Ground Test

1. Connect [7].
2. Disconnect right rear turn signal [18].
3. Test for continuity between [18A] terminal 1 (BK) wire and ground.
4. Is continuity present?
    a. **Yes.** Go to Test 24.
    b. **No.** Repair open in (BK) wire. **(5041)**

## 24. Right Rear Turn Signal Power [18] Circuit Test

1. Test for voltage at [18A] terminal 2 (BN) wire.
2. Turn IGN ON and press the right turn signal switch.
3. Is voltage fluctuating?
    a. **Yes.** Repair right rear turn signal socket assembly.
    b. **No.** Repair open in (BN) wire. **(5041)**

## 25. Left Rear Turn Signal Bulb Test

1. Turn IGN OFF.
2. Remove the left rear turn signal bulb.
3. Inspect the bulb.
4. Is the bulb good?
    a. **Yes.** Go to Test 26.
    b. **No.** Replace the bulb. **(6820)**

## 26. Left Rear Turn Signal Power [7] Circuit Test

1. Disconnect rear lighting [7].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage at [7A] terminal 5 (V) wire.
3. Turn IGN ON and press the left turn signal switch.
4. Is voltage fluctuating?
    a. **Yes.** Go to Test 27.
    b. **No.** Repair open in (V) wire. **(5041)**

## 27. Left Rear Turn Signal [7] Ground Test

1. Turn IGN OFF.
2. Test for continuity between [18B] terminal 6 (BK) wire and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 28.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 28. Left Rear Turn Signal [18] Ground Test

1. Connect [7].
2. Disconnect right rear turn signal [19].
3. Test for continuity between [19A] terminal 1 (BK) wire and ground.
4. Is continuity present?
   a. **Yes.** Go to Test 29.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 29. Left Rear Turn Signal Power [18] Circuit Test

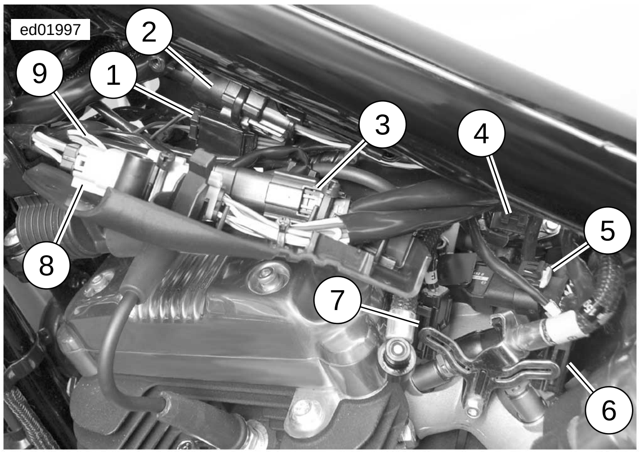
1. Test for voltage at [19A] terminal 2 (V) wire.
2. Turn IGN ON and press the left turn signal switch.
3. Is voltage fluctuating?
   a. **Yes.** Repair left rear turn signal socket assembly.
   b. **No.** Repair open in (V) wire. **(5041)**

# HEADLAMPS 5.4

## DESCRIPTION AND OPERATION

Use the headlamp switch to select either the high beam or the low beam headlamps. When the ignition is turned ON the headlamp switch receives power through the lights fuse.

- In the low position, the headlamp switch directs voltage to illuminate the low beam headlamp.
- In the high position, voltage is directed to the high beam headlamp and the high beam indicator.




1. **Front turn signals [31]**
2. **Instruments [20]**
3. **Right hand controls [22]**
4. **IAC [87]**
5. **TMAP [80]**
6. **Rear fuel injector [85]**
7. **Front fuel injector [84]**
8. **Left hand controls [24]**
9. **Headlamp [38]**

**Figure 5-8. Under Fuel Tank Left Side**

## Diagnostic Tips

If the lights fuse is open,

- Test for short to ground on (BE) wire from the fuse to the headlamp switch.
- Check for a short to ground on the (W) wire from the headlamp switch. If this circuit is grounded, it will open the fuse when the headlamp switch is in the high position.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

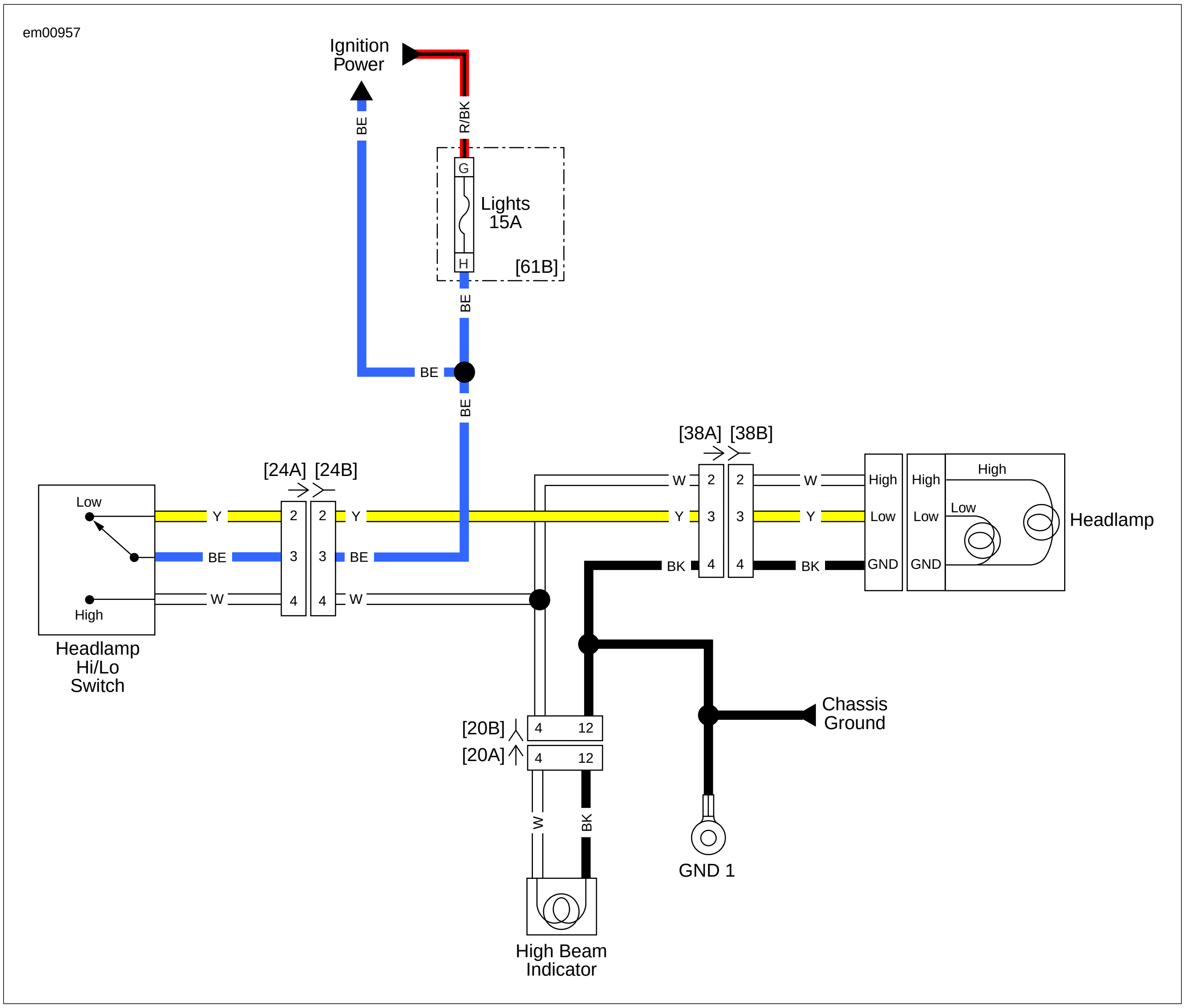



**Figure 5-9. Headlamp and Running Lamps**

## HEADLAMP INOPERATIVE, NO DTCS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-8. Headlamp Inoperative, No DTCs Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open fuse |
| Open power to switch circuit |
| Headlamp Hi/Lo switch malfunction |
| Open ground circuit |
| Open high beam power circuit |
| Open low beam power circuit |
| Headlamp malfunction |

## 1. Operational Test

1. Turn IGN ON.
2. Move the headlamp switch to the high and low positions.
3. Do the headlamps work in both positions?
   a. **Yes.** Concern is intermittent perform wiggle test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No, high beam headlamp inoperative.** Go to Test 2.
   c. **No, low beam headlamp inoperative.** Go to Test 5.
   d. **No, both headlamps inoperative.** Go to Test 7.

## 2. High Beam Indicator Test

1. With the headlamp Hi/Lo switch in the high position, observe the high beam indicator lamp.

2. Does the high beam indicator illuminate?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 3.

## 3. Headlamp Hi/Lo Switch Test

1. With IGN OFF, disconnect left hand controls [24].
2. Using a HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [24B] terminals 3 and 4 together.
3. Turn IGN ON.
4. Does the high beam headlamp operate?
   a. **Yes.** Replace the left switch assembly. **(5171)**
   b. **No.** Repair open in (W) wire between [24B] and indicator. **(5041)**

## 4. High Beam Headlamp Test

1. Disconnect the headlamp.
2. With the IGN ON and the headlamp Hi/Lo switch in the high position using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [38A] terminals 2 and 4.
3. Is battery voltage present?
   a. **Yes.** Replace the headlamp. **(5185)**
   b. **No.** Repair open in (W) wire to headlamp. **(5041)**

## 5. Headlamp Hi/Lo Switch Test

1. With the IGN OFF, disconnect left hand controls [24].
2. Using a HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [24B] terminals 2 and 3 together.
3. Turn IGN ON.
4. Does the low beam headlamp operate?
   a. **Yes.** Replace the left switch assembly. **(5171)**
   b. **No.** Go to Test 6.

## 6. Low Beam Headlamp Test

1. Connect [24].
2. Disconnect the headlamp.
3. With the headlamp Hi/Lo switch in the low position using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between terminals 3 and 4 of [38A].
4. Is battery voltage present?
   a. **Yes.** Replace the headlamp. **(5185)**
   b. **No.** Repair open in (Y) wire to headlamp. **(5041)**

## 7. High Beam Indicator Test

1. With the headlamp Hi/Lo switch in the high position, observe the high beam indicator lamp.
2. Does the high beam indicator illuminate?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 9.

## 8. Headlamp Test

1. Disconnect the headlamp.
2. With the IGN ON and the headlamp Hi/Lo switch in the high position, test for voltage between [38A] terminals 2 and 4.
3. Is battery voltage present?
   a. **Yes.** Replace the headlamp. **(5185)**
   b. **No.** Repair open in (BK) wire between headlamp and ground. **(5041)**

## 9. Ignition Power Circuit Test

1. With IGN ON, observe the tail lamp.
2. Is the tail lamp illuminated?
   a. **Yes.** Go to Test 10.
   b. **No.** Go to Test 11.

## 10. Headlamp Hi/Lo Switch Test

1. With the IGN OFF, disconnect left hand controls [24].
2. Using a HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [24B] terminals 2 and 3 together.
3. Turn IGN ON.
4. Does the low beam headlamp operate?
   a. **Yes.** Replace the left switch assembly. **(5171)**
   b. **No.** Repair open in (BE) wire to [24B]. **(5039)**

## 11. Lights Fuse Test

1. Inspect the lights fuse.
2. Is the fuse good?
   a. **Yes.** Go to Test 12.
   b. **No.** Go to Test 13.

## 12. Power Circuit Test

1. Test for voltage on [61B] socket terminal G of the lights fuse.
2. Is battery voltage present?
   a. **Yes.** Repair open in (BE) wire between fuse block and headlamp Hi/Lo switch. **(5039)**
   b. **No.** Repair open in (R/BK) wire. **(5041)**

## 13. Power Circuit Short to Ground Test

1. With IGN OFF, remove the lights fuse.
2. Disconnect left hand controls [24].
3. Measure resistance between [24B] terminal 3 and ground.
4. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 14.
   b. **No.** Go to Test 17.

## 14. Tail Lamp Test

1. Disconnect rear lighting [94] or [7].

2. Measure resistance between [24B] terminal 3 and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 15.
   b. **No.** Go to Test 16.

## 15. Front Turn Signal Test

1. Disconnect front turn signals [31].
2. Measure resistance between [24B] terminal 3 and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground in (BE) wire between [24B] and fuse block. **(5039)**
   b. **No.** Repair short to ground in front turn signal. **(5041)**

## 16. Rear Turn Signal Test

1. Connect [94] or [7].
2. Disconnect rear lighting [93] (single tail lamp) or [18] and [19] dual tail lamp.
3. Measure resistance between [93A] terminal 1 and ground (single tail lamp) or [18A] and [19A] terminal 3 (dual tail lamp).
4. Is resistance less than 10 Ohms?
   a. **Yes, single stop lamp.** Replace the circuit board. **(5215)**
   b. **Yes, dual tail lamps DOM.** Replace the converter module. **(6809)**
   c. **Yes, dual tail lamps HDI.** Repair short to ground in (O/W) wire between [7B] and tail lamps. **(5039)**
   d. **No.** Replace tail/stop lamp assembly. **(5215)**

## 17. Low Beam Circuit Short to Ground Test

1. Measure resistance between [24B] terminal 2 and ground.
2. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground in (Y) low beam circuit. **(5041)**
   b. **No.** Go to Test 18.

## 18. High Beam Circuit Short to Ground Test

1. Measure resistance between [24B] terminal 4 and ground.
2. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 19.
   b. **No.** Intermittent short perform wiggle test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. Replace lights fuse and verify repair. **(6822)**

## 19. Indicator Short to Ground Test

1. Disconnect the [20].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance between [24B] terminal 4 and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground in (W) high beam circuit. **(5041)**
   b. **No.** Repair or replace the indicator harness. **(5191)**

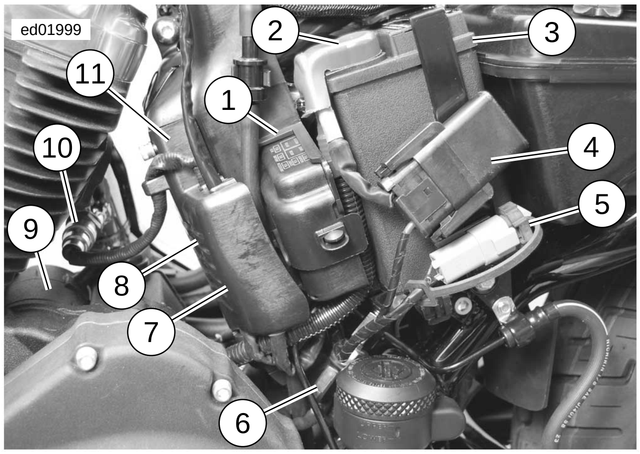
# STOP LAMPS 5.5

## DESCRIPTION AND OPERATION

See Figure 5-10. The front and rear stop lamp switches control the stop lamp portion of the tail/stop lamp. The front stop lamp switch is a mechanical switch. When the front stop lamp lever is applied, the lever presses a mechanical switch and closes the contacts on the switch.

The rear stop lamp switch is a pressure switch. When the rear stop lamp switch is applied, it generates pressure in the brake fluid. This pressure in the fluid causes the contacts for the rear stop lamp switch to close. The fuse supplies power to the stop lamp switches.

- When the front stop lamp switch closes (front brake lever pulled in), power flows through the switch to the tail/stop lamp.
- When the rear stop lamp switch is applied (rear brake pedal pressed), power flows through the switch to the tail/stop lamp.




1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **Main fuse [5]**
5. **DLC [91]**
6. **Rear stop lamp switch (XL models) [121]**
7. **Fuel pump and low fuel switch [141]**
8. **Rear O2 sensor [137]**
9. **Starter**
10. **Rear O2 sensor**
11. **ECM**

**Figure 5-10. Under Left Side Cover: XL**

### Diagnostic Tips

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

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

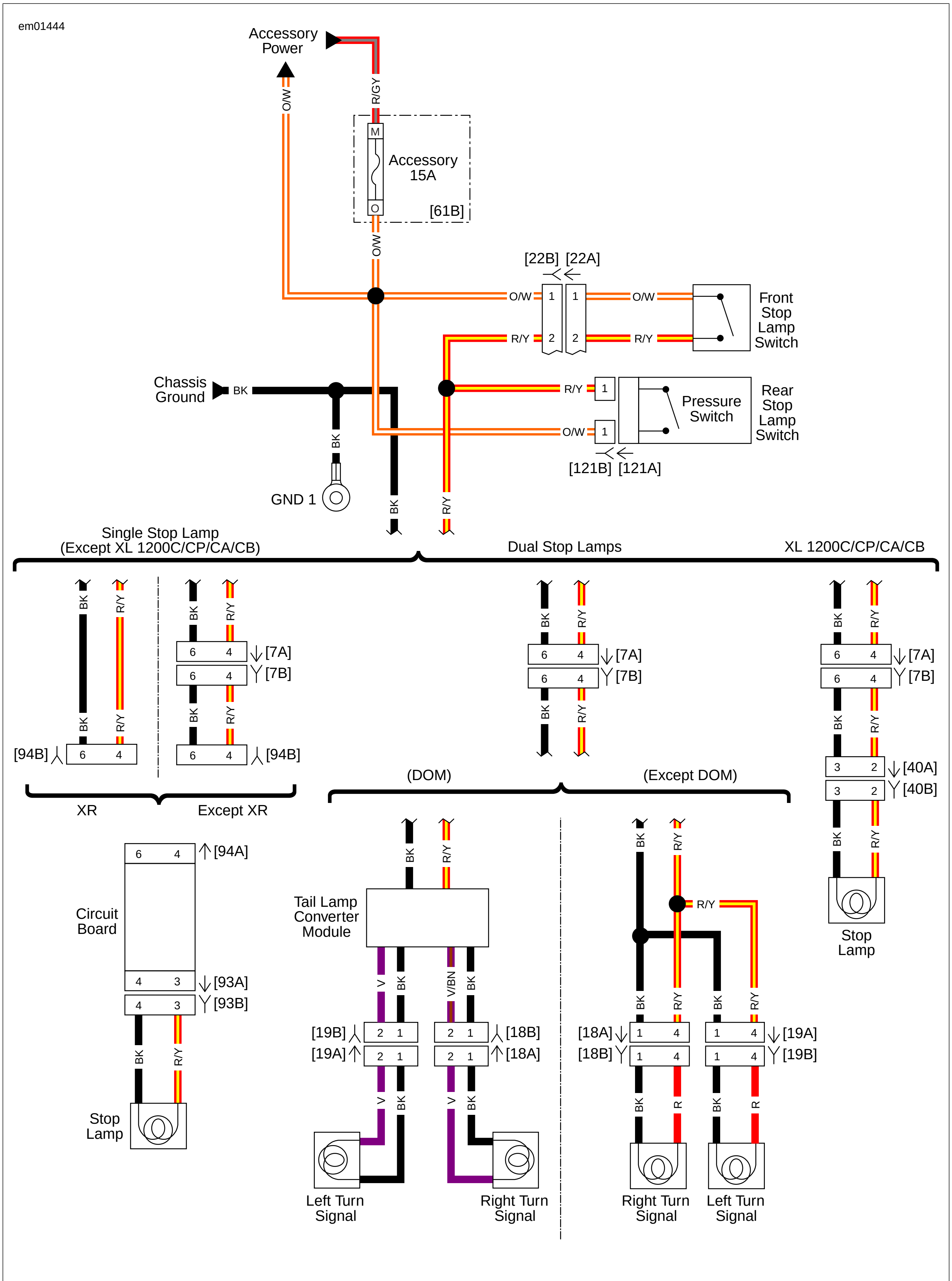



**Figure 5-11. Tail/Stop and Turn Signal Lamps**

## STOP LAMP INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-9. Stop Lamp Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open fuse |
| Short in stop lamp circuit |
| Open power to switch circuit |
| Open ground circuit |
| Open stop lamp circuit |
| Stop lamp malfunction |
| Rear stop lamp switch malfunction |
| Front stop lamp switch malfunction |

### 1. Accessory Circuit Test

1. Turn IGN to ACC.
2. Do the instruments illuminate?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 2.

### 2. Accessories Fuse Test

1. Inspect the ACCY fuse.
2. Is the fuse good?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

### 3. Accessory Circuit from Ignition Switch Test

1. With IGN in ACC, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [61B] socket terminal M and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (O/W) wire from ACCY fuse. **(5043)**
   b. **No.** Go to Test 4.

### 4. Ignition Switch Test

1. Inspect for open or damaged wires between the ignition switch and the accessory fuse.
2. Was any damage to the wiring found?
   a. **Yes.** Repair open between [61B] socket terminal M and ignition switch. **(5041)**
   b. **No.** Replace the ignition switch. **(7287)**

### 5. Accessory Circuit Resistance Test

1. With the accessories fuse removed, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance between [61B] socket terminal O and ground.
2. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** See diagnostic tips. Replace accessories fuse and verify repair. **(6822)**

### 6. Speedometer Test

1. Disconnect the speedometer [39].
2. Measure resistance between [61B] socket terminal O and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes, without tachometer.** Repair short to ground in accessory circuit (O/W) wire. **(5043)**
   b. **Yes, with tachometer.** Go to Test 7.
   c. **No.** Replace the speedometer. **(6765)**

### 7. Tachometer Test

1. Disconnect the tachometer [108].
2. Measure resistance between [61B] socket terminal O and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground in accessory circuit (O/W) wire. **(5043)**
   b. **No.** Replace the tachometer. **(6772)**

### 8. Stop Lamp Switch Test

1. Apply the front stop lamp switch while observing the stop lamp.
2. Apply the rear stop lamp switch while observing the stop lamp.
3. Does the stop lamp illuminate?
   a. **Yes, stop lamp illuminates only with front stop lamp switch applied.** Go to Test 11.
   b. **Yes, stop lamp illuminates only with rear stop lamp switch applied.** Go to Test 13.
   c. **No.** Go to Test 9.

### 9. Tail Stop Lamp Test

1. Disconnect rear lighting [94] (single stop lamp) or [7] (dual stop lamps).
2. With one of the stop lamp switches applied test for voltage between [94B] (single stop lamp) or [7A] (dual stop lamps) terminals 4 and 6.
3. Is battery voltage present?
   a. **Yes, single stop lamp, except XL1200C, CP, CA, CB.** Go to Test 15.
   b. **Yes, single stop lamp, XL1200C, CP, CA, CB.** Go to Test 20.
   c. **Yes, dual stop lamps.** Go to Test 17.
   d. **No.** Go to Test 10.

## 10. Stop Lamp Ground Test

1. With one of the stop lamp switches applied test for voltage between [94B] (single stop lamp) or [7B] (dual stop lamps) terminal 4 and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in the (BK) ground wire between stop lamp and GND 1. **(5041)**
   b. **No.** Repair open in (R/Y) wire between stop lamp switches and stop lamp. **(5041)**

## 11. Rear Stop Lamp Switch Test

1. Disconnect rear stop lamp switch [121].
2. Jumper [121B] terminals A and B together.
3. Turn IGN ON.
4. Does the brake lamp illuminate?
   a. **Yes.** Replace the rear stop lamp switch. **(5141)**
   b. **No.** Go to Test 14.

## 12. Rear Stop Lamp Switch ACCY Circuit Test

1. Test for voltage between [121B] terminal B and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (R/Y) wire between rear stop lamp switch and stop lamp. **(5041)**
   b. **No.** Repair open in (O/W) wire. **(5043)**

## 13. Front Stop Lamp Switch Test

1. With IGN OFF, disconnect right hand controls [22].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) jumper [22B] terminals 1 and 2 together.
3. Turn IGN ON.
4. Does the brake lamp illuminate?
   a. **Yes.** Replace front stop lamp switch. **(5176)**
   b. **No.** Go to Test 14.

## 14. Front Stop Lamp Switch ACCY Circuit Test

1. Test for voltage between [22B] terminal 1 and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (R/Y) wire between front stop lamp switch and stop lamp. **(5041)**
   b. **No.** Repair open in (O/W) wire. **(5043)**

## 15. Stop Lamp Bulb Test

1. Inspect the stop lamp bulb.
2. Is the bulb good?
   a. **Yes.** Go to Test 16.
   b. **No.** Replace the stop lamp bulb. **(5197)**

## 16. Circuit Board Test

1. Connect [94].
2. Disconnect rear lighting [93].
3. With one of the stop lamp switches applied test for voltage at [93A] between terminals 3 and 4.
4. Is battery voltage present?
   a. **Yes.** Replace the tail lamp socket assembly. **(5215)**
   b. **No.** Replace the circuit board. **(5215)**

## 17. Stop Lamp Verification Test

1. Connect [7].
2. Apply either stop lamp switch while observing the stop lamps.
3. Are both stop lamps inoperative?
   a. **Yes, dual stop lamps (DOM).** Replace the tail lamp converter module. **(6809)**
   b. **Yes, dual stop lamps (except DOM).** Repair open in tail lamp harness (R/Y) or (BK) wire. **(5041)**
   c. **No.** Go to Test 18.

## 18. Stop Lamp Circuit Test

*NOTE*

*Depending on the model and destination, the rear turn signal lamps may use LEDs or conventional bulbs. If conventional bulbs are present inspect the bulbs and replace as needed. Replace the entire lamp if the LED fails.*

1. Disconnect inoperative stop lamp [18] right or [19] left.
2. With the stop lamp switch applied test for voltage at [18] right or [19] left between terminals 1 and 2 (DOM) or terminals 1 and 4 (except DOM).
3. Is voltage present?
   a. **Yes.** Replace turn signal. **(6823)**
   b. **No. (DOM).** Replace the tail lamp converter module. **(6809)**
   c. **No. (Except DOM).** Go to Test 19.

## 19. Stop Lamp Circuit Ground Test

1. With the stop lamp switch applied test for voltage at [18] right or [19] left between terminal 4 and ground.
2. Is voltage present?
   a. **Yes.** Repair open in (BK) wire between [7] and [18] right or [19] left. **(5041)**
   b. **No.** Repair open in (R/Y) wire between [7] and [18] right or [19] left. **(5041)**

## 20. Stop Lamp Bulb Test

1. Turn IGN OFF.
2. Remove the stop lamp bulb.
3. Inspect the bulb.

4. Is the bulb good?
   a. **Yes.** Go to Test 21.
   b. **No.** Replace the bulb. **(6820)**

## 21. Stop Lamp [7] Power Test

1. Disconnect rear lighting [7].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage at [7A] terminal 4 (R/Y) wire.
3. Turn IGN ON and apply brake.
4. Is voltage present?
   a. **Yes.** Go to Test 22.
   b. **No.** Repair open in (R/Y) wire. **(5041)**

## 22. Stop Lamp [7] Ground Test

1. Turn IGN OFF.
2. Test for continuity between [7B] terminal 6 (BK) wire and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 23.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 23. Stop Lamp [40] Ground Test

1. Connect [7].
2. Disconnect rear tail lamp assembly [40].
3. Test for continuity between [40A] terminal 3 (BK) wire and ground.
4. Is continuity present?
   a. **Yes.** Go to Test 24.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 24. Stop Lamp [40] Power Test

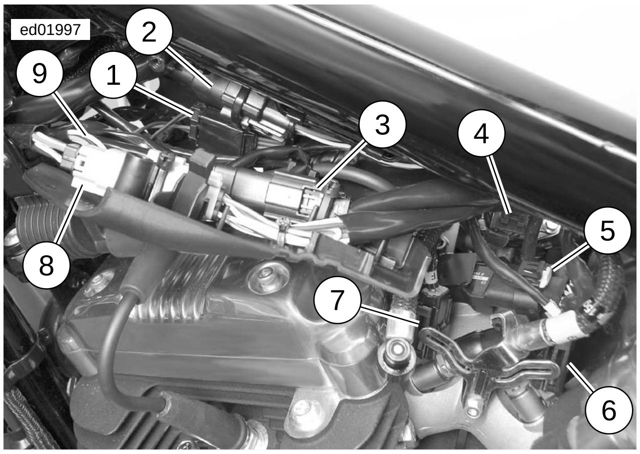
1. Test for voltage at [40A] terminal 2 (R/Y) wire.
2. Turn IGN ON and apply brake.
3. Is voltage present?
   a. **Yes.** Replace rear stop lamp socket assembly. **(5215)**
   b. **No.** Repair open in (R/Y) wire. **(5041)**

# RUNNING LAMPS 5.6

## DESCRIPTION AND OPERATION

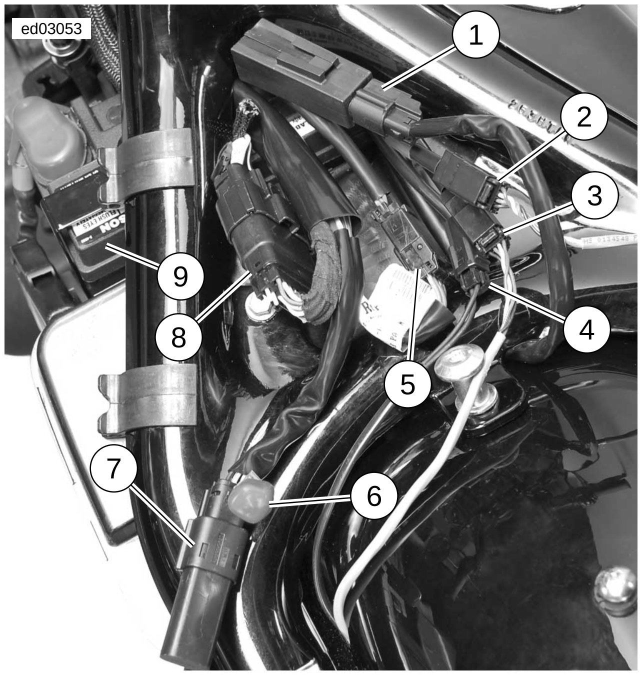
See Figure 5-14. The headlamp connector is located behind the headlamp housing. The rear tail/stop lamp and license plate lamp connectors are located under the seat.

The running lamps consist of the front position lamp (HDI), located in the headlamp housing, the license plate lamp and the tail lamp. The running lamps are powered through the accessory or lights fuse when the ignition switch is in the ON or ACCY position.




1. **Front turn signals [31]**
2. **Instruments [20]**
3. **Right hand controls [22]**
4. **IAC [87]**
5. **TMAP [80]**
6. **Rear fuel injector [85]**
7. **Front fuel injector [84]**
8. **Left hand controls [24]**
9. **Headlamp [38]**

**Figure 5-12. Under Fuel Tank Left Side**




1. **Security antenna [209]**
2. **Right rear turn signal [18] (HDI)**
3. **Left rear turn signal [19] (HDI)**
4. **License plate lamp [40]**
5. **Tail lamp harness to main harness [7]**
6. **P&A battery [160]**
7. **Fuel sender resistor assembly [200]**
8. **Engine sensor harness [145]**
9. **Battery**

**Figure 5-13. Under Seat: XL (Typical)**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

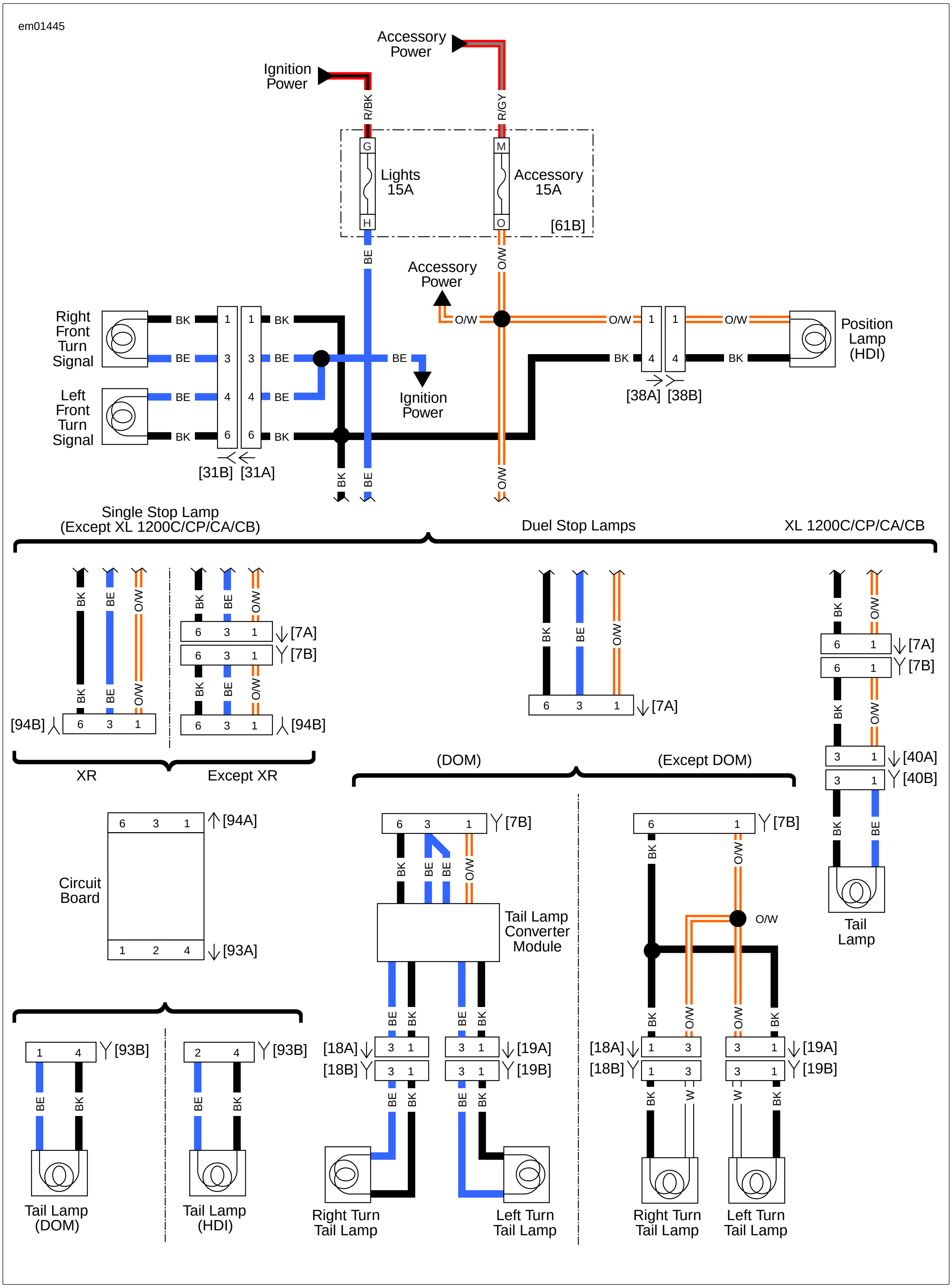



**Figure 5-14. Running Lamps**

HOME

## POSITION LAMP INOPERATIVE: HDI

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-10. Position Lamp Inoperative Diagnostic Faults: HDI**

| POSSIBLE CAUSES |
|---|
| Open accessory circuit |
| Lamp malfunction |
| Open ground |

### 1. Accessory Circuit Test

1. Turn the IGN to ACC.
2. Apply either the front or rear stop lamp switch.
3. Does the stop lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 5.5 STOP LAMPS, Stop Lamp Inoperative.

### 2. Position Lamp Test

1. Disconnect headlamp [38].
2. With the IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [38A] terminals 1 and 4.
3. Is battery voltage present?
   a. **Yes.** Replace position lamp. **(5143)**
   b. **No.** Go to Test 3.

### 3. Ground Circuit Test

1. Test for voltage between [38] terminal 1 and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (BK) ground wire. **(5041)**
   b. **No.** Repair open in (O/W) wire. **(5043)**

## RUNNING LAMPS INOPERATIVE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-11. Running Lamps Inoperative Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open lights circuit |
| Lamp malfunction |
| Open ground |

### 1. Lights Circuit Test

1. Turn the IGN ON.
2. Does the headlamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 5.4 HEADLAMPS, Headlamp Inoperative, No DTCs.

### 2. Stop Lamp Test

1. Apply either stop lamp switch.
2. Does the stop lamp illuminate?
   a. **Yes.** Go to Test 3.
   b. **No.** See 5.5 STOP LAMPS, Stop Lamp Inoperative.

### 3. Rear Running Lamps Test

1. Observe the running lamps.
2. Are both the tail lamp and the license plate lamp inoperative?
   a. **Yes, single tail lamp, except XL1200C, CP, CA, CB.** Go to Test 4.
   b. **Yes, single tail lamp, XL1200C, CP, CA, CB.** Go to Test 10.
   c. **Yes, dual tail lamps.** Go to Test 7.
   d. **No.** Go to Test 8.

### 4. Tail Lamp Bulb Test

1. Inspect the bulb.
2. Is the bulb good?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace the tail lamp bulb. **(5197)**

### 5. Running Lamps Circuit Test

1. Disconnect rear lighting [93].
2. With the IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [93A] terminals 1 and 4 (DOM) or terminals 2 and 4 (except DOM).
3. Is battery voltage present?
   a. **Yes.** Repair open in (BE) wire [93B]. **(5039)**
   b. **No.** Go to Test 6.

### 6. Circuit Board Test

1. Disconnect circuit board [94].
2. Test for voltage between terminal 3 and ground (DOM) or terminal 1 and ground (except DOM).
3. Is battery voltage present?
   a. **Yes.** Replace the circuit board. **(5215)**
   b. **No.** Repair open in terminal 3 circuit (DOM) or terminal 1 circuit (except DOM). **(5041)**

### 7. Running Lamp Verification Test

1. Disconnect rear lighting [7].

2. Test for voltage at [7B] between terminal 2 and ground (DOM) or 6 and ground (except DOM).
   a. **Yes. (DOM).** Replace the tail lamp converter module. **(6809)**
   b. **Yes. (Except DOM).** Repair open in (O/W) wire between [7B] and inoperative lamp. **(5043)**
   c. **No. (DOM).** Repair open in (BE) wire. **(5039)**
   d. **No. (Except DOM).** Repair open in (O/W) wire. **(5043)**

## 8. Individual Lamp Test

1. Disconnect the inoperative lamp.
2. Test for voltage between terminals 1 and 2 of inoperative lamp circuit.
3. Is voltage present?
   a. **Yes.** Repair or replace inoperative lamp. **(6823)**
   b. **No. (DOM).** Replace tail lamp converter module. **(6809)**
   c. **No. (Except DOM).** Go to Test 9.

## 9. Lamp Circuit Ground Test

1. Test voltage between terminal 1 (DOM) or terminal 3 (except DOM) and ground.
2. Is voltage present?
   a. **Yes.** Repair open in ground circuit. **(5041)**
   b. **No. (DOM).** Repair open in (BE) wire. **(5039)**
   c. **No. (Except DOM).** Repair open in (O/W) wire. **(5043)**

## 10. Running Lamp Bulb Test

1. Turn IGN OFF.
2. Remove the running lamp bulb.
3. Inspect the bulb.
4. Is the bulb good?
   a. **Yes.** Go to Test 11.
   b. **No.** Replace the bulb. **(6820)**

## 11. Running Lamp [7] Power Test

1. Disconnect rear lighting [7].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage at [7A] terminal 1 (O/W) wire.
3. Turn IGN ON.
4. Is voltage present?
   a. **Yes.** Go to Test 12.
   b. **No.** Repair open in (O/W) wire. **(5041)**

## 12. Running Lamp [7] Ground Test

1. Turn IGN OFF.
2. Test for continuity between [7B] terminal 6 (BK) wire and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 13.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 13. Running Lamp [40] Ground Test

1. Connect [7].
2. Disconnect rear tail lamp assembly [40].
3. Test for continuity between [40A] terminal 3 (BK) wire and ground.
4. Is continuity present?
   a. **Yes.** Go to Test 14.
   b. **No.** Repair open in (BK) wire. **(5041)**

## 14. Running Lamp [40] Power Test

1. Test for voltage at [40A] terminal 1 (O/W) wire.
2. Turn IGN ON and apply brake.
3. Is voltage present?
   a. **Yes.** Replace rear stop lamp socket assembly. **(5215)**
   b. **No.** Repair open in (O/W) wire. **(5041)**

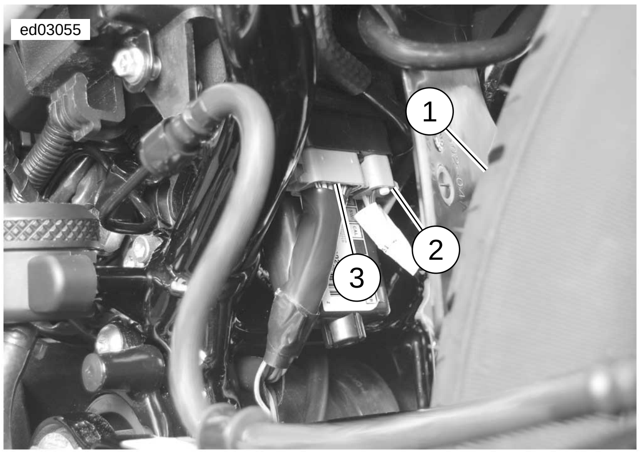
# DTC B1121, B1122, B1123, B1124, B1125, B1126 5.7

## DESCRIPTION AND OPERATION

See Figure 5-15. The TSM, TSSM or HFSM is located under the battery. It receives battery power through terminal 1 and ignition power through terminal 2. The ground for the TSM, TSSM or HFSM is through terminal 12. The TSM, TSSM or HFSM communicates with the other modules on the vehicle through the serial data circuit from terminal 3.

The turn signal switches are inputs to the TSM, TSSM or HFSM. When the TSM, TSSM or HFSM receives voltage from either of the turn signal switches it supplies voltage to the corresponding turn signal lamps and indicator.

The TSM, TSSM or HFSM also monitors the position of the clutch and neutral switches to determine if it is safe to start the vehicle. The BAS is internal to the TSM, TSSM or HFSM and allows the TSM, TSSM or HFSM to determine if the vehicle is tipped over. If a tip over event occurs, the TSM, TSSM or HFSM shuts off the engine.




1. **Rear tire**
2. **HFSM antenna [208]**
3. **TSM, TSSM or HFSM [30]**

**Figure 5-15. TSM, TSSM or HFSM**

The TSM, TSSM or HFSM monitors the output circuits and sets DTCs if faults are detected.

**Table 5-12. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1121 | Left turn output fault |
| B1122 | Right turn output fault |
| B1123 | Left turn signal short-to-ground: HFSM |
| B1124 | Right turn signal short-to-ground: HFSM |
| B1125 | Left turn signal short-to-voltage: HFSM |
| B1126 | Right turn signal short-to-voltage: HFSM |

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

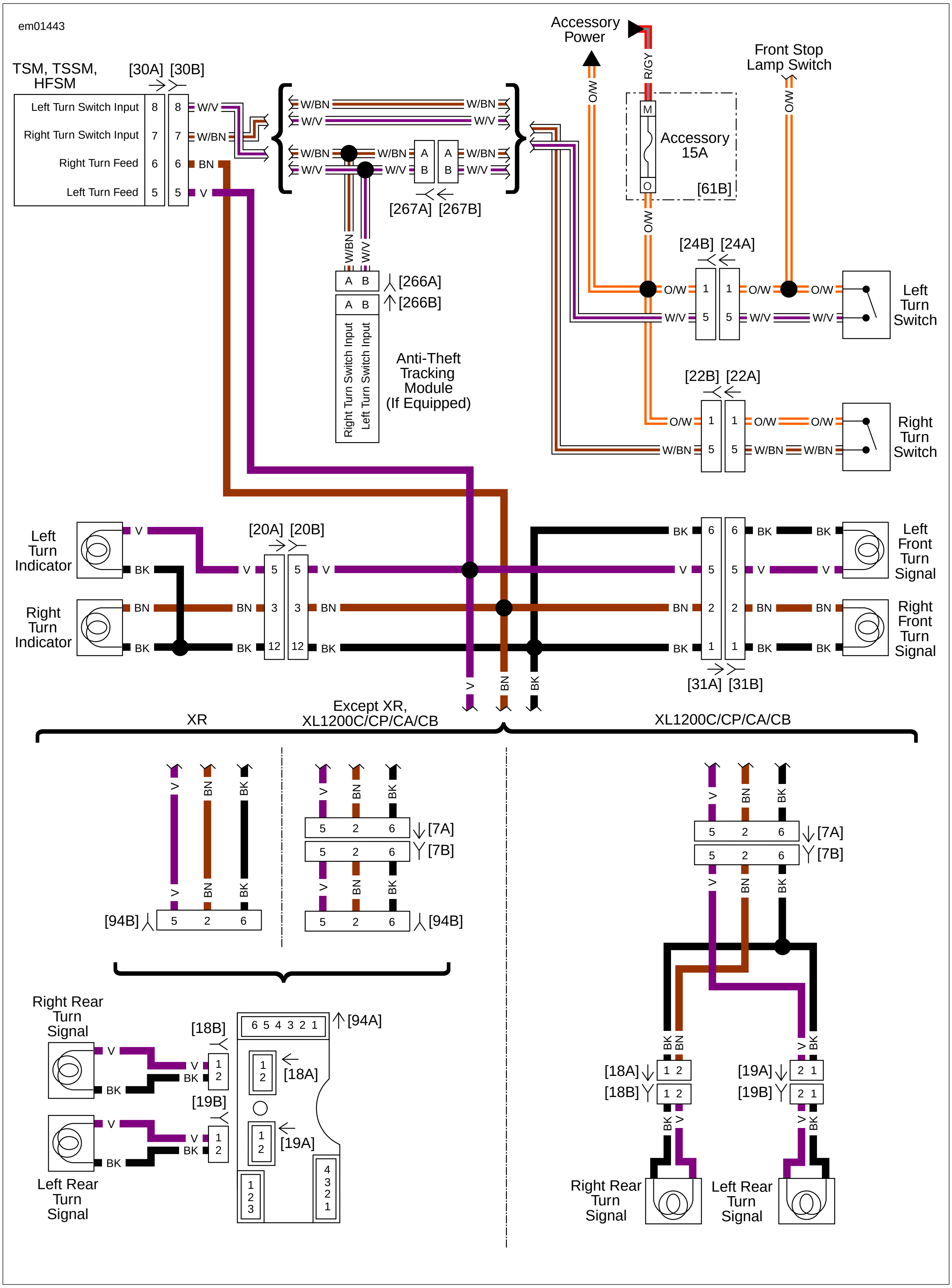



**Figure 5-16. Single Stop Lamp Turn Signal Circuit**

HOME

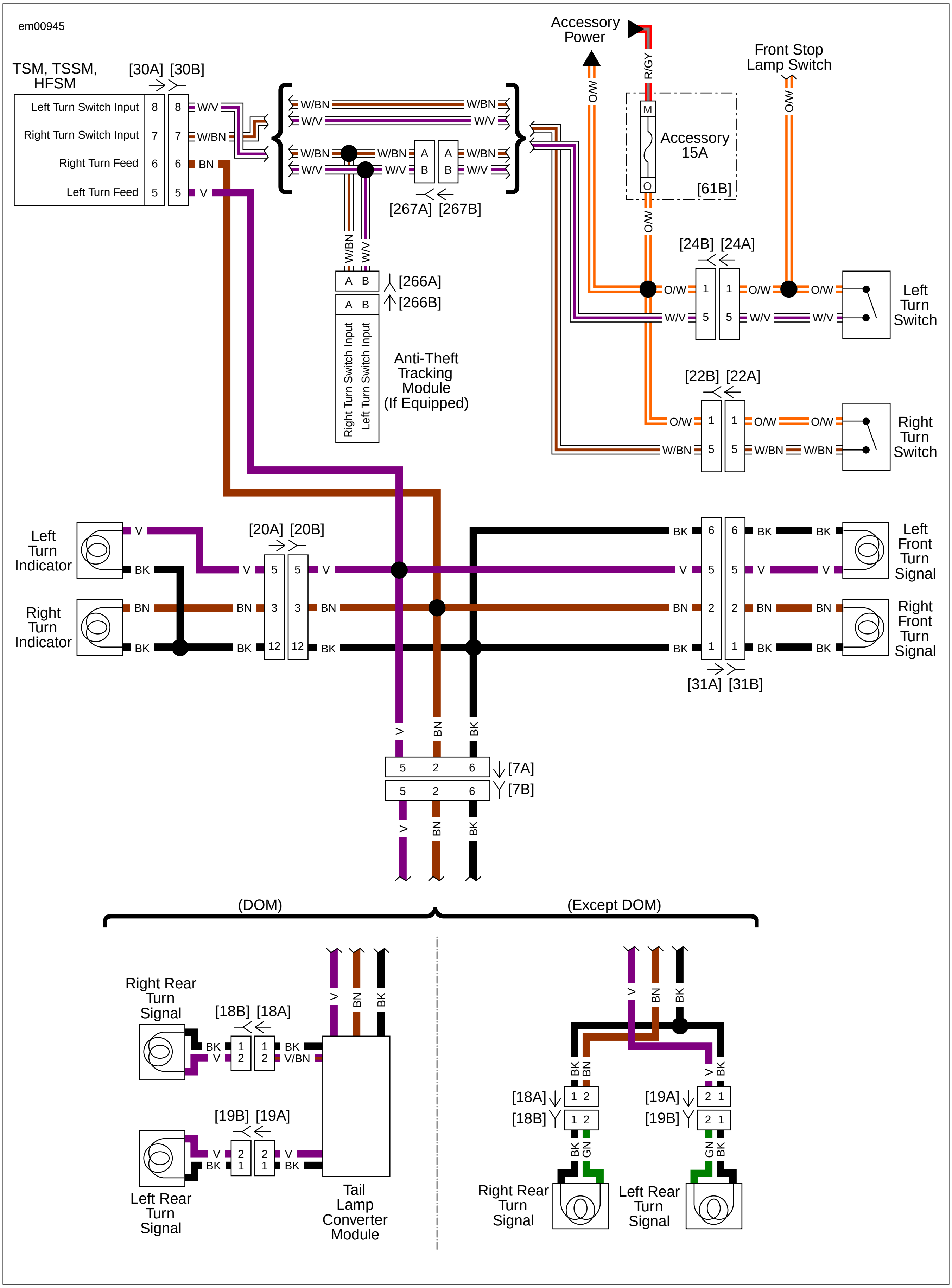



**Figure 5-17. Dual Stop Lamp Turn Signal Circuit**

## DTC B1121: HFSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42682 | BREAKOUT BOX |

**Table 5-13. DTC B1121 Diagnostic Faults: HFSM**

| POSSIBLE CAUSES |
|---|
| Open left turn signal circuit |

### 1. Turn Signal Lamp Inspection Test

1. Remove and inspect left side turn signal bulbs.
2. Confirm the turn signal bulbs are the correct part numbers and the sockets are not corroded or damaged.
3. Were any issues found with the lamps?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 2.

### 2. Turn Signal Circuit Open Test

1. With IGN OFF, disconnect HFSM [30].
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B] leaving HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Disconnect front turn signals [31].
4. Test for continuity between breakout box terminal 5 and [31A] terminal 5.
5. Is continuity present?
   a. **Yes.** Replace the HFSM.
   b. **No.** Repair open in (V) wire.

## DTC B1121: TSM OR TSSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-14. DTC B1121 Diagnostic Faults: TSM or TSSM**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to voltage on left turn signal circuit |
| Short to ground on left turn signal circuit |
| Open left turn signal circuit |

### 1. Operational Test

1. Turn IGN ON.
2. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

### 2. Indicator Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect the instruments [20].
3. Turn IGN ON.
4. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace indicator lamp assembly.

### 3. TSM or TSSM Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B], leaving the TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminal 5 and ground.
4. Is voltage present?
   a. **Yes.** Repair short to voltage on the (V) wire.
   b. **No.** Replace the TSM or TSSM.

### 4. Indicator Shorted Test

1. With IGN OFF, disconnect the instruments [20].
2. Turn IGN ON.
3. Operate the left turn signals.
4. Do the turn signals flash?
   a. **Yes.** Replace indicator lamp assembly.
   b. **No.** Go to Test 5.

### 5. Shorted Turn Signal Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B] leaving TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between breakout box terminal 5 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (V) wire from terminal 5.
   b. **No.** Go to Test 6.

### 6. Turn Signal Circuit Open Test

1. Disconnect front turn signals [31].
2. Test for continuity between breakout box terminal 5 and [31A] terminal 5.
3. Is continuity present?
   a. **Yes.** Replace the TSM or TSSM.
   b. **No.** Repair open in (V) wire.

## DTC B1122: HFSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42682 | BREAKOUT BOX |

**Table 5-15. DTC B1122 Diagnostic Faults: HFSM**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Open right turn signal circuit |

### 1. Turn Signal Lamp Inspection Test

1. Remove and inspect the right side turn signal bulbs.
2. Confirm the turn signal bulbs are the correct part numbers and the sockets are not corroded or damaged.
3. Were any issues found with the lamps?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 2.

### 2. Turn Signal Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B], leaving HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Disconnect front turn signals [31].
4. Test for continuity between breakout box terminal 6 and [31A] terminal 2.
5. Is continuity present?
   a. **Yes.** Replace the HFSM.
   b. **No.** Repair open in (BN) wire.

## DTC B1122: TSM OR TSSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-16. DTC B1122 Diagnostic Faults: TSM or TSSM**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to voltage on right turn signal circuit |
| Short to ground on right turn signal circuit |
| Open right turn signal circuit |

### 1. Operational Test

1. Turn IGN ON.
2. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

### 2. Indicator Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect the instruments [20].
3. Turn IGN ON.
4. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace indicator lamp assembly.

### 3. TSM, TSSM or HFSM Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminal 6 and ground.
4. Is voltage present?
   a. **Yes.** Repair short to voltage on the (BN) wire.
   b. **No.** Replace the TSM or TSSM.

### 4. Indicator Shorted Test

1. With IGN OFF, disconnect the instruments [20].
2. Turn IGN ON.
3. Operate the left turn signals.
4. Do the turn signals flash?
   a. **Yes.** Replace indicator lamp assembly.
   b. **No.** Go to Test 5.

### 5. Turn Signal Circuit Shorted Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B] leaving TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between breakout box terminal 6 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (BN) wire.
   b. **No.** Go to Test 6.

### 6. Turn Signal Circuit Open Test

1. Disconnect front turn signals [31].
2. Test for continuity between breakout box terminal 6 and [31A] terminal 2.
3. Is continuity present?
   a. **Yes.** Replace the TSM or TSSM.
   b. **No.** Repair open in (BN) wire.

## DTC B1123

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-17. DTC B1123 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to ground on left turn signal circuit |

### 1. Turn Signal Lamp Inspection Test

1. Remove and inspect left side turn signal bulbs.
2. Confirm the turn signal bulbs are the correct part numbers and the sockets are not corroded or damaged.
3. Were any issues found with the lamps?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 2.

### 2. Turn Signal Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving the HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Disconnect the instruments [20].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box terminals 5 and 12.
5. Is continuity present?
   a. **Yes.** Repair short to ground in left turn signal circuit (V) wire.
   b. **No.** Go to Test 3.

### 3. Indicator Test

1. Install turn signal bulbs.
2. Remove breakout box and connect HFSM [30].
3. With [20] disconnected, operate the left turn signals.
4. Do the turn signals function and flash correctly?
   a. **Yes.** Replace the indicator lamp assembly.
   b. **No.** Replace the HFSM.

## DTC B1124

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-18. DTC B1124 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to ground on right turn signal circuit |

### 1. Turn Signal Lamp Inspection Test

1. Remove and inspect right side turn signal lamps.
2. Confirm the turn signal bulbs are the correct part numbers and the sockets are not corroded or damaged.
3. Were any issues found with the lamps?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 2.

### 2. Turn Signal Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Disconnect the instruments [20].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box terminals 6 and 12.
5. Is continuity present?
   a. **Yes.** Repair short to ground in right turn signal circuit (BN) wire.
   b. **No.** Go to Test 3.

### 3. Indicator Test

1. Install turn signal bulbs.
2. Remove breakout box and connect HFSM [30].
3. With [20] disconnected, operate the right turn signals.
4. Do the turn signals function and flash correctly?
   a. **Yes.** Replace the indicator lamp assembly.
   b. **No.** Replace the HFSM.

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## DTC B1125

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-19. DTC B1125 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to voltage on left turn signal circuit |

### 1. Turn Signal Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving the TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminals 5 and 12.
3. Is voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace HFSM.

### 2. Indicator Test

1. With IGN OFF, disconnect the instruments [20].
2. Turn IGN ON.
3. Test for voltage between breakout box terminals 5 and 12.
4. Is voltage present?
   a. **Yes.** Repair short to voltage in left turn signal circuit (V) wire.
   b. **No.** Replace the indicator lamp assembly.

## DTC B1126

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-20. DTC B1126 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Indicator lamp assembly malfunction |
| Short to voltage on right turn signal circuit |

### 1. Turn Signal Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and multimeter, test for voltage between breakout box terminals 6 and 12.
3. Is voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace HFSM.

### 2. Indicator Test

1. With IGN OFF, disconnect the instruments [20].
2. Turn IGN ON.
3. Test for voltage between breakout box terminals 6 and 12.
4. Is voltage present?
   a. **Yes.** Repair short to voltage in right turn signal circuit (V) wire.
   b. **No.** Replace the indicator lamp assembly.

# DTC B1135, B1136, B1141, B1142 5.8

## DIAGNOSTICS

### DTC B1135 Accelerometer Fault

DTC B1135 indicates a failure which requires replacement of the TSM, TSSM or HFSM.

*NOTE*

*When DTC B1135 is set, the tip-over engine shutdown, HFSM tamper alarm and bank angle sensors are disabled. The security lamp will also illuminate when this code is set.*

### DTC B1136 Accelerometer Tip-Over Self-Test Fault

DTC B1136 indicates a failure which requires replacement of the HFSM.

### DTC B1141 Ignition Switch Open/Low

DTC B1141 indicates the TSM, TSSM or HFSM is recognizing an open or low condition on the ignition circuit.

### DTC B1142 Internal Fault

DTC B1142 indicates a failure which requires replacement of the HFSM.

## DTC B1141

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-21. DTC B1141 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Open ignition circuit |

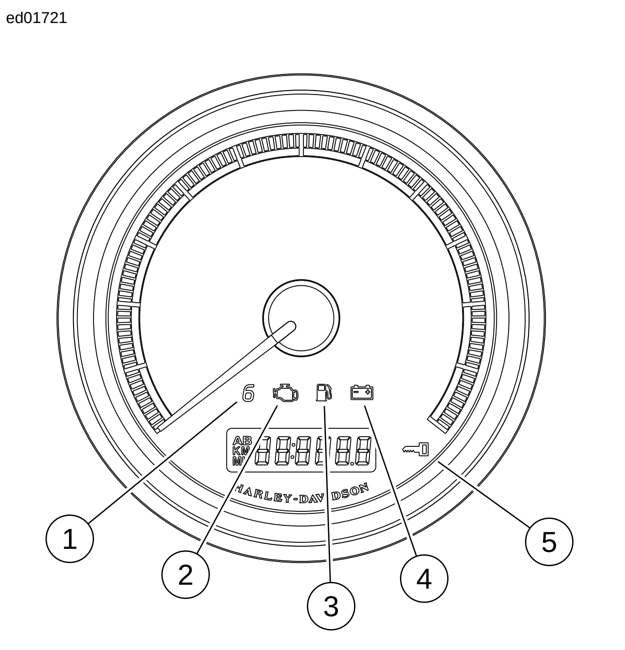
### 1. Ignition Circuit Open Test

1. With IGN OFF, connect TSM, TSSM or HFSM BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSM, TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. With the IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminal 2 and ground.
3. Is voltage present?
   a. **Yes.** Replace the TSM, TSSM or HFSM.
   b. **No.** Repair open in (GY) ignition wire.

# SECURITY SYSTEM 5.9

## SECURITY LAMP

See Figure 5-18. The security lamp (key icon) in the instrument face provides feedback to the rider confirming armed or disarmed status. Refer to Table 5-22.




1. **Sixth gear indicator**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Battery lamp**
5. **Security lamp (key icon)**

**Figure 5-18. Indicator Lamps (Typical)**

**Table 5-22. Security Lamp Status**

| LAMP | MODE |
|---|---|
| Does not flash. | No security system (TSM only), security system not armed. |
| Flashes every second. | 2 minute (HFSM) or ten minute (TSSM) timeout after failed PIN entry attempt or a battery reconnect has occurred while armed. |
| Flashes every 2.5 seconds. | Security system armed. |
| Flashes 4 times a second. | PIN entry mode. |
| Stays on solid with IGN OFF. | Arming is starting up. You have 5 seconds (HFSM) or 30 seconds (TSSM) before system is armed. |
| Stays on solid with IGN ON. | If solid for more than 4 seconds after IGN ON, a current DTC is present. |

## SECURITY IMMOBILIZATION

The TSSM or HFSM provides security and immobilization functions not found on the TSM. The TSSM or HFSM will disable the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

*NOTE*

*The siren must be in the chirp mode for the siren to chirp on arming or disarming. See 5.11 SIREN, Siren Chirp Mode Confirmation: HFSM.*

Conditions that activate the security system when system is armed include:

- **Detecting tampering of the ignition circuit:** Turn signals flash three times, optional siren chirps once and then turns off. If the tampering continues, a second warning will activate after four seconds. Continued tampering will cause the alarm to activate for 30 seconds and then turn off. The two warnings/alarm cycle is repeated for each tampering incident.
- **Detecting vehicle movement:** Turn signals flash three times, optional siren chirps once and then turns off. If the vehicle is not returned to its original position, a second warning will activate after four seconds. If the vehicle is not returned to its original position, the alarm activates for 30 seconds then turns off. The two warnings/alarm cycle may repeat a maximum of 10 times with a 10 second pause between cycles.
- **Detecting that a battery or ground disconnect has occurred while armed:** The optional siren activates its self-alarm mode. Turn signals will not flash.

*NOTE*

*Always disarm the TSSM or HFSM before removing or disconnecting the battery to prevent the siren (if installed) from activating. If the TSSM is in auto-arming mode, you must disarm the system and disconnect the battery or remove the battery fuse before the 30 second arming period expires.*

## TSSM OR HFSM FEATURES

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

The following information applies only to vehicles equipped with the TSSM or HFSM.

- **Security lamp:** See Figure 5-18. The security lamp (key icon) tells the rider if the system is armed or disarmed.
- **Personal code disarming:** If the fob is not available, the TSSM or HFSM allows the rider to disable the security alarm and immobilization functions with a five-digit personal code.
- **Arming confirmation:** When the TSSM or HFSM is armed, the system provides visual feedback (confirmation) to the rider by flashing the turn signals and an audible

"chirp" if equipped with the optional smart siren and chirp mode is enabled.

- **Remote arming/disarming (TSSM only):** See 5.10 KEY FOB. Owners may enable and disable security alarm and immobilization functions with a personally carried transmitter. This transmitter is referred to as a **key fob**. Remote arming/disarming is a function of the TSSM (Japan/Korea) only.
- **Auto-arming (TSSM only):** Automatically enables the security alarm and immobilization functions within 30 seconds after the ignition switch is switched OFF.
- **Disarming confirmation:** When the TSSM or HFSM is disarmed, the system provides an audible "chirp" (confirmation) if equipped with the optional smart siren and chirp mode is enabled.
- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be moved in an immobilized state.
- **Starter/ignition disable:** When armed the starter and ignition system are disabled.
- **Security system alarm:** See 5.11 SIREN. The system will alternately flash the left and right turn signals and sound an optional Smart Siren if a vehicle security condition is detected while the system is armed.
- **Dealer service mode (HFSM only):** This mode allows the dealer to disable security system via DIGITAL TECHNICIAN II (Part No. HD-48650). Dealer service mode is exited when module detects an assigned fob in range.

### Security System Options: TSSM

The following options are only available on the TSSM unit: alarm sensitivity, auto-arming feature and storage mode.

Default settings for the TSSM include:

- Solo vehicle configuration.
- Medium motion sensitivity on alarm sensitivity.
- All vehicles are shipped with auto-arming disabled.
- Storage mode set to 10 days.

## WARNINGS

A warning consists of three alternate flashes of the turn signals and chirp from the optional smart siren. Warnings are issued from an armed TSSM or HFSM in the following order:

1. **First Warning:** A warning is issued whenever a person without a fob present or with the system armed attempts to move the vehicle or turns the ignition switch to **IGN.**
2. **Second Warning:** If the motion continues or the ignition switch is not turned back to **OFF**, a second warning is issued within four seconds of the first.
3. **Alarm:** If the motion continues or the ignition switch is not turned to **OFF** past the second warning, the smart security system will go into full alarm.

## ARMING: HFSM

The H-DSSS automatically arms within five seconds when the vehicle is parked and the ignition switch is turned to **OFF** and motion is not detected.

### Indicator

Upon arming, the turn signals flash twice and the smart siren will "chirp" twice if chirp function is activated. While armed, the security lamp (key icon) will flash once every 2.5 seconds. Refer to Table 5-22.

## ARMING: TSSM

There are two methods to arm the security system:

- Using the key fob.
- Using auto-arming.

*NOTE*

*The vehicle cannot be armed with the IGN ON.*

### Auto-Arming Function: TSSM

Auto-arming causes the system to automatically arm itself (no key fob needed) within 30 seconds after the ignition switch is turned OFF. During this period, the security lamp stays illuminated to indicate auto-arming is starting up.

The vehicle may be moved during these 30 seconds without triggering the alarm. However, any motion after that period will trigger the security alarm. Upon expiration of the auto-arming period, the turn signals flash twice, the security lamp begins to flash and the siren (if equipped) chirps twice.

The TSSM allows remote arming via the key fob at any time. However, if the system is remotely disarmed (with the key fob) but the ignition switch is not turned ON within 30 seconds, the system will re-arm itself when auto-arming is enabled.

Japan and Korea vehicles have auto-arming disabled by default. However, the feature may be enabled if the customer desires.

When auto-arming is disabled, the key fob must be used to arm the security system. To set the auto-arming function, refer to Table 5-23.

**Table 5-23. Selecting TSSM Auto-Arming Function**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop switch to **OFF** | | Verify the security lamp is not flashing (vehicle is disarmed) |
| 2 | Turn IGN **ON**-OFF-**ON**-OFF-**ON** | | |

**Table 5-23. Selecting TSSM Auto-Arming Function**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 3 | Press **left** turn switch **2 times** and release | Two flashes turn signals and indicators (See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects.) | Two flashes - Japan/Korea configuration TSSM |
| 4 | Press and hold **key fob** button until confirmation is received | One flash turn signals and indicators | |
| 5 | Press and hold **key fob** button until confirmation is received | Two flashes turn signals and indicators | |
| 6 | Press **left** turn switch **1 time** and release | Turn signals and indicators flash to indicate option selected | One flash - auto-arming disabled<br>Two flashes - auto-arming enabled |
| 7 | Press and release **left** turn switch to advance through options | Turn signals and indicators flash to indicate option selected | |
| 8 | Turn IGN OFF | | |

## DISARMING: HFSM

There are two ways to disarm the H-DSSS:

- Automatic Disarming.
- Using the PIN.

### Automatic Disarming

Always have the fob present when riding, loading, fueling, moving, parking or servicing the vehicle. Carry the fob in a convenient pocket. The H-DSSS disarms automatically when the ignition switch is turned to ON.

On disarming, the smart siren will chirp once (if chirp function is activated) and the security lamp (key icon) will turn ON solid for four seconds then go out. Refer to Table 5-22.

### Disarming with a PIN

See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS to enter an initial PIN to enable the system.

If you make an error while disarming the HFSM using the PIN, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 2 minutes (HFSM) or ten minutes (TSSM). **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to Table 5-24.

## DISARMING: TSSM

There are two ways to disarm the system:

- Using the key fob. This method works in all situations **except** before turning ignition switch ON when TSSM storage mode is activated.
- Using a PIN.

If you make an error while disarming the TSSM using a PIN, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 10 minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to Table 5-24.

**Table 5-24. Disarming TSSM or HFSM with the PIN (Example: 3-1-3-1-3)**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop switch to **OFF** | | |
| 2 | Turn IGN to the IGN position (HFSM)<br>Turn IGN to the ACC position (TSSM) | | |
| 3 | Hold **both** turn switches in until confirmation | Security lamp flashes at fast rate | System is ready for PIN entry |
| 4 | Enter first digit of code (3) by pressing **left** turn switch **3 times** | | |
| 5 | Press **right** turn switch **1 time** | | Serves as "enter" key for first digit |
| 6 | Enter second digit of code (1) by pressing **left** turn switch **1 time** | | |
| 7 | Press **right** turn switch **1 time** | | Serves as "enter" key for second digit |
| 8 | Enter third digit of code (3) by pressing **left** turn switch **3 times** | | |

**Table 5-24. Disarming TSSM or HFSM with the PIN (Example: 3-1-3-1-3)**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 9 | Press **right** turn switch **1 time** | | Serves as "enter" key for third digit |
| 10 | Enter fourth digit of code (1) by pressing **left** turn switch **1 time** | | Serves as "enter" key for fourth digit |
| 11 | Press **right** turn switch **1 time** | | |
| 12 | Enter fifth digit of code (3) by pressing **left** turn switch **3 times** | | System is disarmed. You may use the vehicle or program another key fob |
| 13 | Press **right** turn switch **1 time** | Security lamps stop flashing | |

## ALARM

### Activation

In the full alarm state, the turn signals flash alternately, and if equipped with the smart siren, the siren will sound.

After 30 seconds of alarm, if no further vehicle motion is detected, the alarm will stop.

*NOTE*

*Vehicle must be returned to original parked position with ignition switch turned to **OFF**.*

If vehicle motion continues, the alarm will start again continue for another 30 seconds.

The TSSM or HFSM will repeat the alarm cycles 10 times for a total of five minutes, with a 10-second pause between alarm cycles.

During warnings and alarms, the starter motor and the ignition remain disabled.

### Deactivation

The alarm cycles can be discontinued at any time by moving an assigned fob to the vehicle. The presence of the fob will terminate the alarm.

## ALARM SENSITIVITY: TSSM

### Sensitivity

The TSSM has four sensitivity settings: extremely low, low, medium or high. The selection chosen controls the sensitivity of the security system regarding motion detection.

To set alarm sensitivity, refer to Table 5-25.

**Table 5-25. TSSM Alarm Sensitivity**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop switch to **OFF** | | Verify the security lamp is not flashing (vehicle is disarmed) |
| 2 | Turn IGN **ON**-OFF-**ON**-OFF-**ON** | | |
| 3 | Press **left** turn switch **2 times** and release | Two flashes turn signals and indicators depending on vehicle configuration. (See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects.) | Two flashes - Japan/Korea configuration TSSM |
| 4 | Press and hold **key fob** button until confirmation is received | One flash turn signals and indicators | |
| 5 | Press **left** turn switch **1 time** and release | Turn signals and indicators flash to indicate option selected | One flash - extremely low<br>Two flashes - low sensitivity<br>Three flashes - medium sensitivity<br>Four flashes - high sensitivity |
| 6 | Press and release **left** turn switch to advance through options | Turn signals and indicators flash to indicate option selected | One flash - extremely low<br>Two flashes - low sensitivity<br>Three flashes - medium sensitivity<br>Four flashes - high sensitivity |
| 7 | Turn IGN OFF | | |

# KEY FOB 5.10

## HFSM FOB

See Figure 5-19. The HFSM's reception range for the hands-free fob signal depends on a specific receiver pattern. The typical range will be an arm's length.

*NOTES*

- *Environmental and geographic conditions may affect signal range.*
- *Always have the fob present whenever the vehicle is operated.*
- *Do not place fob in metal enclosure, and do not place it closer than 3.0 in. (80.0 mm) to cellular phones, the handsfree antenna, PDAs, displays and other electronic devices while operating the vehicle. That may prevent the fob from disarming the security system.*
- *Replace fob battery every year.*

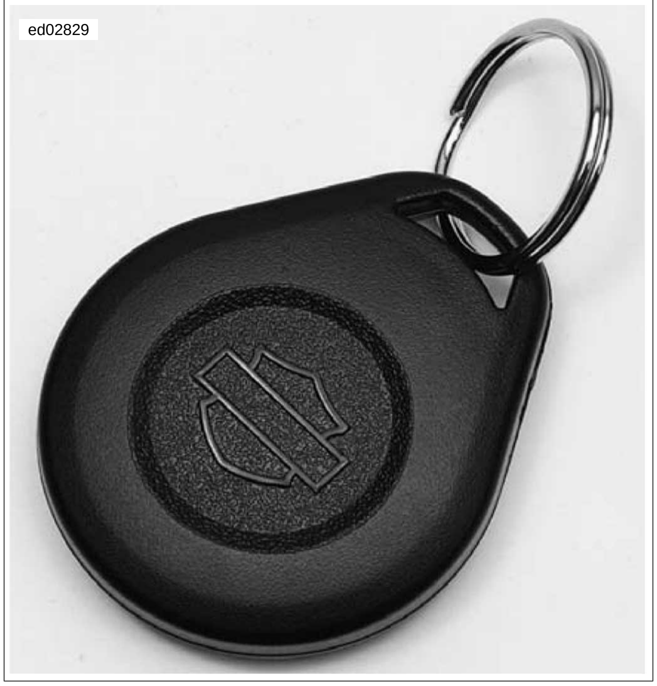



**Figure 5-19. Hands-Free Fob**

## TSSM FOB

The TSSM reception range for the key fob signal depends on a specific receiver pattern.

*NOTE*

*Environmental and geographic conditions may affect signal range.*

### Arming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Hold down the key fob button until the system responds with two turn signal flashes.

### Disarming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Quickly press the key fob button twice. The system will respond with one turn signal flash.

*NOTE*

*Disarming function may require practice. The key fob button **must** be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

### Troubleshooting

If the key fob button has been pressed numerous times while away from the vehicle, the fob may fall out of synchronization with the TSSM. If this happens, the TSSM might fail to recognize the key fob's commands.

To solve this problem, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes. After confirmation, you may resume normal fob operation.

## FOB ASSIGNMENT: HFSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

Use DIGITAL TECHNICIAN II (Part No. HD-48650) to assign both fobs to the H-DSSS. Follow the menu prompts in the DIGITAL TECHNICIAN II (Part No. HD-48650) display and scan the fob serial number with the bar code reader, or key-in the number from the keyboard. See a Harley-Davidson dealer.

*NOTE*

*Each fob has a unique serial number. Attach label from fob to a blank NOTES page in the Owner's Manual for reference.*

## FOB ASSIGNMENT: TSSM

Refer to Table 5-26 to assign a key fob to a vehicle equipped with a TSSM.

The key fob on TSSM vehicles must be set so it will operate the alarm system on the vehicle. This assignment **must** be completed with no pauses between steps greater than 10 seconds. Turn the ignition OFF after all key fobs have been assigned. The programming mode will also exit after 60 seconds has elapsed without detecting any fob sign-up messages or turn signal switch activity.

Two key fobs may be assigned to the TSSM. The first successful attempt to program a fob will disable all previously assigned fobs. If a second fob is to be programmed, it must be done in the same programming sequence as the initial fob.

**Table 5-26. Key Fob Assignment: TSSM**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop to **OFF** | | Verify the security lamp is not flashing (vehicle is disarmed)<br>This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds |
| 2 | Turn ignition/headlamp switch **ON**-OFF-**ON**-OFF-**ON** | | |
| 3 | Press **left** turn switch **2 times** and release | One to four flashes turn signals and indicators depending on vehicle configuration<br>(See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects.) | One flash - Worldwide TSM, no security<br>Two flashes - Japan/Korea configuration TSSM |
| 4 | Press **right** turn switch **1 time** and release | One flash turn signals and indicators | |
| 5 | Press **left** turn switch **1 time** and release | Two flashes turn signals and indicators | |
| 6 | Press and hold **key fob** button until confirmation is received | Two flashes turn signals and indicators | This may take 10-25 seconds. |
| 7 | If you have two key fobs, press and hold button on second **key fob** until confirmation is received | Two flashes turn signals and indicators | Optional step |
| 8 | Turn IGN OFF | | |

# SIREN 5.11

## DESCRIPTION AND OPERATION

The Smart Siren is not a standard part of the security system but can be added to the system. The siren is attached at [142] off the TSSM or HFSM. Through this connector it shares the battery circuit, the ground circuit and the alarm signal circuit with the TSSM or HFSM. The siren is used to add an audible warning to the visual warnings that are a standard function of the security system.

## SIREN CHIRP MODE CONFIRMATION: HFSM

### Chirpless Mode

In the chirpless mode, the siren does not chirp on arming or disarming.

*NOTE*

*Even when armed in the chirpless mode, the siren still chirps warnings on movement and will activate the alarm through the normal cycles.*

### Chirp Mode

On arming in the chirp mode, the siren responds with two chirps. When disarming, the siren responds with a single chirp.

### Switching Modes

Cycling quickly through three armings and disarmings will switch the system from either the chirpless mode or the chirp mode to its opposite.

1. With the fob present, the IGN ON and the system disarmed, turn the IGN OFF.
2. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.
3. Wait until the security lamp goes out, then immediately turn the IGN OFF.
4. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.
5. Wait until the security lamp goes out, then immediately turn the IGN OFF.
6. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.

# SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS 5.12

## GENERAL

Setting up a vehicle's TSM, TSSM or HFSM depends on whether the vehicle has a TSM or the optional TSSM or HFSM security system installed.

## ACTUATION: HFSM

Actuation consists of assigning two fobs to the system and entering an initial PIN. The PIN can be changed by the rider at any time.

1. Configure HFSM vehicles by assigning **both** fobs to the vehicle.
2. Configure HFSM vehicles by entering a PIN picked by the owner. The personal code allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the owner's manual. Instruct the customer to carry a copy (use the wallet card found in the owner's manual).

Once the system has been activated, it will always "arm" within 5 seconds of turning the ignition switch to **OFF** and no vehicle motion.

## CONFIGURING A TSSM

*NOTE*

*Do not forget to enter a PIN for TSSM vehicles. If a PIN is not assigned and both key fobs are lost or damaged while the vehicle is armed, the TSSM must be replaced.*

Changes to TSSM settings are made by a series of programming operations involving the ignition key, left/right turn signal switches and key fob (security systems).

At certain steps in the programming sequence, the vehicle may provide confirmation of settings by flashing the turn signals, turn signal indicators and/or security lamp. In addition, when programming a PIN into a TSSM system, the odometer displays the PIN to the user and dynamically updates it as the code is entered or changed.

All programming operations are listed in table format. Follow the numbered steps to configure the system. If a confirmation response is listed, wait for the confirmation before continuing to the next step. Important information pertaining to certain actions will be found in the NOTES column.

## SELECTING A PIN

The PIN consists of five digits. Each digit can be any number from 1-9. There can be no zeros (0) in the PIN. The PIN **must** be used to disarm the security system in case the fob becomes unavailable.

## INITIAL PIN ENTRY: HFSM

To enter a PIN on a vehicle with no PIN previously installed during HFSM actuation, refer to Table 5-27.

**Table 5-27. Entering an Initial PIN: HFSM**

| NO. | ACTION | WAIT FOR CONFIRMATION |
|---|---|---|
| 1 | Select a 5-digit (1 through 9) initial PIN and record in the owner's manual and on the wallet card. | |
| 2 | With an assigned fob present, set engine stop switch to **OFF.** | |
| 3 | Cycle **IGN ON-OFF-ON-OFF-ON** | |
| 4 | Press **left** turn signal button **2** times. | Turn signals will flash 3 times. |
| 5 | Press **right** turn signal button **1** time. | Five dashes will appear in the odometer window. The first dash will flash. |
| 6 | Enter first digit (a) of initial PIN by pressing **left** turn signal button **a** times. | |
| 7 | Press **right** turn signal button **1** time. | The digit (a) will replace the dash in the odometer. The second dash will flash. |
| 8 | Enter second digit (b) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer. | |
| 9 | Press **right** turn signal button **1** time. | The digit (b) will replace the dash in the odometer. The third dash will flash. |
| 10 | Enter third digit (c) of initial PIN by pressing **left** turn signal button **c** times. | |
| 11 | Press **right** turn signal button **1** time. | The digit (c) will replace the dash in the odometer. The fourth dash will flash. |
| 12 | Enter fourth digit (d) of initial PIN by pressing **left** turn signal button **d** times. | |

**Table 5-27. Entering an Initial PIN: HFSM**

| NO. | ACTION | WAIT FOR CONFIRMATION |
|---|---|---|
| 13 | Press **right** turn signal button **1** time. | The digit (d) will replace the dash in the odometer. The fifth dash will flash. |
| 14 | Enter fifth digit (e) of initial PIN by pressing **left** turn signal button **e** times. | |
| 15 | Press **right** turn signal button **1** time. | The digit (e) will replace the dash in the odometer. The first digit will flash. |
| 16 | Turn **IGN OFF.** | |

## INITIAL PIN ENTRY: TSSM

*NOTE*

*Do not forget to enter a PIN for TSSM vehicles. If a PIN is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.*

The TSSM PIN consists of five digits. Each digit can be any number from 1-9. There can be no zeros (0) in the PIN. The PIN **must** be used to disarm the security system in case the key fob becomes unavailable.

Refer to Table 5-28 to enter an initial PIN with no PIN previously installed. The procedure listed uses 3-1-3-1-3 as the desired PIN.

*NOTE*

*For better security, do not use 3-1-3-1-3 as a PIN. It is shown as an example only.*

Decide what five-digit PIN the owner would like to use. The code will be programmed using the turn signal switches and key fob. Keep a record of the PIN in a secure place such as your wallet or the Owner's Manual.

- When programming the PIN, the security lamp flashes to provide feedback when entering each digit. The odometer also displays the PIN and the change dynamically.
- The number of security lamp flashes corresponds to the number currently selected for a given digit. Therefore, the lamp may flash 1-9 times depending on the number entered. The five-digit PIN will change in the odometer window and the active digit will blink.
- Press the left turn switch one time to increment each digit.
- Quickly press the key fob button twice to advance to the next digit.

*NOTE*

*The programming mode exits upon turning the ignition switch to OFF, or if no turn signal switch/key fob button activity occurs for 60 seconds. No data is saved for partial configuration attempts if entering a PIN for the first time. If a PIN has previously been entered, the user can change any digit or group of digits.*

**Table 5-28. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop switch to **OFF** | | Verify the security lamp is not flashing (vehicle is disarmed)<br>This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds |
| 2 | Turn IGN **ON**-OFF-**ON**-OFF-**ON** | | |
| 3 | Press **left** turn switch **2** times and release | One to four flashes turn signals and indicators depending on vehicle configuration<br>(See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects) | One flash - Worldwide TSM, no security<br>Two flashes - Japan/Korea configuration TSSM |
| 4 | Quickly press **key fob** button **2 times** and release | One flash turn signals and indicators Odometer displays current five-digit PIN (five dashes if no code entered), first digit flashes | Vehicle is in PIN entry mode ready to enter or modify first digit |
| 5 | Press **left** turn switch **1 time** and release | Security lamp flashes 1-9 times if code was previously entered | A lack of confirmation flashes indicates no digit entered |

**Table 5-28. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 6 | Press and release **left** turn switch to advance through the digits<br>In this example, you will press and release three times | Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected<br>In this example, the blinking digit displayed is 3 and the security lamp will flash three times | You have selected 3 as a number for the first digit |
| 7 | Quickly press **key fob** button **2 times** and release | Two flashes turn signals and indicators second digit in odometer display blinks | You have confirmed 3 as a number for the first digit and have advanced to entering the second digit |
| 8 | Press **left** turn switch **1 time** and release | None | A lack of confirmation flashes indicates no digit entered |
| 9 | Press and release **left** turn switch to advance through the digits<br>In this example, you will perform this step one time | Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected<br>In this example, the blinking digit displayed is 1 and the security lamp will flash one time | You have selected 1 as a number for the second digit |
| 10 | Quickly press **key fob** button **2** times and release | Three flashes turn signals and indicators third digit in odometer display blinks | You have confirmed 1 as a number for the second digit and have advanced to entering the third digit |
| 11 | Press **left** turn switch **1** time and release | None | A lack of confirmation flashes indicates no digit entered |
| 12 | Press and release **left** turn switch to advance through the digits<br>In this example, you will repeat this step three times | Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected<br>In this example, the blinking digit displayed is 3 and the security lamp will flash three times | You have selected 3 as a number for the third digit |
| 13 | Quickly press **key fob** button **2 times** and release | Four flashes turn signals and indicators fourth digit in odometer display blinks | You have confirmed 3 as a number for the third digit and have advanced to entering the fourth digit |
| 14 | Press **left** turn switch **1** time and release | None | A lack of confirmation flashes indicates no digit entered |
| 15 | Press and release **left** turn switch to advance through the digits<br>In this example, you will perform this step one time | Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected<br>In this example, the blinking digit displayed is 1 and the security lamp will flash one time | You have selected 1 as a number for the fourth digit |
| 16 | Quickly press **key fob** button **2 times** and release | Five flashes turn signals and indicators fifth digit in odometer display blinks | You have confirmed 1 as a number for the fourth digit and have advanced to entering the fifth digit |
| 17 | Press **left** turn switch **1 time** and release | None | A lack of confirmation flashes indicates no digit entered |
| 18 | Press and release **left** turn switch to advance through the digits<br>In this example, you will repeat this step three times | Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected<br>In this example, the blinking digit displayed is 3 and the security lamp will flash three times | You have selected 3 as a number for the fifth digit |
| 19 | Quickly press **key fob** button **2 times** and release | One flash turn signals and indicators first digit in odometer display blinks | You have confirmed 3 as a number for the fifth digit and have gone back to the first digit |
| 20 | Turn IGN OFF | | |

**Table 5-28. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 21 | Write down code in Owner's Manual | | |
| 22 | Arm the security system and attempt to disarm using PIN entry. Refer to Table 5-24. | | |

## CHANGING THE PIN

To change a PIN, refer to Table 5-29.

If a PIN was previously entered, the odometer will display the equivalent digit. Each additional press of the left turn switch will increment the digit.

Examples:

- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

**Table 5-29. Changing the PIN: HFSM**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Select a 5-digit (1 through 9) personal code and record in the owner's manual and on the wallet card. | | |
| 2 | With fobs present, cycle **IGN ON**-OFF-**ON**-OFF-**ON** | | |
| 3 | Press **left** turn signal button **2** times. | Turn signals will flash 3 times. | |
| 4 | Press **right** turn signal button **1** time. | Current PIN will appear in odometer. The first digit will flash. | |
| 5 | Enter first digit (a) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer. | | |
| 6 | Press **right** turn signal button **1** time. | The new digit will replace the current in the odometer. The second digit will flash. | |
| 7 | Enter second digit (b) of new PIN by pressing **left** turn signal button until the desired digit is displayed in the odometer. | | |
| 8 | Press **right** turn signal button **1** time. | The new digit will replace the current in the odometer. The third digit will flash. | |
| 9 | Enter third digit (c) of new PIN by pressing **left** turn signal button until desired digit is displayed in the odometer. | | |
| 10 | Press **right** turn signal button **1** time. | The new digit will replace the dash in the odometer. The fourth digit will flash. | |
| 11 | Enter fourth digit (d) of new PIN by pressing **left** turn signal button until desired digit is displayed in the odometer. | | |
| 12 | Press **right** turn signal button **1** time. | The new digit will replace the current in the odometer. The fifth digit will flash. | |
| 13 | Enter fifth digit (e) of new PIN by pressing **left** turn signal button until desired digit is displayed in the odometer. | | |

**Table 5-29. Changing the PIN: HFSM**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 14 | Press **right** turn signal button **1** time. | The new digit will replace the current in the odometer. The first digit will flash. | |
| 15 | Turn the IGN OFF. | | Turning the ignition switch to OFF stores the PIN. |

## TRANSPORT MODE

Transport mode is especially useful when working on the vehicle. If it is not used, the alarm will activate under many typical service activities.

### To Enter Transport Mode: HFSM

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state, however, any attempt to start the engine will trigger the alarm.

1. Turn IGN ON.
2. Set the engine stop switch to OFF.
3. With an assigned fob within range, turn the ignition switch from OFF to ACC.
4. Simultaneously, press both the left and the right turn signal switches. This must be done within five seconds of turning the ignition switch to ACC.
5. After the turn signals flash once, turn the ignition switch to OFF and the module is armed.
6. The turn signals flash three times to confirm module arming in transfer mode for one ignition cycle.

### To Exit Transport Mode: HFSM

Return the system to normal operation:

1. With the fob present, turn the ignition switch to IGN to disarm the HFSM.
2. To cancel the transport mode, set the engine stop switch to RUN.

### To Enter Transport Mode: TSSM

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. In this mode, any attempt to bypass the ignition system will trigger the security system.

1. Set the engine stop switch to OFF. Verify the security lamp is not flashing.
2. Turn IGN ON.
3. Press and hold key fob button until the turn signals and indicators flash three times.
4. Turn IGN OFF.
5. Press and hold key fob button until the turn signals and indicators flash three times.

### To Exit Transport Mode: TSSM

To exit from transport mode and return the system to normal operation/functions, disarm the system using either the key fob or PIN.

## SERVICE MODE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

With a fob present, the HFSM can be configured for service by disabling the security system with DIGITAL TECHNICIAN II (Part No. HD-48650).

Once disabled, the vehicle can be operated without an assigned fob present. To maintain the Service Mode, the assigned fobs must be kept out of range. If the fob appears in range, the Service Mode will be exited.

## FOUR-WAY FLASHING

### To Arm the HFSM with the Hazard Warning Flashers ON

If it is necessary to leave a vehicle parked along side the road, the hazard warning four-way flashers can be turned ON with the smart security system armed.

1. Turn IGN ON.
2. Simultaneously press both left and right turn signal switches to turn the four-way flashers ON. The four-way flashers will continue for two hours.
3. Turn IGN OFF to arm the smart security system.

### To Disarm the HFSM and Turn the Hazard Warning Flashers OFF

1. With a fob present, turn IGN ON.
2. Simultaneously press the left and right turn signal switches.

## STORAGE MODE: TSSM

The TSSM has a special mode for long term storage. This mode prevents the security system from draining the battery after a period of days (10, 20, 60 or infinite) without any ignition switch activity.

- If the TSSM is set to infinite, the system will not go into storage mode.
- Vehicles will enter storage mode whether the security system is armed or disarmed.
- If set to 20 days or greater, the customer must use an approved trickle charger to keep the battery from discharging.

In storage mode, all alarm functions remain active but the receiver is shut down and will not respond to the key fob. The vehicle is immobilized because the starter motor and ECM are disabled. When the storage mode is entered, the security lamp stops flashing to conserve power.

To wake up the TSSM from storage mode, the ignition switch must be turned ON. This will trigger a warning/alarm if the system was previously armed. You must use the key fob or PIN to disarm the system and stop the alarm.

To set the storage mode preferences, refer to Table 5-30.

**Table 5-30. Storage Mode Preferences: TSSM**

| NO. | ACTION | WAIT FOR CONFIRMATION | NOTES |
|---|---|---|---|
| 1 | Set engine stop switch to **OFF** | | Verify the security lamp is not flashing (vehicle is disarmed) |
| 2 | Turn IGN **ON**-OFF-**ON**-OFF-**ON** | | |
| 3 | Press **left** turn switch **2 times** and release | Two flashes turn signals and indicators depending on vehicle configuration (See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects.) | Two flashes - Japan/Korea configuration TSSM |
| 4 | Press and hold **key fob** button until confirmation is received | One flash turn signals and indicators | |
| 5 | Release and then hold **key fob** button until confirmation is received | Two flashes turn signals and indicators | |
| 6 | Release and then hold **key fob** button until confirmation is received | Three flashes turn signals and indicators | |
| 7 | Press **left** turn switch **1 time** and release | Turn signals and indicators flash to indicate option selected | One flash - 10 days<br>Two flashes - 20 days<br>Three flashes - 60 days<br>Four flashes - Infinite |
| 8 | Press **left** turn switch to advance through options | Turn signals and indicators flash to indicate option selected | One flash - 10 days<br>Two flashes - 20 days<br>Three flashes - 60 days<br>Four flashes - Infinite |
| 9 | Turn IGN OFF. | | |

## POWER DISRUPTION AND CONFIGURING: HFSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42682 | BREAKOUT BOX |

The HFSM will not enter PIN entry mode on the first attempt after battery voltage has been removed from terminal 1. This will occur after any of the following:

- Battery disconnect or power drain.
- Main fuse removal.
- Connecting BREAKOUT BOX (Part No. HD-42682) to HFSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows:

1. Set engine stop switch to the OFF position, cycle ignition switch IGN to **ON**-OFF-**ON**-OFF-**ON** and press left turn signal switch twice.
2. Repeat previous step.
3. Continue with PIN entry sequence listed.

## POWER DISRUPTION AND CONFIGURING: TSSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42682 | BREAKOUT BOX |

The TSSM will not enter configuration mode on the first attempt after battery voltage has been removed from terminal 1. This will occur after any of the following:

- Battery disconnect or power drain.
- Main fuse removal.
- Connecting BREAKOUT BOX (Part No. HD-42682) to TSSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows.

1. Set engine stop switch to OFF, cycle ignition/headlamp switch **ON**-OFF-**ON**-OFF-**ON** and press left turn signal switch twice.
2. Repeat previous step.
3. Continue with configuration sequence listed.

# FAILS TO DISARM 5.13

## DESCRIPTION AND OPERATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### HFSM

If the HFSM does not respond, responds with limited range or will not consistently disarm with fob within normal range, follow the diagnostic procedure.

### TSSM

This section applies only to those vehicles equipped with the optional security system (TSSM).

*NOTE*

*Disarming function may require practice. The key fob button* ***must*** *be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

The key fob sends a RF signal to activate all remote TSSM functions. The left front turn signal switch wire serves as the vehicle's antenna. If the TSSM does not respond (no confirmation at arming/disarming system) or responds weakly (limited range, won't consistently arm/disarm or synchronize), follow the diagnostic procedure.

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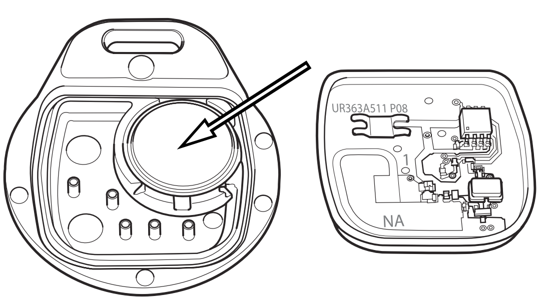



**Figure 5-20. Key Fob Battery: TSSM**

### Diagnostic Tips

- Verify that cell phone is not within 3.0 in. (80.0 mm) of key fob.
- Interference from physical surroundings may affect RF transmission. Place fob next to vehicle or move vehicle to a new location and retest.
- See Figure 5-20. Verify that antenna is in OE location and that seat has not been replaced with a metal base seat.
- Check for damage to antenna wire.
- See Figure 5-21. Verify fob battery voltage is at least 2.9V.
- Using DIGITAL TECHNICIAN II (Part No. HD-48650), the dealer can verify this is the correct fob for the vehicle by the serial number.

ed02051


1. **Battery**
2. **Fob serial number**

**Figure 5-21. Open Fob: HFSM**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

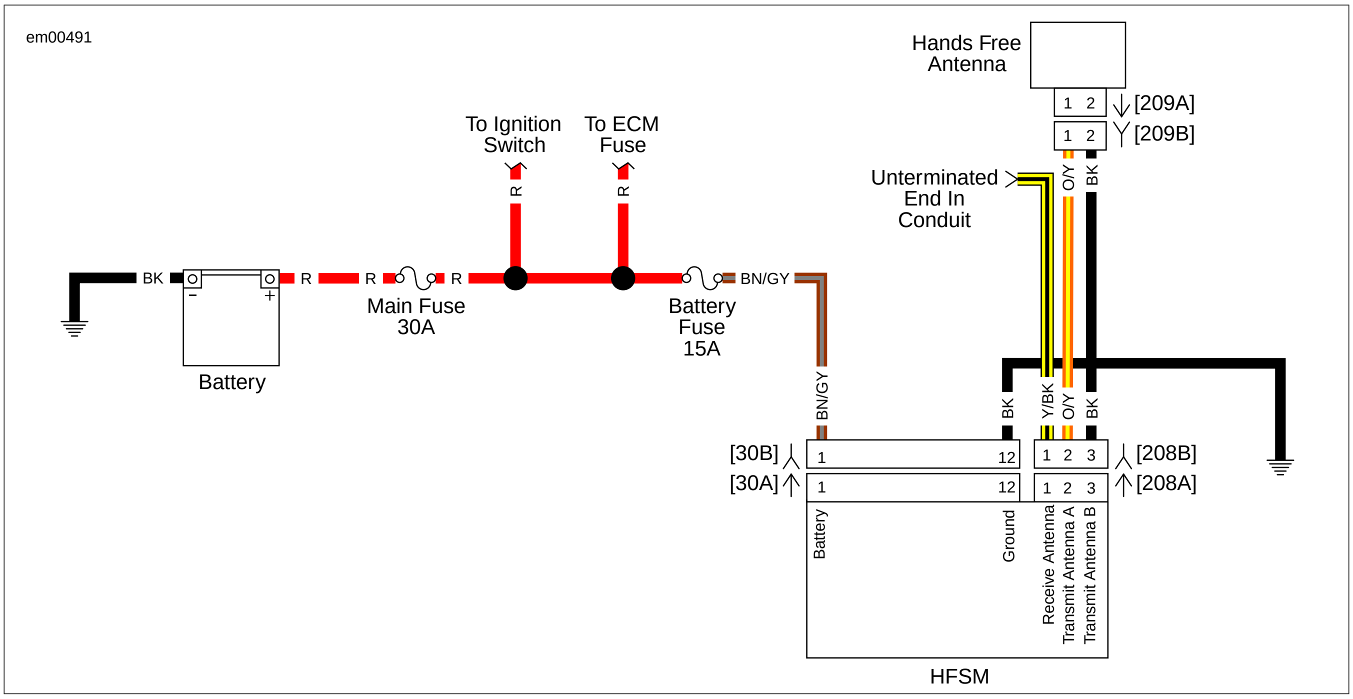



**Figure 5-22. Antenna Circuit: HFSM**

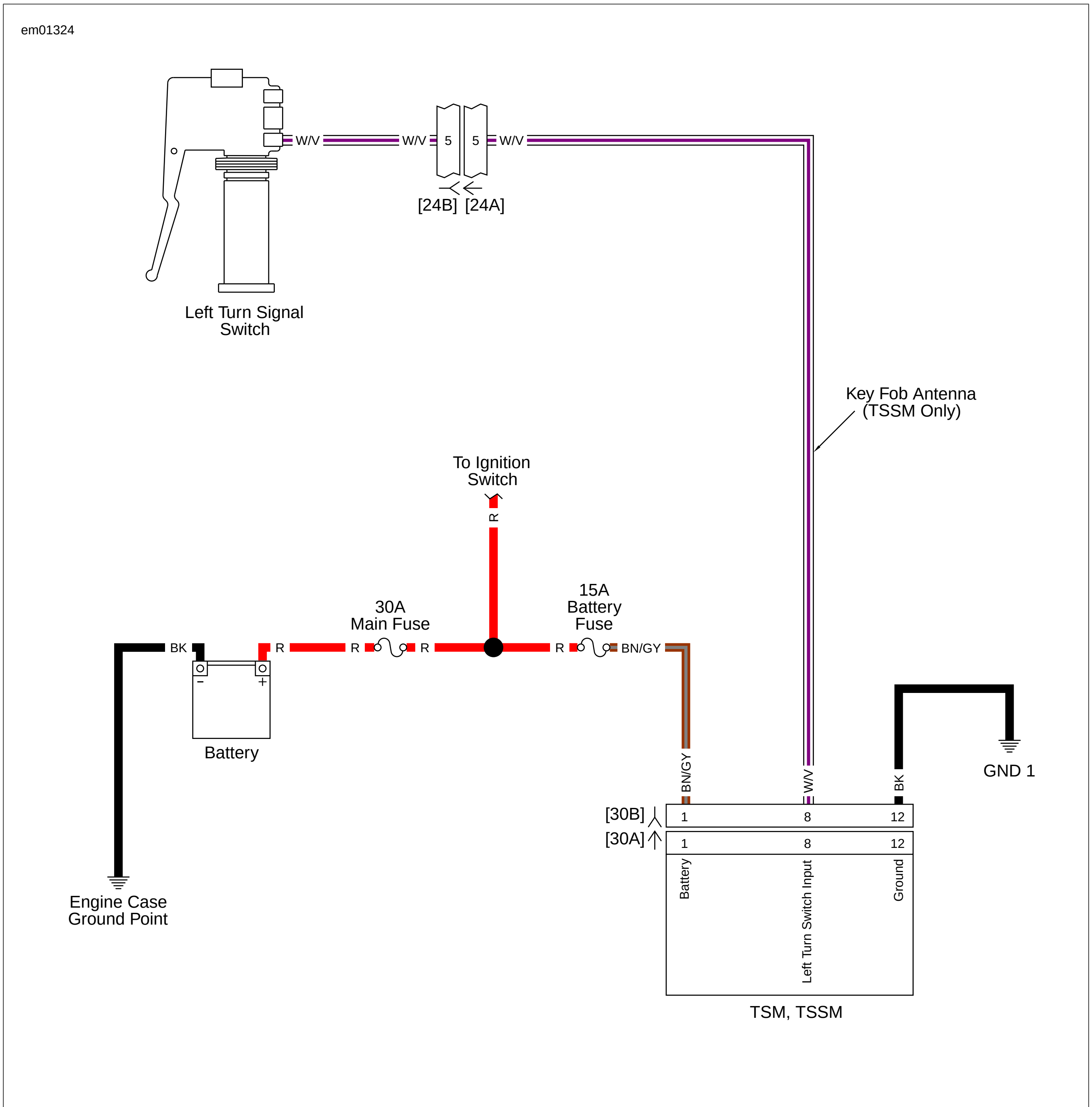



**Figure 5-23. Antenna Circuit: TSSM**

## FAILS TO DISARM: HFSM

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-31. Fails to Disarm Diagnostic Faults: HFSM**

| POSSIBLE CAUSES |
|---|
| Open antenna circuit |
| Short to ground in antenna circuit |
| Antenna malfunction |
| Fob malfunction |
| Electromagnetic interference |

### 1. Fob Test

1. Test all assigned fobs.
2. Does any assigned fob work?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 2.

### 2. Antenna Circuit Short to Ground Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [208B] terminal 1 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground. **(5041)**
   b. **No.** Go to Test 3.

### 3. Antenna Circuit Open Test

1. Check for continuity between [208B] terminal 1 and end of (Y/BK) wire (pull back conduit to expose unterminated end of wire).
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (Y/BK) wire. **(5041)**

### 4. Security System Antenna Test

1. Replace the security antenna with a known good security antenna.
2. Does the security system now disarm?
   a. **Yes.** Replace the security antenna. **(6878)**
   b. **No.** Replace HFSM. **(6757)**

### 5. Non-Functional Fob Test

1. Check battery on non-functional fob.
2. Is battery voltage greater than 2.9V?
   a. **Yes.** Replace fob. **(6756)**
   b. **No.** Replace battery. **(6755)**

## FAILS TO DISARM: TSSM

**Table 5-32. Fails to Disarm Diagnostic Faults: TSSM**

| POSSIBLE CAUSES |
|---|
| Fob malfunction |
| Fob battery discharged |

### 1. Key Fob Test

1. Verify the key fob is correct for the vehicle.
2. Is the key fob correct for the vehicle?
   a. **Yes.** Go to Test 2.
   b. **No.** Obtain correct fob or replace fob. Verify fob is synchronized to vehicle's TSSM.

### 2. Left Turn Signal Test

1. Operate the left turn signal.
2. Does left turn signal function?
   a. **Yes.** Go to Test 3.
   b. **No.** See 5.3 TURN SIGNALS.

### 3. Fob Battery Test

1. Replace fob battery and retest.
2. Does fob work?
   a. **Yes.** System OK. **(6755)**
   b. **No.** Go to Test 4.

### 4. TSSM Test

1. Attempt to assign **new** fob to TSSM and retest.
2. Does fob work?
   a. **Yes.** System OK. **(6756)**
   b. **No.** Replace TSSM. **(6757)**

# DTC B1131, B1132 5.14

## DESCRIPTION AND OPERATION

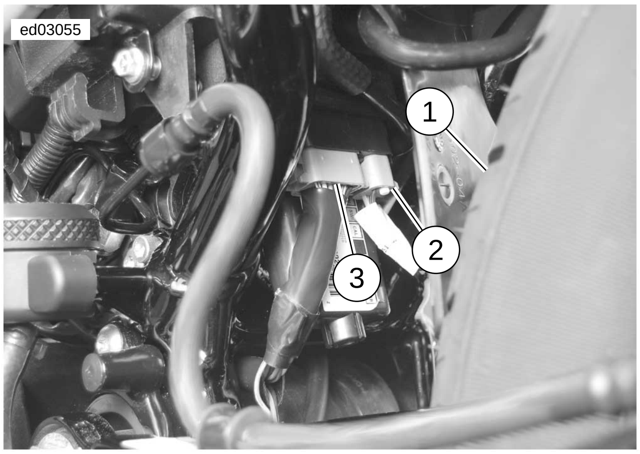
*NOTE*

*This section applies only to those vehicles equipped with the optional security system.*

See Figure 5-24. An alarm cycle is activated when the HFSM is connected, the siren has been armed by the HFSM and a security event occurs. See 5.9 SECURITY SYSTEM. Under normal armed operation, the siren input (terminal B) is driven low by the HFSM to trigger the audible alarm. When the siren input is driven high by the HFSM the audible alarm stops.

**Table 5-33. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1131 | Alarm output low |
| B1132 | Alarm output high |




1. **Rear tire**
2. **HFSM antenna [208]**
3. **TSM, TSSM or HFSM [30]**

**Figure 5-24. TSM, TSSM or HFSM**

## Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected or has been charging for a period longer than 24 hours, the siren will respond with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle's battery is less than 12.5V.
- If the siren does not chirp two or three times on a valid arming command from the HFSM, the chirp function has been disabled, the siren is either not connected, not working or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal 9V battery, the turn-signal lamps will not alternately flash. If the HFSM activates the siren, the turn-signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren will alarm for 20-30 seconds and then turn off for 5-10 seconds. This alarm cycle will be repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the HFSM output or siren input may be shorted to ground, the siren vehicle battery connection is open or shorted to ground, the siren vehicle ground connection is open or a security event has occurred. See 5.9 SECURITY SYSTEM for a description of alarm functions.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

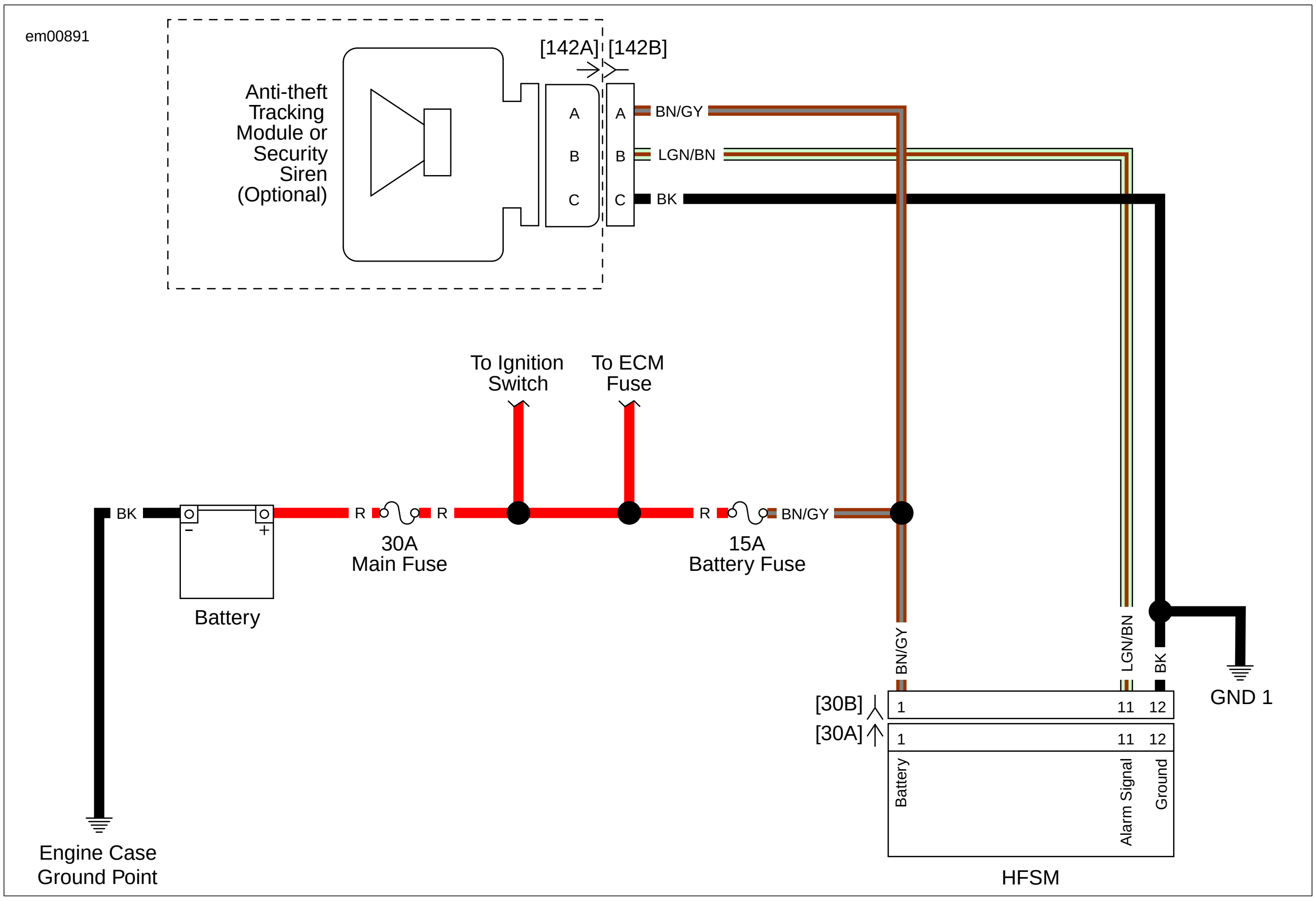



**Figure 5-25. Smart Siren Circuit**

## DTC B1131

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-34. DTC B1131 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in alarm signal |
| Open ground circuit |
| Open power circuit |
| Open alarm signal |
| Siren malfunction |

## 1. Siren Verification Test

1. Disarm the security system.
2. Inspect the vehicle for a security siren.
3. Is a security siren present?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

## 2. Alarm Signal Short to Ground Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box terminals 11 and 12.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/BN) wire between [142B] terminal B and [30B] terminal 11.
   b. **No.** Replace the TSSM or HFSM.

## 3. Battery Circuit Test

1. Remove the security siren.
2. With IGN ON, and the engine stop switch in the RUN position, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for battery voltage at [142B] between terminals A and C.
3. Is battery voltage present?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 4.

## 4. Power Supply and Ground Test

1. Test for battery voltage between [142B] terminal A and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (BK) ground wire between [142B] terminal C and ground.
   b. **No.** Repair open in (BN/GY) wire.

## 5. Alarm Signal Circuit Open Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [142B] terminal B and breakout box terminal 11.
3. Is continuity present?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (LGN/BN) wire between [142B] and [30B].

## 6. Alarm Signal Short to Ground Test

1. Test for continuity between breakout box terminals 11 and 12.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/BN) wire.
   b. **No.** Go to Test 7.

## 7. Security Siren Resistance Test

1. Measure resistance at [142A] between terminals B and C.
2. Is the security siren resistance between 40,000-160,000 Ohms?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace the security siren.

## 8. Security Siren Validation Test

1. Connect and operate the security siren on a known good vehicle.
2. Does the siren function properly with no DTCs set?
   a. **Yes.** Replace the TSSM or HFSM.
   b. **No.** Replace the security siren.

## DTC B1132

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-35. DTC B1132 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in alarm signal |
| Open ground circuit |
| Open power circuit |
| Open alarm signal |
| Siren malfunction |

## 1. Siren Verification Test

1. Disarm the security system.
2. Inspect the vehicle for a security siren.
3. Is a security siren present?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

## 2. Alarm Signal Circuit Short to Voltage Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminal 11 and ground.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (LGN/BN) wire.
   b. **No.** Replace the TSSM or HFSM.

## 3. Alarm Signal Short to Voltage Test

1. Disconnect the security siren.
2. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON, test for voltage between breakout box terminal 11 and ground.
4. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (LGN/BN) wire.
   b. **No.** Replace the TSSM or HFSM.

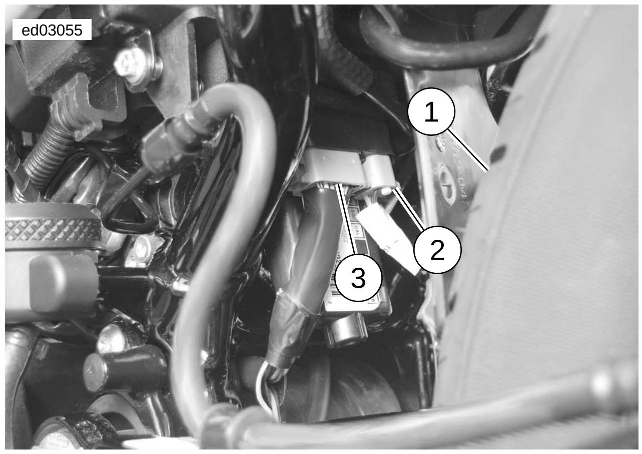
# DTC B1134 5.15

## DESCRIPTION AND OPERATION

See Figure 5-26. With the TSSM or HFSM (if equipped) disarmed, IGN ON, engine stop switch in the RUN position and the transmission in neutral or clutch lever pulled in, the start relay is grounded. Battery voltage is applied to the start relay coil which is grounded through the TSM, TSSM or HFSM. DTC B1134 is set when that ground is not established through the TSM, TSSM or HFSM.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.




1. **Rear tire**
2. **HFSM antenna [208]**
3. **TSM, TSSM or HFSM [30]**

**Figure 5-26. TSM, TSSM or HFSM**

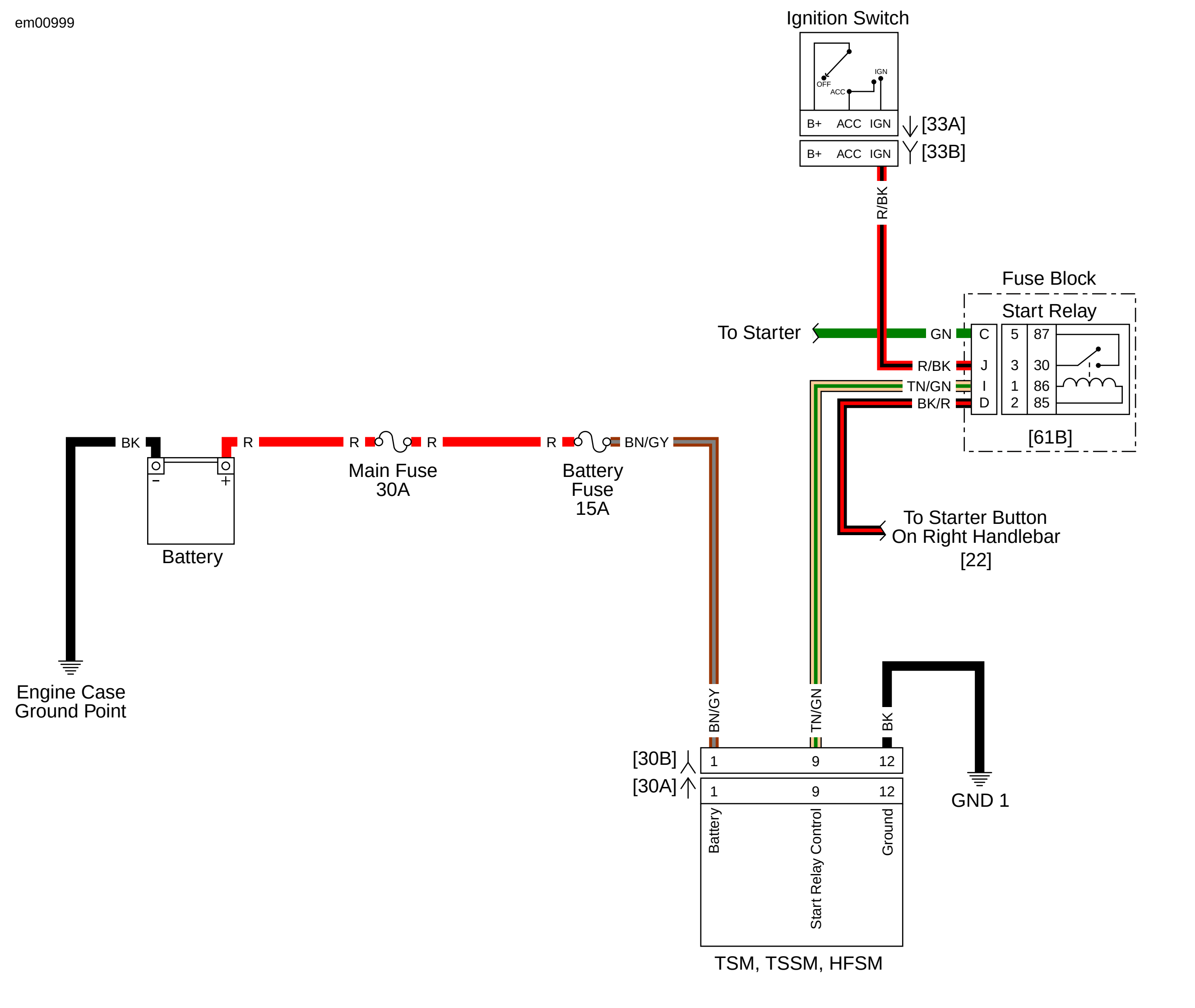



**Figure 5-27. Starter TSM, TSSM or HFSM Circuit**

## DTC B1134

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-36. DTC B1134 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Start relay malfunction |
| Short to voltage in start relay control circuit |

### 1. Relay Control Circuit Short to Voltage Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and TSM, TSSM or HFSM [30A]. See 1.2 DIAGNOSTIC TOOLS.
2. Remove start relay.
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage on breakout box (Gray) terminal 9.
4. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (TN/GN) wire.
   b. **No.** Go to Test 2.

### 2. Start Relay Test

1. Test start relay. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
2. Does relay pass test?
   a. **Yes.** Replace TSM, TSSM or HFSM.
   b. **No.** Replace start relay.

# DTC B1143, B1144, B1145 5.16

## DESCRIPTION AND OPERATION

DTC B1143, B1144 or B1145 will set when a fault occurs to the security antenna circuit used to transmit to the fob. Refer to Table 5-37.

**Table 5-37. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1143 | Security antenna short-to-ground |
| B1144 | Security antenna short-to-voltage |
| B1145 | Security antenna open |

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

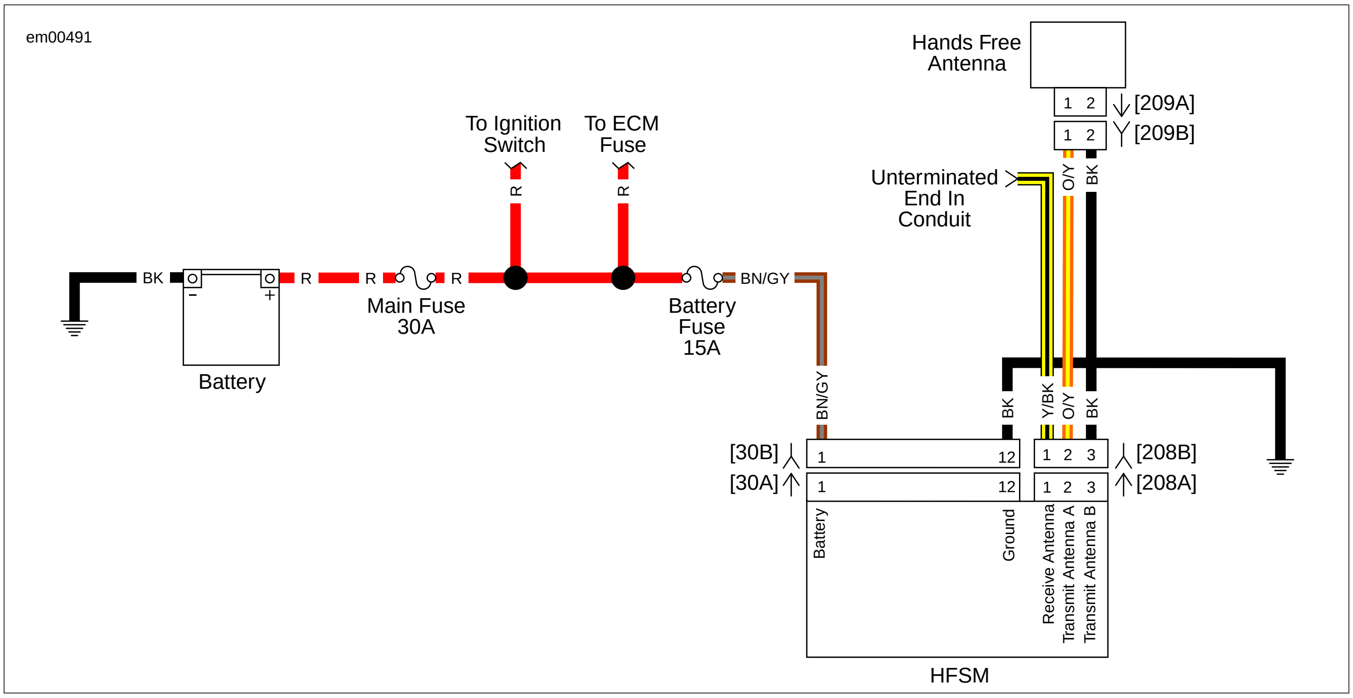



**Figure 5-28. Antenna Circuit: HFSM**

## DTC B1143

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-38. DTC B1143 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Security antenna malfunction |
| Open antenna circuit |

### 1. Security Antenna Visual Test

1. Inspect the security antenna for damage.
2. Is the security antenna damaged?
   a. **Yes.** Repair or replace security antenna as needed.
   b. **No.** Go to Test 2.

### 2. Security Antenna Short to Ground Test

1. Disconnect HFSM antenna jumper [208].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between terminal 2 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (O/Y) wire.
   b. **No.** Replace the HFSM.

## DTC B1144

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-39. DTC B1144 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Security antenna malfunction |
| Short to voltage in antenna circuit |

### 1. Security Antenna Visual Test

1. Inspect the security antenna for damage.
2. Is the security antenna damaged?
   a. **Yes.** Repair or replace security antenna as needed.
   b. **No.** Go to Test 2.

### 2. Security Antenna Short to Voltage Test

1. Disconnect HFSM antenna jumper [208].
2. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between terminal 2 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage in (O/Y) wire.
   b. **No.** Replace the HFSM.

## DTC B1145

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 5-40. DTC B1145 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Security antenna malfunction |
| Open antenna circuit |

### 1. Security Antenna Resistance Test

1. Disconnect HFSM antenna [209].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance at [209A] between terminals 1 and 2.
3. Is resistance greater than 5700 Ohms?
   a. **Yes.** Replace the security antenna.
   b. **No.** Go to Test 2.

### 2. Antenna B Circuit Open Test

1. Disconnect HFSM antenna jumper [208].
2. Test for continuity between [208B] terminal 3 and [209B] terminal 2.
3. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

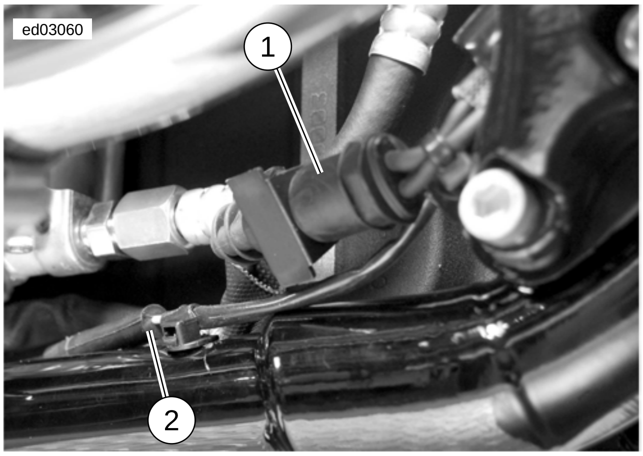
### 3. Antenna A Circuit Open Test

1. Test for continuity between [208B] terminal 2 and [209B] terminal 1.
2. Is continuity present?
   a. **Yes.** Replace the HFSM.
   b. **No.** Repair open in (O/Y) wire.

# DTC B1154, B1155 5.17

## DESCRIPTION AND OPERATION

The TSM, TSSM or HFSM monitors the clutch and neutral switch circuits to determine whether or not to let the vehicle start. If the TSM, TSSM or HFSM does not see that the clutch switch is closed (lever pulled in) or the neutral switch is closed (transmission in neutral) it will not activate the start relay. The TSM, TSSM or HFSM controls the start relay by supplying the ground circuit to the coil of the start relay.




1. **Voltage regulator to stator [47]**
2. **Neutral switch [136]**

**Figure 5-29. Lower Right Front**

## Diagnostic Tips

DTCs B1154 and B1155 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 5-41.

**Table 5-41. Code Description**

| DTC | DESCRIPTION |
|---|---|
| B1154 | Clutch switch short-to-ground |
| B1155 | Neutral switch short-to-ground |

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

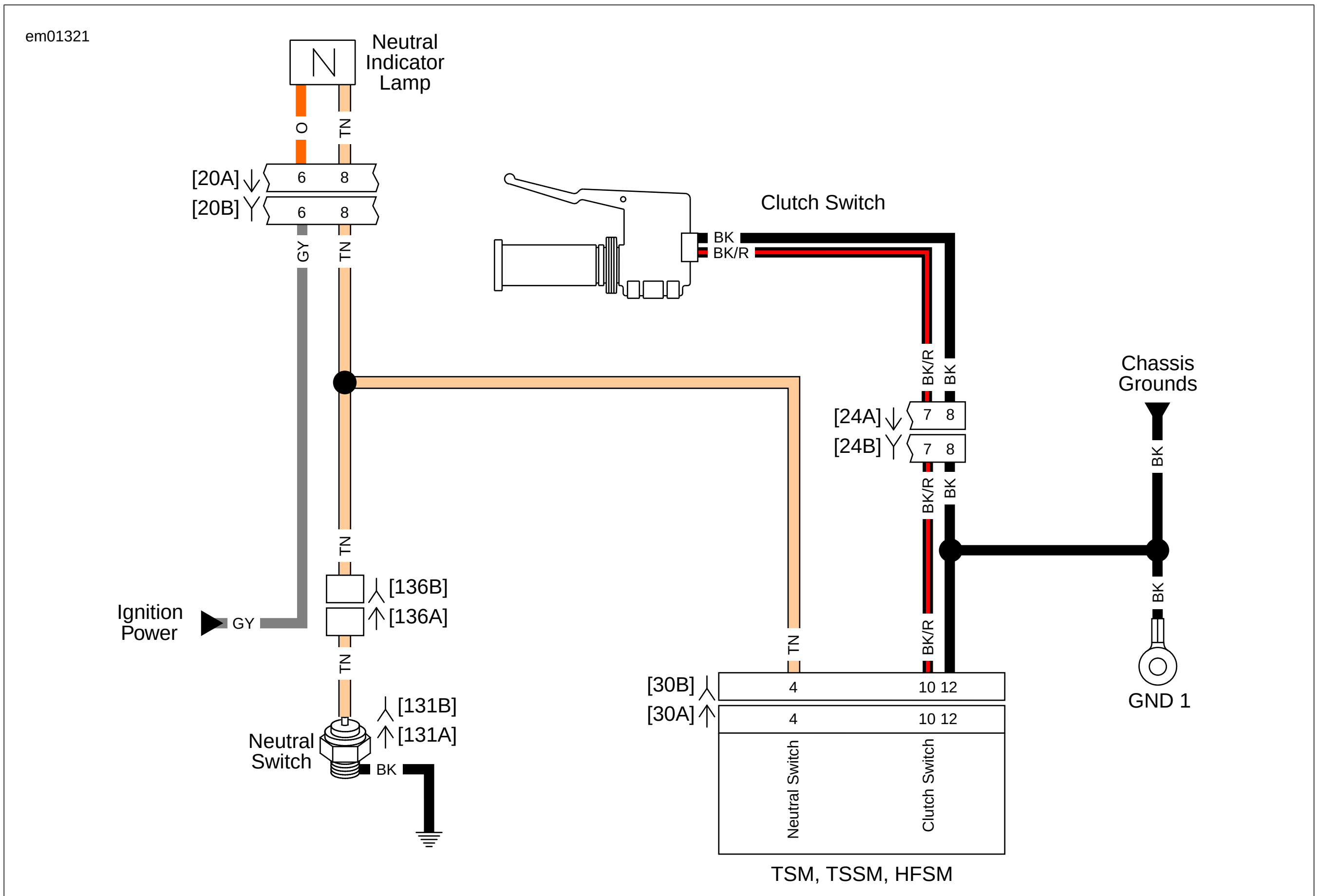



**Figure 5-30. Starting Circuit**

## DTC B1154

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-42. DTC B1154 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Switch malfunction |
| Short to ground in clutch switch circuit |

*NOTE*

*This DTC may occur if the vehicle is ridden with clutch disengaged (pulled in) at speeds greater than 10 mph (16 km/h) for more than 60 seconds (coasting down a long mountain road).*

## 1. Clutch Circuit Short to Ground Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSM, TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box (Gray) terminal 10 and terminal 12.
3. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TSM, TSSM or HFSM.

## 2. Clutch Switch Circuit Test

1. Disconnect left hand controls [24].
2. Test for continuity between breakout box (Gray) terminal 10 and terminal 12.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (BK/R) wire in main wiring harness between [30B] and [24B].
   b. **No.** Go to Test 3.

## 3. Clutch Switch Test

1. Inspect left handlebar switch wiring for a short to ground.
2. Was a short to ground present?
   a. **Yes.** Repair short to ground in left handlebar switch wiring.
   b. **No.** Replace clutch switch.

## DTC B1155

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-42682 | BREAKOUT BOX |

**Table 5-43. DTC B1155 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in neutral circuit |
| Neutral switch malfunction |

*NOTE*

*This DTC may occur if the vehicle is ridden in neutral at speeds greater than 10 mph (16 km/h) for more than 60 seconds (coasting down a long mountain road).*

### 1. Neutral Circuit Short to Ground Test

1. Shift the transmission into 1st or 2nd gear.
2. With IGN OFF, connect BREAKOUT BOX (Part No. HD-42682) to wire harness [30B], leaving TSM, TSSM or HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance between breakout box (Gray) terminal 4 and terminal 12.
4. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TSM, TSSM or HFSM.

### 2. Neutral Switch Short to Ground Test

1. Disconnect neutral switch [131].
2. Measure resistance between breakout box (Gray) terminal 4 and terminal 12.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground on (TN) wire.
   b. **No.** Replace neutral switch.

# NOTES

TABLE OF CONTENTS

# NOTES

# EFI SYSTEM 6.1

## GENERAL

This chapter describes the operation of the Harley-Davidson EFI System. It is essential to have a working knowledge of the many components surrounding the engine to accurately troubleshoot and correct problems that may occur. 6.2 ELECTRONIC CONTROL MODULE and 6.3 SENSORS AND DRIVERS briefly explain the operation of the ECM and function of the various sensors and drivers. See 1.2 DIAGNOSTIC TOOLS for instructions on using the test equipment called out in the diagnostic test procedures in this chapter.

The EFI System provides microprocessor-based electronic engine management for the 883 and 1200 engines. The EFI system has the following features:

- Independently mapped spark and fuel control
- Compensated fuel delivery through engine temperature, intake air temperature and manifold air pressure
- Engine load measurement via throttle position sensing
- Single point spark delivery
- Sequential port indirect (manifold) fuel injection
- Open/closed loop air/fuel control
- Automatic enrichment at start-up
- Engine speed and position determined by using a single CKP sensor
- Engine idle speed electronically managed with an IAC system

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

- Crank Position (CKP)
- Throttle Position Sensor (TPS)
- Jiffy Stand Sensor (JSS) (HDI)
- Turn Signal Module (TSM) or optional, factory-installed Turn Signal Security Module (TSSM: Japan/Korea) or Hands-Free Security Module (HFSM). This includes an integrated Bank Angle Sensor (BAS).
- Clutch switch
- Neutral switch
- Engine Temperature (ET)
- Vehicle Speed Sensor (VSS)
- Oxygen (O2) Sensor
- Temperature Manifold Absolute Pressure (TMAP) (includes IAT)

### EFI Operation

The EFI system operates as an open or closed loop system, allowing it to adjust for all possible operating conditions.

- During open loop operation, the system uses programmed fuel and spark maps in the ECM providing easy cold starting and maximum power at Wide Open Throttle (WOT). The adaptive fuel value, learned during closed loop operation, is applied to open loop operation to adjust fuel and spark maps for optimal performance.
- During closed loop operation, the O2 sensors provide input for an optimal air/fuel mixture resulting in reduced emissions, good fuel economy and smooth power. O2 sensors must be at the normal operating temperature of the engine.

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

### Symptom Diagnostics

For symptoms of engine malfunctions not specifically covered by DTCs, refer to Table 6-1, Table 6-2 and Table 6-3. For other symptoms, refer to Table 2-3.

HOME

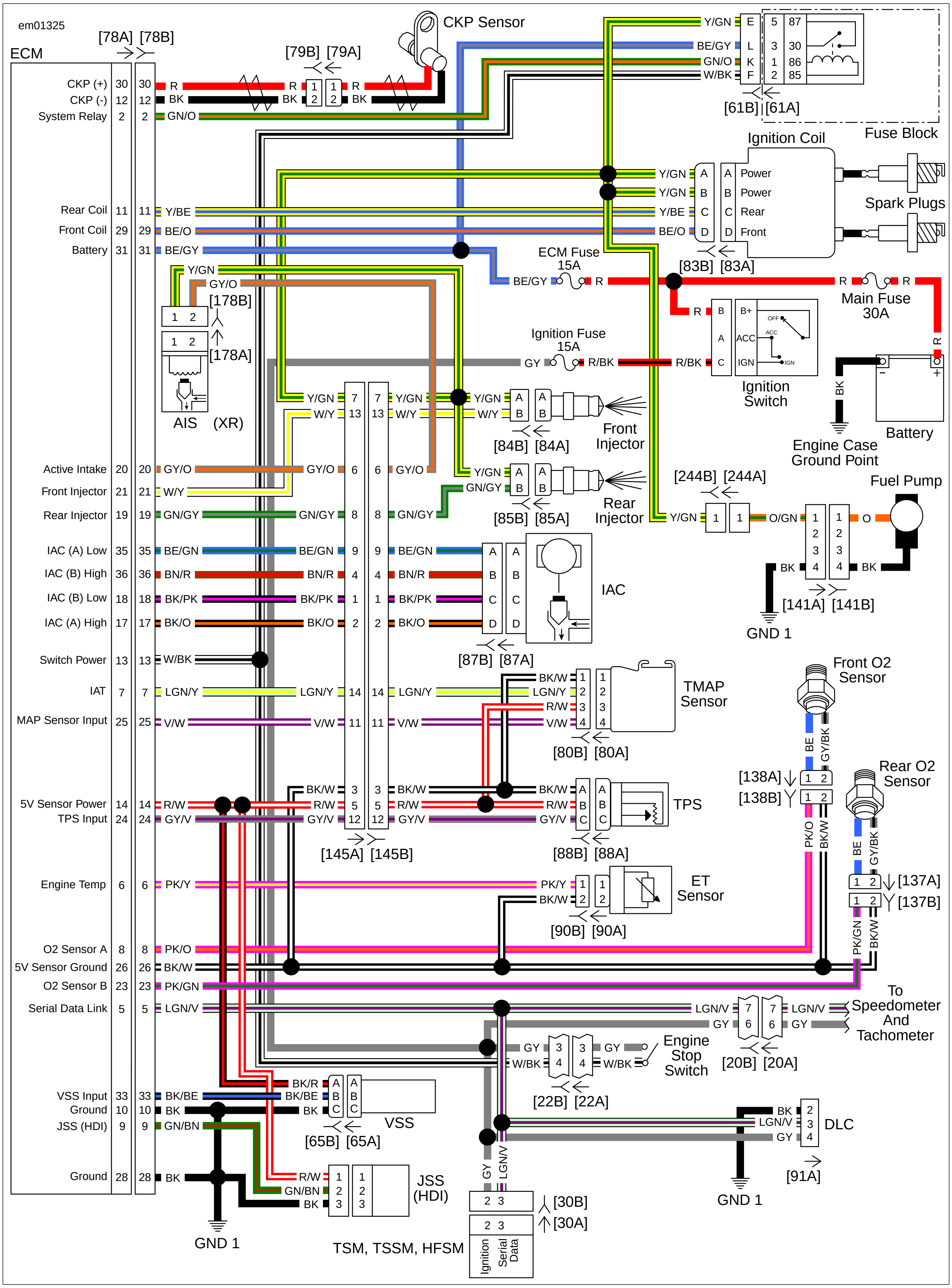
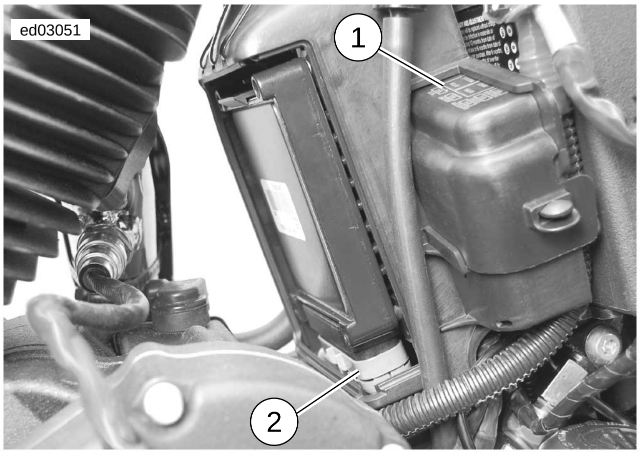


Figure 6-1. EFI Simplified Schematic

# ELECTRONIC CONTROL MODULE 6.2

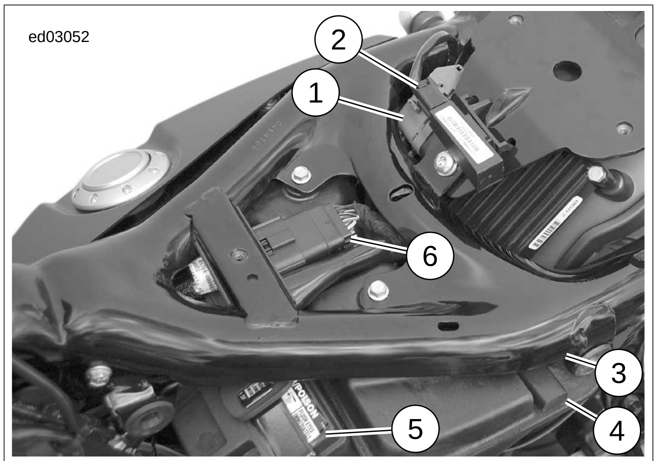
## GENERAL

See Figure 6-2 or Figure 6-3 depending upon vehicle variant. The ECM receives and processes signals from the sensors and applies output signals to the drivers to start, idle and run the engine. This section describes the configuration of the ECM for this vehicle.




1. **Fuse block [61]**
2. **ECM [78]**

**Figure 6-2. ECM: XL**




1. **ECM [78]**
2. **Security antenna [209]**
3. **P&A battery [160]**
4. **Fuel sender resistor assembly [200]**
5. **Battery**
6. **Engine sensor harness [145]**

**Figure 6-3. ECM: XR**

## ECM

The ECM is mounted behind the rear cylinder (XL) or under the passenger seat (XR). It computes the spark advance for proper ignition timing and fuel control based on sensor inputs (from CKP, TMAP and TPS sensors) and controls the low-voltage circuits for the ignition coils and injectors.

The ECM contains all of the components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to give adequate spark at all speeds. (The ECM has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts.) The ECM is fully enclosed to protect it from vibration, dust, water or oil. This unit is a non-repairable item. If it fails, it must be replaced.

### 32-2 Flywheel

The left flywheel has 32 teeth evenly spaced around its circumference with two consecutive teeth missing (sync gap). In this configuration, the ECM determines engine position, engine phase and engine speed from the CKP sensor input. Phase (TDC compression) is determined by the ECM during startup and, when necessary, while running. No engine ignition events can occur until the ECM determines the relationship of piston position to crankshaft position. The following paragraphs in this section describe synchronization and phasing by the ECM to provide smooth operation of the engine at all speeds.

### Crank Position Signal Synchronization

In the 32-2 crank configuration, crankshaft position is determined by the ECM finding the two-tooth (sync gap) in the CKP sensor signal. This is usually accomplished the first time the sync gap is encountered. The ECM monitors the CKP signal status every engine revolution. If the ECM determines synchronization is lost, it immediately terminates ignition events and synchronizes on the next occurrence of the sync gap.

### Engine Phase

Phasing is accomplished by the ECM identifying a widening in the CKP signal caused by the deceleration of the crankshaft, as a piston approaches TDC on its compression stroke. Since the rear cylinder approaches TDC earlier than the front cylinder, engine phase can be readily discriminated. Phasing is normally accomplished on the first TDC cycle after engine synchronization. Once phased, the ECM can begin normal ignition events. If the ECM experiences a system reset or loss of synchronization while the engine is running it also loses phase.

When phase is lost one of the following occurs:

- If an engine-not-running (Crank Mode) rpm is detected, the ECM executes the normal start-up phasing process.
- If Engine Run Mode is detected, the ECM executes a running re-phase sequence.

The front cylinder is fired every engine revolution. The ECM monitors the power stroke after the fire event to determine if sufficient acceleration occurred to indicate the ECM fired on the compression stroke. When two valid power strokes are detected, the ECM locks phase and resumes normal ignition events.

### Engine Run Mode

Many functions of the EFI system require an engine run mode determination. Engine run is determined by the level of engine rpm. Generally, the engine is considered to be running when engine rpm exceeds a minimum of 750 rpm.

# SENSORS AND DRIVERS 6.3

## DESCRIPTION AND OPERATION

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

## SENSORS

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

### Crank Position (CKP) Sensor

The CKP sensor, located on the left front of the lower crankcase half, is a variable reluctance device that generates AC voltage as the teeth on the flywheel pass by the sensor. The signal is routed to the ECM where it is used to determine crankshaft position, engine speed (rpm) and engine phase (TDC compression). Without the presence of the CKP signal, the ECM will not allow the ignition and fuel injection drivers to operate, and thus the engine will not run. The ECM uses crankshaft compression slow down events to determine engine phase. Therefore, the spark plugs must be installed when checking for spark.

### Throttle Position Sensor (TPS)

The TPS is a variable resistor (potentiometer) having a linear resistance range, mounted on the throttle plate shaft. The output of the sensor is a voltage, dependent on the position of the throttle plate, and used by the ECM to determine ignition timing and fuel required at any given rpm and engine load.

### Jiffy Stand Sensor (JSS): HDI Only

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

### Bank Angle Sensor (BAS)

The BAS is within the TSM, TSSM or HFSM. The TSM, TSSM or HFSM will shut the engine down if the vehicle is tipped over. Once the sensor is tripped, the motorcycle must be righted, the ignition turned off and then on again before the engine can be restarted. This is communicated across the serial data circuit.

### Clutch Switch

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

### Neutral Switch

The speedometer (XL) or tachometer (XR) provides voltage to the neutral switch, which is open when the transmission is in gear. With the transmission in neutral, the switch is closed, allowing current flow to ground. The TSM, TSSM or HFSM will not allow the engine to start unless the transmission is in neutral or the clutch is engaged.

### Engine Temperature (ET) Sensor

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

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on ECM [78] terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining Idle Air Control (IAC) pintle position.

### Temperature Manifold Absolute Pressure (TMAP) Sensor

The TMAP sensor combines the MAP and IAT in a single component. Each functions as described in the paragraphs following, and are tested as separate units.

### Manifold Absolute Pressure (MAP) Sensor

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

### Intake Air Temperature (IAT) Sensor

The IAT sensor is a thermistor device. As such, it will have a specific resistance across its terminals at a specific temperature. As the temperature varies, the thermistor resistance varies, and so does the voltage on ECM [78] terminal 7.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on ECM [78] terminal 7.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions.

### Vehicle Speed Sensor (VSS)

The VSS is a Hall-effect device mounted close to the teeth of the 5th gear in the transmission. The output signal frequency varies with vehicle speed. The ECM processes the vehicle speed signal and transmits it via the serial data circuit to the speedometer to indicate vehicle speed.

## O2 Sensor (Front and Rear)

The O2 sensor detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0-1.0V.

- Output above 0.5V represents a rich mixture.
- Output of 0.5V represents a proper balance between lean and rich.
- Output below 0.5V represents a lean mixture.

The change in output level signals the ECM to modify the air/fuel ratio.

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

# DRIVERS

The ECM drivers are the output devices or system outputs of the EFI system. Drivers are provided ground by the ECM to pump, inject and ignite the air/fuel mixture in the engine, and to activate relays.

## Fuel Pump

The fuel pump, located inside the fuel tank, is provided battery voltage when the system relay is activated.

## Ignition Coils and Spark Plugs

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

See Figure 6-1. Each cylinder has its own ignition coil which is provided power by the system relay. Each coil is controlled independently by the ECM.

## Fuel Injectors

The system relay provides battery power to the fuel injectors. The ECM provides the path to ground to trigger the injectors. The fuel injectors are pulse-width modulated solenoids for metering fuel into the intake tract. The pulse-width of the ground path to the injectors is varied by the ECM in response to inputs from the various sensors, thus varying the length of time the injector is open.

## Idle Air Control (IAC)

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

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.

## Start Relay

Pressing the start switch activates the start relay, sending battery voltage to the starter solenoid. The TSM, TSSM or HFSM controls the ground to the start relay, disabling it during security and tip over conditions.

## Active Intake Solenoid (AIS): XR England, Japan

The AIS regulates the amount of air entering the air cleaner. The AIS opens when vehicle speed exceeds 45 mph (70 km/h) with 50% or greater throttle opening. Once open, active intake will close when vehicle speed falls below 40 mph (65 km/h).

**Table 6-1. Engine Starts Hard**

| CAUSE | SOLUTION |
|---|---|
| Engine temperature circuit | Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs. |
| Fuel or Ignition system fault | Perform misfire diagnostics. |
| Battery discharged | Charge and test the battery. Perform charging system diagnosis if problem continues. |
| Crank position sensor circuit | Repair the circuit. If DTC P0373 or P0374 is present, diagnose and correct DTC. |
| Manifold leak | Perform intake leak test. |
| Ignition coil circuit/spark plugs | Repair the circuit. If DTC P1351, P1352, P1354 or P1355 is present, diagnose and correct DTCs. |
| Leaky injectors | Check for mechanical failures of the fuel injectors. If DTC P0261, P0262, P0263 or P0264 is present, diagnose and correct them. |
| Clogged fuel injectors | Clean or replace fuel injectors. |
| Valve sticking | Perform compression test. |

**Table 6-2. Engine Performance Problems**

| CAUSE | SOLUTION |
|---|---|
| Engine temperature circuit | Repair the circuit. If DTC P0117 or P0118 are present, diagnose and correct DTCs. |
| Crank position sensor circuit | Repair the circuit. If DTC P0373 and P0374 are present, diagnose and correct DTC. |
| Fuel or Ignition system fault | Perform misfire diagnostics. |
| Manifold Leak<br>**Note:** If manifold leak is large enough, the IAC closes and DTC P0505 sets. | Perform intake leak test. |
| Throttle plates not opening fully | Perform Throttle Cable Adjustment. |
| Clogged fuel injector | Clean or replace injectors. |
| EVAP hose disconnected from induction module | Connect. |
| Fuel system contaminated | Drain and refill with fresh fuel. |

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

| CAUSE | SOLUTION |
|---|---|
| Engine temperature circuit | Repair the circuit. If DTC P0117 or P0118 are present, diagnose and correct DTCs. |
| Clogged air filter | Replace air filter. |
| Leaky injectors | Repair the circuit. If DTC P0261, P0262, P0263 or P0264 are present, diagnose and correct DTCs. |
| TMAP sensor circuit | Repair the circuit. If DTC P0107, P0108, P0112 or P0113 are present, diagnose and correct DTCs. |

# DTC P0107, P0108 6.4

## DESCRIPTION AND OPERATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-23738 | VACUUM PUMP |

See Figure 6-4. The MAP portion of the TMAP sensor is supplied 5V from the ECM terminal 14 and sends a signal back to the ECM terminal 25. This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

**Table 6-4. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0107 | MAP sensor open/low |
| P0108 | MAP sensor high |

### Diagnostic Tips

These codes will set if the MAP sensor signal is out of range. Code P0108 can only be detected with the engine running.

*NOTE*

*Do not over-pump vacuum pump during MAP sensor output check as sensor damage may result.*

- MAP sensor output check. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the TMAP sensor. The signal voltage should lower as the vacuum is applied.
- The TMAP, JSS, TPS and VSS are connected to the same 5V reference line. If the reference line shorts to ground or opens, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P1501, P1502).
- A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs after this test. Be sure to perform this test before replacing a component.

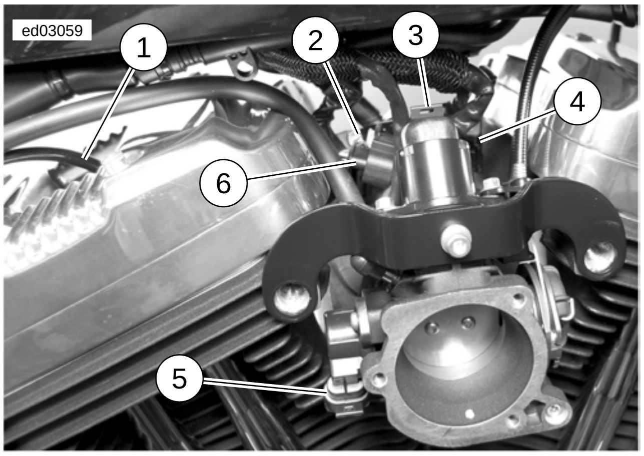
*NOTE*

*Intermittent TPS malfunctions may cause the TMAP to set a code prior to the TPS codes setting. Verify smooth and consistent TPS operation before replacing the ECM.*

See Figure 6-5 for common 5V sensor power and ground interconnections.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.




1. **ET sensor**
2. **Rear fuel injector [85]**
3. **IAC [87]**
4. **Front fuel injector [84]**
5. **TPS [88]**
6. **TMAP sensor [80]**

**Figure 6-4. Between Cylinders Right Side**

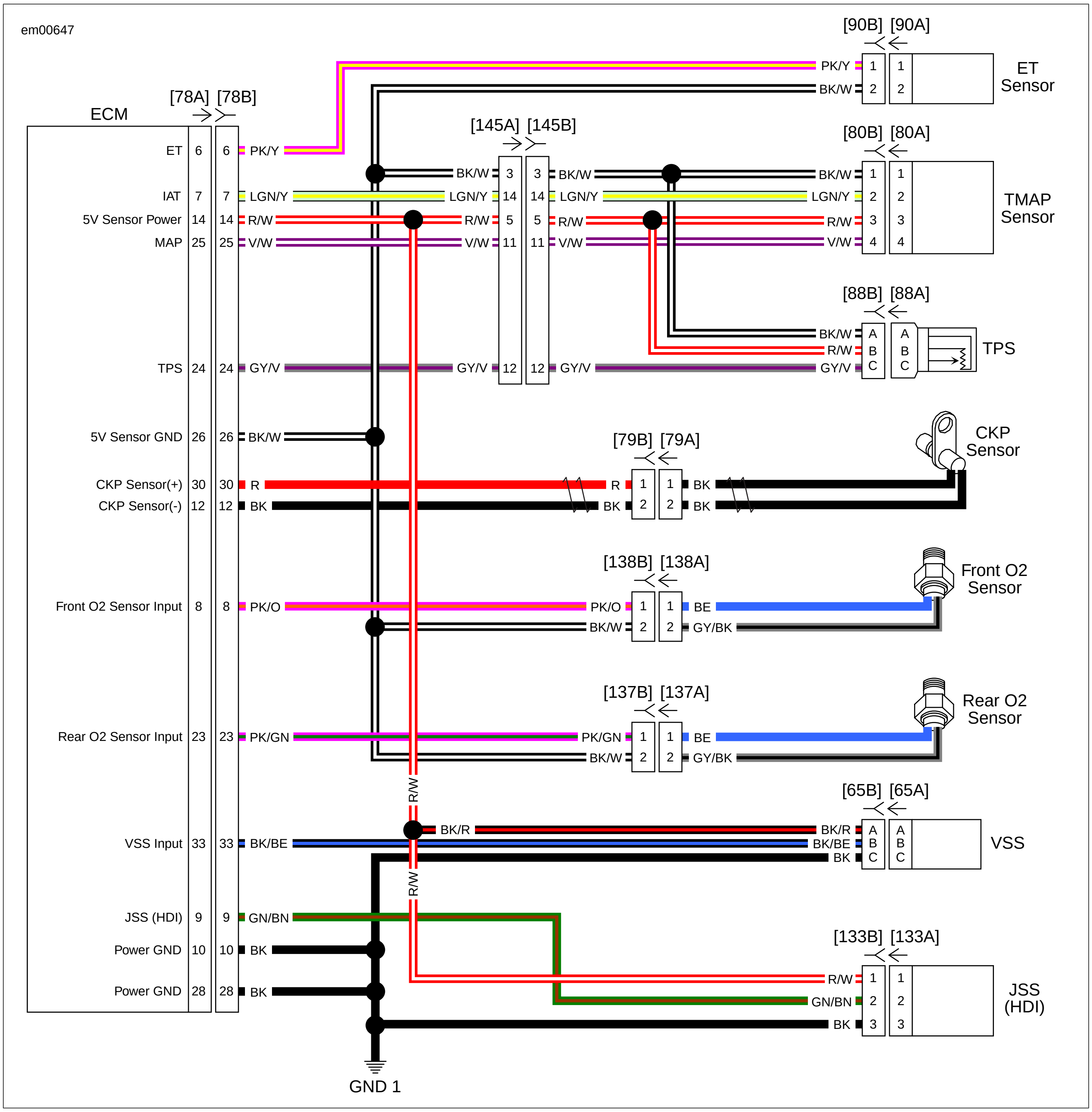



**Figure 6-5. Sensor Circuit**

## DTC P0107

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-5. DTC P0107 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TMAP sensor malfunction |
| Open or shorted to ground signal wire |
| Open or shorted to ground 5V reference circuit |

### 1. MAP Sensor Test

1. Disconnect the TMAP sensor [80].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire between [80B] terminals 3 and 4.
3. Clear DTC P0107. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
4. Turn IGN OFF and ON.
5. Does the DTC P0107 reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the TMAP sensor.

### 2. MAP Sensor Signal Voltage Test

1. Remove the test wire.
2. With IGN ON, test for voltage from [80B] terminal 3 to ground.
3. Is voltage approximately 5V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 6.

### 3. MAP Sensor Signal Wire Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between [80B] terminal 4 and breakout box terminal 25.
3. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (V/W) wire.

### 4. MAP Sensor Signal Wire Shorted to Ground Test

1. Test for continuity between breakout box terminal 25 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (V/W) wire.
   b. **No.** Go to Test 5.

### 5. MAP Sensor Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Test for continuity between breakout box terminals 25 and 26.
3. Is continuity present?
   a. **Yes.** Repair short between (V/W) and (BK/W) wires.
   b. **No.** See diagnostic tips before replacement. Replace the ECM.

### 6. MAP Sensor 5V Reference Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between [80B] terminal 3 and breakout box terminal 14.
3. Is continuity present?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (R/W) wire.

### 7. MAP Sensor 5V Reference Shorted to Signal Ground Test

1. Test for continuity between breakout box terminals 14 and 26.
2. Is continuity present?
   a. **Yes.** Repair short between the (R/W) and (BK/W) wires.
   b. **No.** See diagnostic tips before replacement. Replace the ECM.

## DTC P0108

| PART NUMBER | TOOL NAME |
|---|---|
| HD-43876 | BREAKOUT BOX |

**Table 6-6. DTC P0108 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TMAP sensor malfunction |
| Short to voltage |

### 1. MAP Sensor Test

1. Disconnect the TMAP sensor [80].
2. Clear DTC P0108. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
3. Start engine.
4. Does the DTC P0108 reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

## 2. MAP Sensor Signal Wire Short to 5V Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminals 14 and 25.
3. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (V/W) wires.
   b. **No.** Go to Test 3.

## 3. MAP Sensor Signal Wire Short to Voltage Test

1. With IGN ON, test for voltage on breakout box terminal 25.
2. Is voltage present?
   a. **Yes.** Repair short to voltage in (V/W) wire.
   b. **No.** Go to Test 4.

## 4. MAP Sensor 5V Reference Shorted to Battery Voltage Test

1. With IGN ON, test for voltage between breakout box terminal 14 and ground.
2. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage in (R/W) wire.
   b. **No.** Go to Test 5.

## 5. MAP Sensor Ground Wire Open Test

1. Test for continuity between [80B] terminal 1 and breakout box terminal 26.
2. Is continuity present?
   a. **Yes.** Replace the TMAP sensor.
   b. **No.** Repair open in (BK/W) wire.

# DTC P0112, P0113 6.5

## DESCRIPTION AND OPERATION

The ECM supplies and monitors a voltage signal on terminal 7 to one side of the IAT portion of the TMAP sensor. The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM terminal 26.

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 voltage at terminal 7.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on terminal 7.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V.

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

**Table 6-7. Code Description**

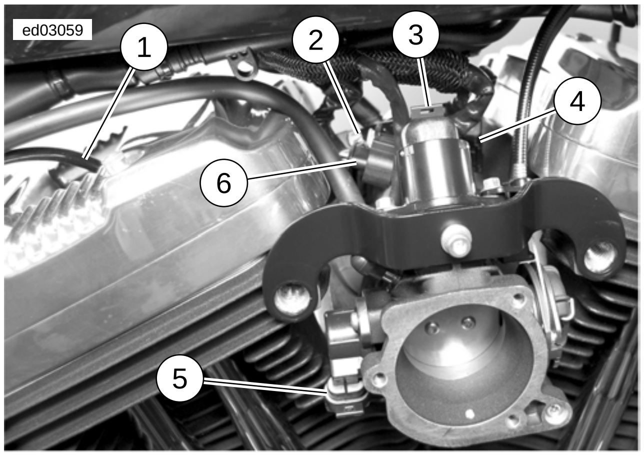
| DTC | DESCRIPTION |
|---|---|
| P0112 | IAT sensor voltage low |
| P0113 | IAT sensor open/high |

### Diagnostic Tips

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

Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal- to-wire connection and damaged harness.
- **Perform** 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, use a multimeter to check the IAT sensor voltage while moving related connectors and wiring harness. If the failure is induced, the IAT voltage will change.
- **Shifted sensor resistance value:** Compare the temperatures of the ET and IAT sensors with the engine at ambient temperature in order to evaluate the possibility of a shifted (out of calibration) sensor which may result in driveability problems. The sensor temperatures should be within 10 degrees of each other.
- A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected. Clear DTCs after this test. Be sure to perform this test before replacing a component.




1. **ET sensor**
2. **Rear fuel injector [85]**
3. **IAC [87]**
4. **Front fuel injector [84]**
5. **TPS [88]**
6. **TMAP sensor [80]**

**Figure 6-6. Between Cylinders Right Side**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

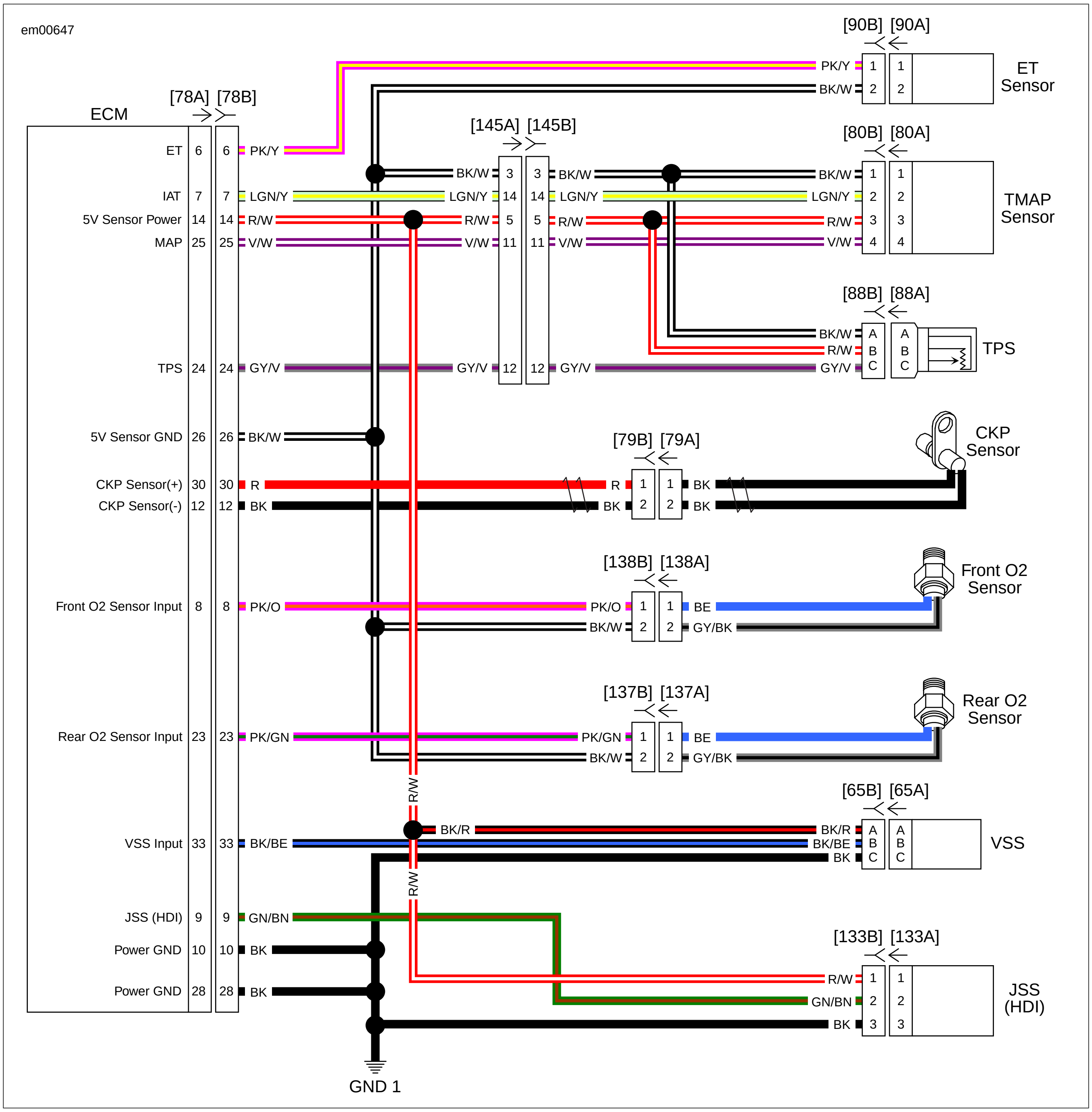



**Figure 6-7. Sensor Circuit**

## DTC P0112

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-8. DTC P0112 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TMAP sensor malfunction |
| Short to ground in 5V reference circuit |

## 1. IAT Sensor Test

1. Disconnect TMAP sensor [80].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance between terminals 1 and 2 of [80A].
3. Is the resistance reading between 500-5000 Ohms with the vehicle and sensor at ambient room temperature?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TMAP sensor.

## 2. IAT Sensor Signal Wire Shorted to Ground Test

1. Measure resistance between [80B] terminal 2 (LGN/Y) and ground.
2. Is resistance reading less than 1 Ohm?
   a. **Yes.** Repair short to ground on (LGN/Y) wire.
   b. **No.** Go to Test 3.

## 3. IAT Sensor Signal Voltage High Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test continuity between breakout box terminals 7 and 10.
3. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair short to ground on (LGN/Y) wire.

## 4. IAT Sensor Signal Wire Shorted to Sensor Ground Test

1. Test continuity between breakout box terminals 7 and 26.
2. Is continuity present?
   a. **Yes.** Repair short between terminals 1 and 2 of [80B] (LGN/Y and BK/W) wires.
   b. **No.** Replace ECM.

## DTC P0113

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-9. DTC P0113 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TMAP sensor malfunction |
| Open or short to voltage in 5V reference circuit |

## 1. IAT Sensor Test

1. Disconnect TMAP sensor [80].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between [80B] terminal 2 (LGN/Y) and ground.
3. With the IGN ON, the voltage reading greater than 6V?
   a. **Yes.** Repair short to voltage on (LGN/Y) wire.
   b. **No.** Voltage is less than 4V. Go to Test 2.

## 2. IAT Sensor Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wiring harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between [80B] terminal 2 (LGN/Y) and breakout box terminal 7.
4. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open circuit in (LGN/Y) wire.

## 3. IAT Sensor Open Ground Wire Test

1. Test for continuity between breakout box terminal 26 and [80B] terminal 1 (BK/W).
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (BK/W) wire.

## 4. IAT Sensor Signal Wire Shorted to Sensor Power Test

1. Test for continuity between breakout box terminals 7 and 14.
2. Is continuity present?
   a. **Yes.** Repair short between (LGN/Y) and (R/W) wires. Verify IAT sensor resistance value and if incorrect replace TMAP sensor.
   b. **No.** Replace ECM.

# DTC P0117, P0118 6.6

## DESCRIPTION AND OPERATION

The ECM supplies and monitors a voltage signal from terminal 6 to one side of the ET sensor. The other side of the ET sensor is connected to a common sensor ground, which is also connected to the ECM terminal 26.

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 on terminal 6.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V.

The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining IAC pintle position.

**Table 6-10. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0117 | ET sensor voltage low |
| P0118 | ET sensor open/high |

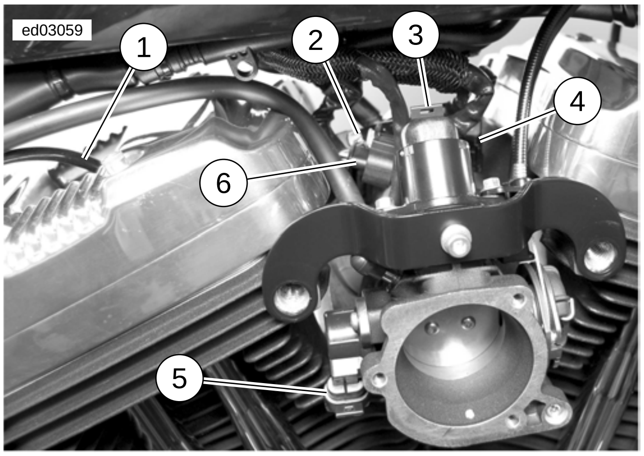
### Diagnostic Tips

Once the engine is started, the temperature should rise steadily.

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

Check the following conditions:

- **Poor connection:** Inspect ECM harness connector [78] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, use a multimeter to check the engine temperature reading while moving related connectors and wiring harness. If the failure is induced, the engine temperature display will change.
- **Shifted sensor resistance value:** Compare the temperatures of the ET and IAT sensors with the engine at ambient temperature in order to evaluate the possibility of a shifted (out of calibration) sensor which may result in driveability problems. The sensor temperatures should be within 10 °F (5.6 °C) of each other.




1. **ET sensor**
2. **Rear fuel injector [85]**
3. **IAC [87]**
4. **Front fuel injector [84]**
5. **TPS [88]**
6. **TMAP sensor [80]**

**Figure 6-8. Between Cylinders Right Side**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

[HOME](#)

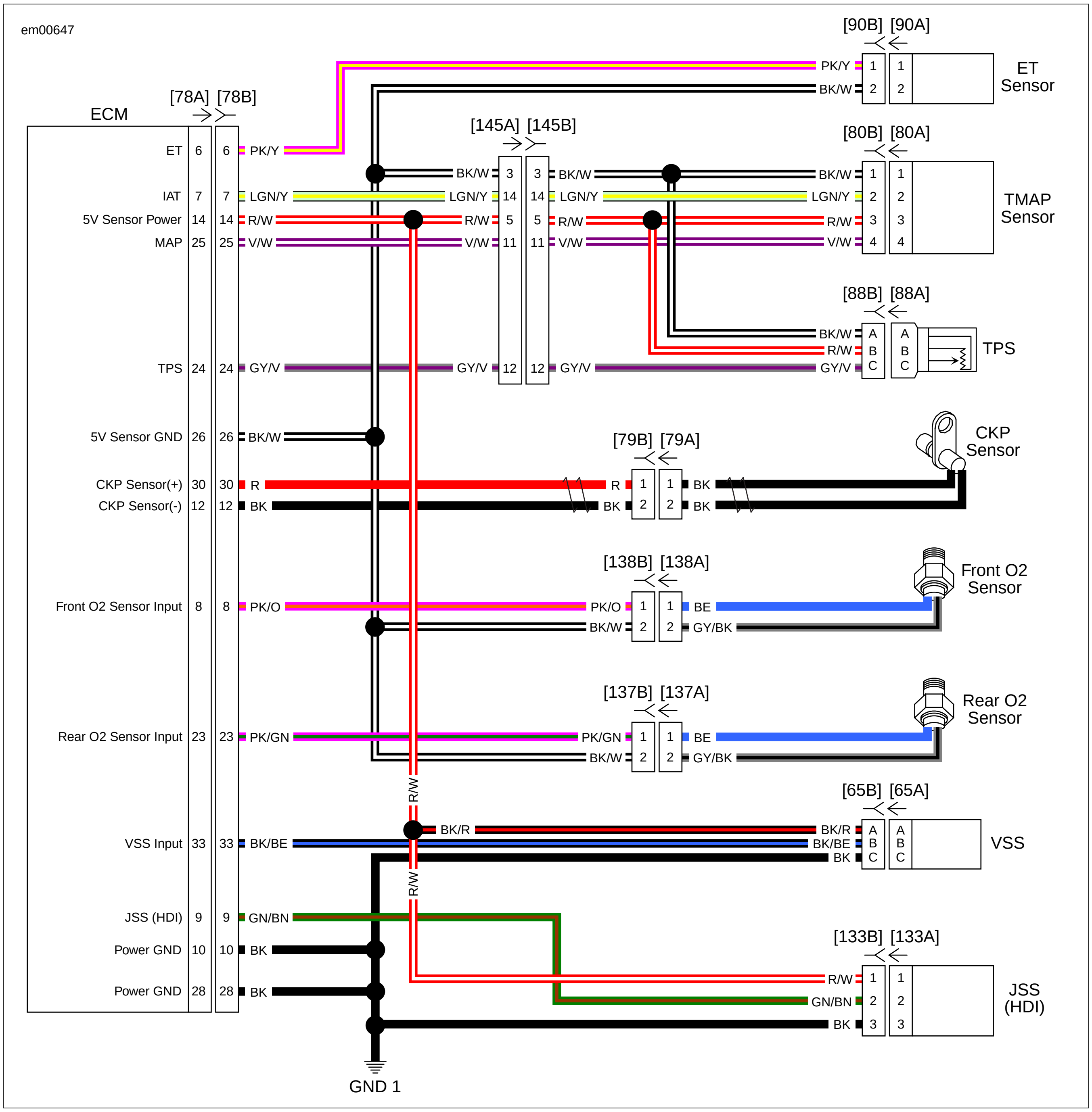



**Figure 6-9. Sensor Circuit**

## DTC P0117

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-11. DTC P0117 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| ET sensor malfunction |
| Short to ground in 5V reference circuit |

## 1. ET Sensor Test

1. Disconnect ET sensor [90].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure the resistance between [90A] terminals 1 and 2.
3. Is the resistance reading between 900-10,000 Ohms with the vehicle and sensor at ambient room temperature?
   a. **Yes.** [Go to Test 2.](#)
   b. **No.** Replace ET sensor.

## 2. ET Sensor Signal Wire Shorted to Ground Test

1. Measure resistance between ET sensor [90B] terminal 1 (PK/Y) and ground.
2. Is resistance reading less than 1 Ohm?
   a. **Yes.** Repair short to ground in (PK/Y) wire.
   b. **No.** Go to Test 3.

## 3. ET Sensor Signal Wire Shorted to Sensor Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test continuity between to breakout box terminals 6 and 26.
3. Is continuity present?
   a. **Yes.** Repair short between terminal 1 (PK/Y) and 2 (BK/W) of [90B] wires.
   b. **No.** Replace ECM.

## DTC P0118

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-12. DTC P0118 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| ET sensor malfunction |
| Open or short to voltage in 5V reference circuit |

## 1. ET Sensor Test

1. Disconnect ET sensor [90].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure the voltage between to ET sensor [90B] terminal 1 (PK/Y) and ground.
3. With the IGN ON, is the voltage reading greater than 6V?
   a. **Yes.** Repair short to voltage on (PK/Y) wire.
   b. **No.** Voltage is less than 4V. Go to Test 2.

## 2. ET Sensor Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wiring harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between ET sensor [90B] terminal 1 (PK/Y) and breakout box terminal 6.
4. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (PK/Y) wire.

## 3. ET Sensor Open Ground Wire Test

1. Test for continuity between ET sensor [90B] terminal 2 (BK/W) and breakout box terminal 26.
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (BK/W) wire.

## 4. ET Sensor Signal Wire Shorted to Sensor Power Test

1. Test for continuity between breakout box terminals 6 and 14.
2. Is continuity present?
   a. **Yes.** Repair short between (PK/Y) and (R/W) wires. Verify ET sensor resistance value and if incorrect replace ET sensor.
   b. **No.** Replace ECM.

# DTC P0122, P0123 6.7

## DESCRIPTION AND OPERATION

The ECM supplies a 5V signal on terminal 14 to terminal B of the TPS. The TPS sends a signal back to the ECM on terminal 24. The returned signal varies in voltage according to throttle position.

- At idle (closed throttle), the signal is typically in the range of 0.2-0.8V.
- At wide open throttle, the signal is normally 4.0-4.9V.

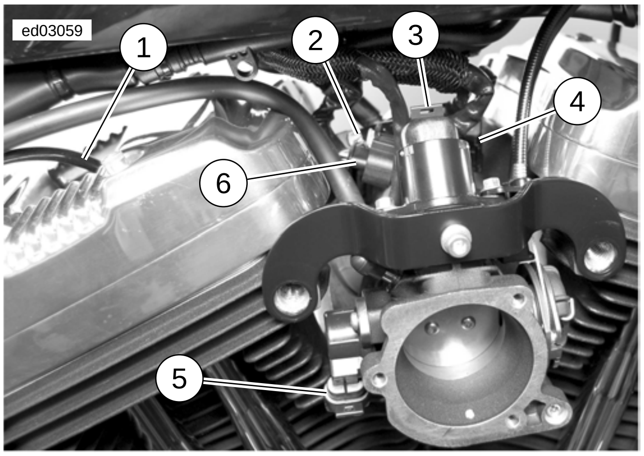
DTC P0122 or P0123 will set if the TPS voltage signal does not fall within the acceptable range.

**Table 6-13. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0122 | TPS open/low |
| P0123 | TPS high |

### Diagnostic Tips

The multimeter reads throttle position in Volts. Voltage should increase at a steady rate as the throttle is moved from idle to wide open. A short to ground or open on the (GY/V) or (R/W) wires also will result in a DTC P0122. A short to ground or open on the (R/W) wire (+5V REF) sets multiple codes as described below.




1. **ET sensor**
2. **Rear fuel injector [85]**
3. **IAC [87]**
4. **Front fuel injector [84]**
5. **TPS [88]**
6. **TMAP sensor [80]**

**Figure 6-10. Between Cylinders Right Side**

*NOTE*

*The TMAP and TPS are both connected to the same reference line (+5V REF). If the line goes to ground or open, multiple trouble codes will be set (DTCs P0107, P0108 and P0122, P0123, P1501 or P1502). Start with the DTC having the lowest ranking value.*

Check for the following conditions:

- **Poor connection:** Inspect ECM harness connector [78B] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, monitor TPS voltage using a multimeter while moving related connectors and wiring harness. If the failure is induced, the TPS voltage will change.
- **TPS scaling:** Observe the TPS voltage display while opening the throttle with engine stopped and ignition switch ON. Display should vary from closed throttle TPS voltage (when throttle is closed) to greater than 4.0V (when throttle is held wide open). As the throttle is **slowly** moved, the voltage should change gradually without spikes or low voltages being observed.
- A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected. Clear DTCs after this test. Be sure to perform this test before replacing a component.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

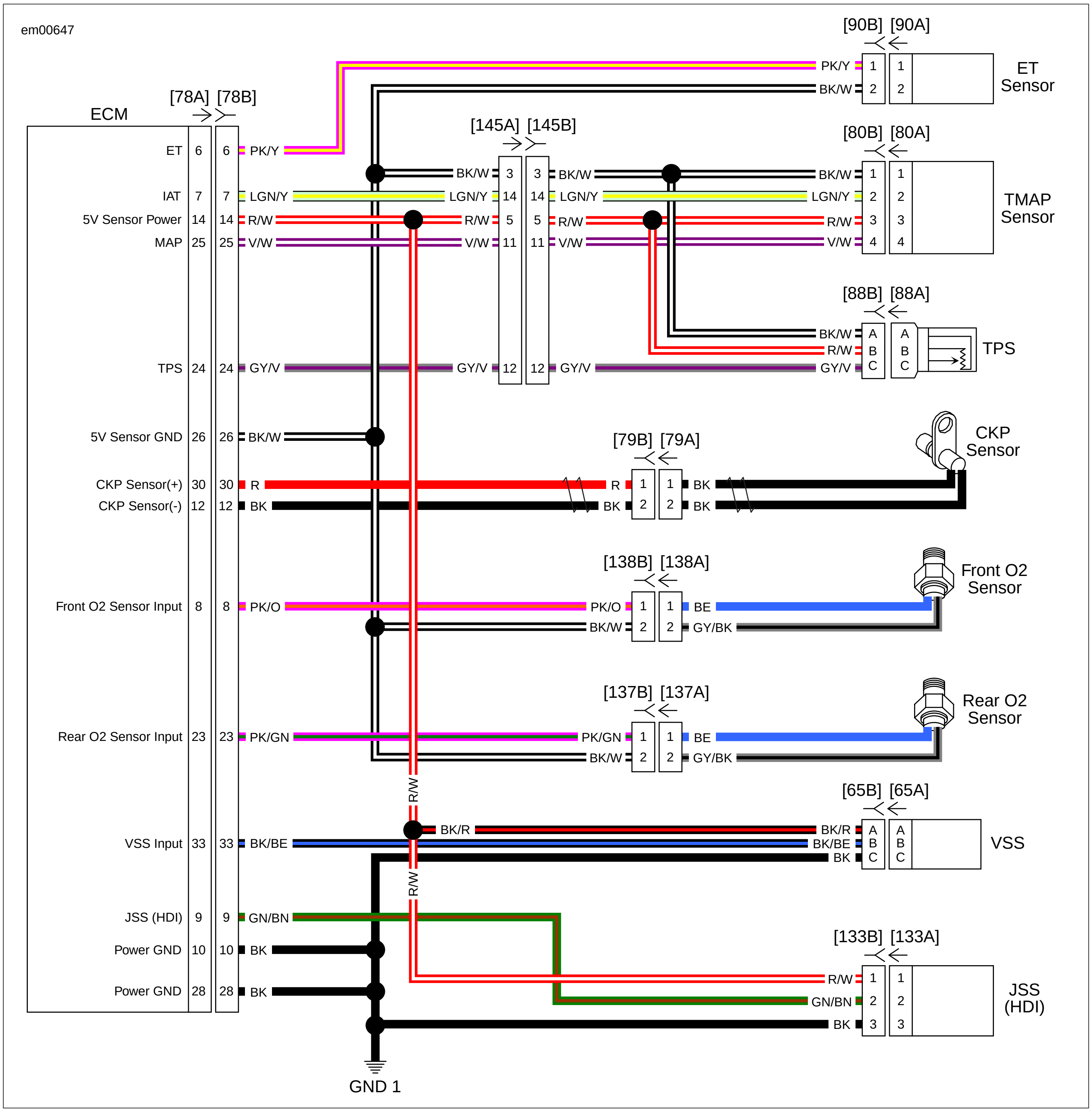



**Figure 6-11. Sensor Circuit**

## DTC P0122

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-14. DTC P0122 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TPS malfunction |
| Open or short to ground in 5V reference circuit |
| Short to ground in signal circuit |

### 1. TPS Test

1. Disconnect the TPS [88].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire across [88B] terminals B and C.
3. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
4. Turn IGN OFF and ON.
5. Does the DTC P0122 reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the TPS.

### 2. TPS Signal Voltage Test

1. Remove the test wire.
2. With IGN ON, test for voltage between [88B] terminal B and ground.
3. Is voltage approximately 5V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 6.

### 3. TPS Signal Wire Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity in (GY/V) wire between [88B] terminal C and breakout box terminal 24.
3. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY/V) wire.

### 4. TPS Signal Wire Shorted to Ground Test

1. Test for continuity in (GY/V) wire between breakout box terminal 24 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GY/V) wire.
   b. **No.** Go to Test 5.

### 5. TPS Signal Wire Shorted to Sensor Ground Test

1. Test for continuity between breakout box terminals 24 and 26.
2. Is continuity present?
   a. **Yes.** Repair short between (GY/V) and (BK/W) wires.
   b. **No.** Replace the ECM.

### 6. TPS 5V Sensor Power Open Wire Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity in (R/W) wire between [88B] terminal B and breakout box terminal 14.
3. Is continuity present?
   a. **Yes.** Replace the ECM.
   b. **No.** Repair open in (R/W) wire.

## DTC P0123

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-15. DTC P0123 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| TPS malfunction |
| Short to voltage in 5V reference circuit |
| Open sensor ground |

### 1. TPS Test

1. Disconnect the TPS [88].
2. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
3. Turn IGN OFF and ON.
4. Does the DTC P0123 reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

### 2. TPS Signal Wire Short to 5V Test

1. Disconnect the ECM [78].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [88B] terminals B and C.
3. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (GY/V) wires.
   b. **No.** Go to Test 3.

### 3. TPS Signal Wire Short to Voltage Test

1. With IGN ON, test for voltage on [88B] terminal C.

2. Is voltage present?
   a. **Yes.** Repair short to voltage in (GY/V) wire.
   b. **No.** Replace the ECM.

## 4. TPS 5V Shorted to Battery Voltage Test

1. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage on [88B] terminal B and ground.
2. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage in (R/W) wire.
   b. **No.** Go to Test 5.

## 5. TPS Ground Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between [88B] terminal A and breakout box terminal 26.
3. Is continuity present?
   a. **Yes.** Replace the TPS.
   b. **No.** Repair open in (BK/W) wire.

# DTC P0131, P0132, P0134, P0151, P0152, P0154 6.8

## DESCRIPTION AND OPERATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

See Figure 6-12. The O2 sensor provides a signal to the ECM which indicates whether the engine is running rich or lean.

- A P0131 (front) or P0151 (rear) is set when the ECM detects an excessively lean condition for a specified length of time. DTCs may also set if O2 sensor fails.
- A P0132 (front) or P0152 (rear) is set when the ECM detects an excessively rich condition for a specified length of time. DTCs may also set if O2 sensor fails. This condition may also occur with oil contamination.
- A P0134 is set when the front O2 sensor circuit is open or sensor is too cold to respond. A P0154 is set when the rear O2 sensor circuit is open or sensor is too cold to respond. May also occur in cases of extreme oil contamination.

When the air/fuel mixture is ideal, approximately 14.6 parts air to 1 part fuel, the voltage will be approximately 0.45V.

**Table 6-16. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0131 | Front O2 sensor low or engine running lean |
| P0132 | Engine front O2 running rich |
| P0134 | Front O2 sensor open/not responding/high |
| P0151 | Rear O2 sensor low or engine running lean |
| P0152 | Engine rear O2 running rich |
| P0154 | Rear O2 sensor open/not responding/high |


**Figure 6-12. O2 Sensor**

## Diagnostic Tips

O2 sensor diagnostic codes may be seen during the vehicle break-in period. The O2 sensor DTCs will not illuminate the check engine lamp for current or historic codes and will only be indicated by DIGITAL TECHNICIAN II (Part No. HD-48650) or odometer self-diagnostics. If the DTCs are reported during the break-in period, clear or ignore the codes until the break-in period is completed. All historic O2 sensor DTCs are to be ignored and cleared.

The multimeter displays the signal from the O2 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 (PK/O) wire (front) and (PK/GN) wire (rear) will cause the engine to run rich (short to ground) or lean (short to voltage) until fault is detected. Once fault is detected, vehicle will run in open loop.

Check for the following conditions:

- **Poor connection:** Inspect the ECM [78], fuel injector [84, 85] and O2 sensor connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.
- **Dirty/stuck open injectors:** The vehicle may run lean (dirty/clogged injectors) or rich (stuck open injectors) if there are injector problems. This could also cause poor fuel economy and performance.
- **Loose O2 sensor:** If an O2 sensor is loose, engine performance may be affected. This could also show up as a slow changing O2 sensor voltage.
- **Loose/leaking exhaust:** This can cause a poor ground connection for the sensor or allow fresh air into the exhaust system. If fresh air enters exhaust system, the O2 sensor will read a lean condition, causing the system to go rich.
- **Engine misfire:** See 6.24 MISFIRE AT IDLE OR UNDER LOAD.
- **Leaking injectors:** This causes fuel imbalance and poor idle quality due to different air/fuel ratios in each cylinder. To check for leaky injectors, first remove the air box and air filter. Then, with the throttle wide open, turn IGN ON for 2 seconds and then OFF for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores. See Fuel Injectors in the service manual.
- **Intake leaks:** See the service manual.
- **Excessive oil consumption:** This may cause a P0132, P0134, P0152 or P0154 to set. The burning oil can create a rich condition due to the carbon build up on the O2 sensors. If signs of oil consumption are evident inspect the O2 sensors and replace if necessary.

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

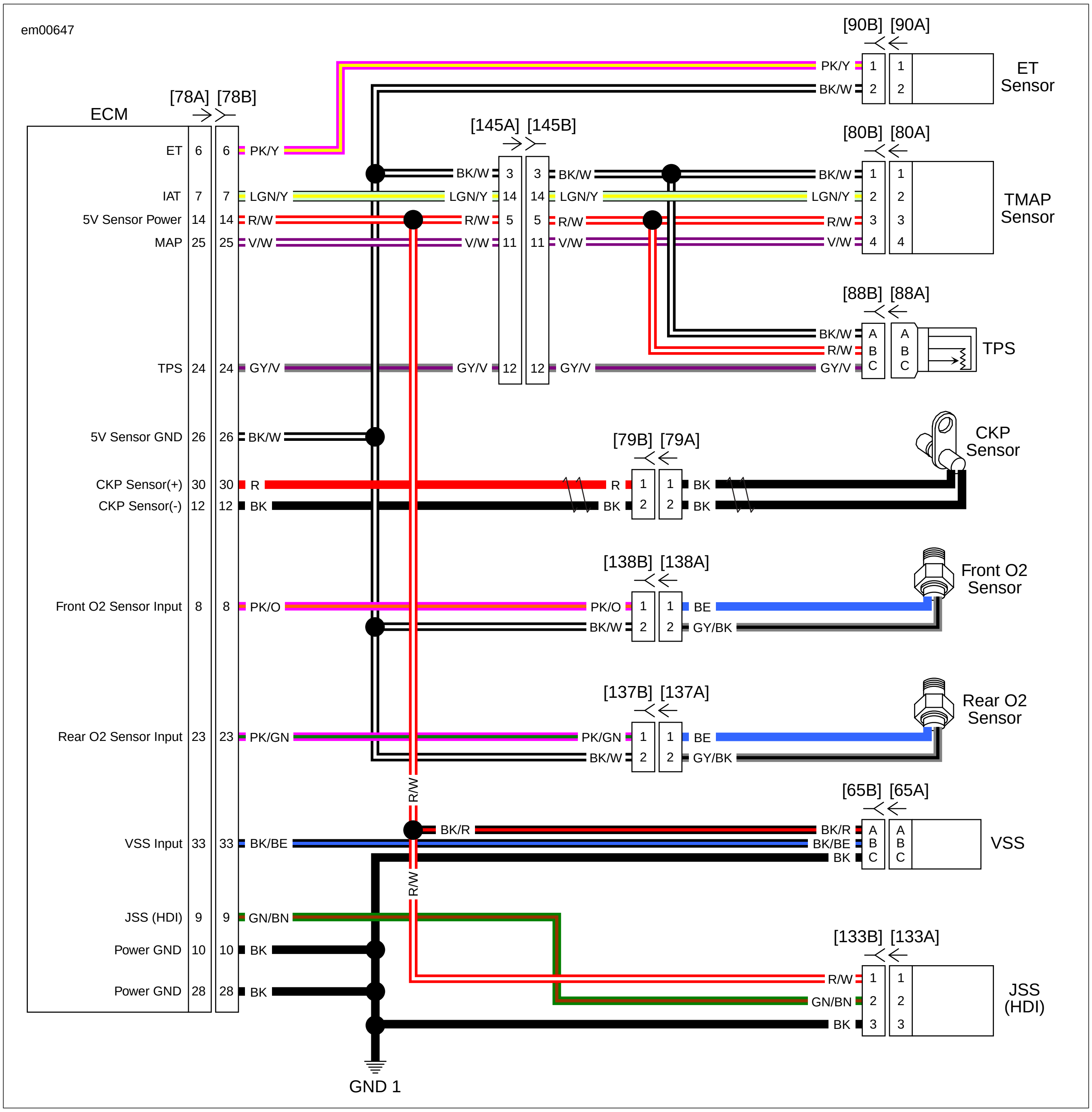



**Figure 6-13. Sensor Circuit**

## DTC P0131

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-17. DTC P0131 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Front O2 sensor malfunction |
| Short to ground in signal circuit |
| Fuel system malfunction |

### 1. Front O2 Sensor Test

1. Disconnect front O2 sensor [138].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between front O2 sensor [138B] terminal 1 (PK/O), to chassis ground.
4. Is voltage approximately 5V?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 2.

### 2. Front O2 Sensor Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78].
3. Test for continuity between front O2 sensor [138B] terminals 1 (PK/O) and 2 (BK/W).
4. Is continuity present?
   a. **Yes.** Repair short between (PK/O) and (BK/W) wires.
   b. **No.** Go to Test 3.

### 3. Front O2 Sensor Signal Wire Shorted to Ground Test

1. Test for continuity between front O2 sensor [138B] terminal 1 (PK/O) and vehicle ground.
2. Is continuity present?
   a. **Yes.** Repair short between (PK/O) wire and ground.
   b. **No.** If ECM [78] connections are good, replace ECM.

### 4. Front O2 Sensor Operation Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Connect O2 sensor.
3. Place transmission in neutral, engine stop switch to RUN and IGN ON. Start engine and allow to reach operating temperature.
4. With engine speed at a steady rpm, measure voltage between breakout box terminals 8 and 26.
5. Is voltage above 0.6V?
   a. **Yes.** Replace ECM.
   b. **No.** Perform fuel pressure test. Look for correct ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace O2 sensor.

## DTC P0132

| PART NUMBER | TOOL NAME |
|---|---|
| HD-43876 | BREAKOUT BOX |

**Table 6-18. DTC P0132 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Front O2 sensor malfunction |
| Fuel system malfunction |

### 1. Front O2 Sensor Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
3. Start the engine and allow it to reach operating temperature.
4. With engine speed at a steady rpm, measure voltage between breakout box terminals 8 and 26.
5. Is voltage less than 0.4V?
   a. **Yes.** Replace the ECM.
   b. **No.** Perform fuel pressure test. Look for correct ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the O2 sensor.

## DTC P0134

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-19. DTC P0134 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Front O2 sensor malfunction |
| Open or short to voltage in signal circuit |
| Open sensor ground |

### 1. Front O2 Sensor Signal Wire Short Circuit Voltage Test

1. Disconnect front O2 Sensor [138].
2. Turn IGN ON.

3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between front O2 sensor [138B] terminal 1 to chassis ground.
4. Is voltage greater than 5.2V?
   a. **Yes.** Repair short to voltage on (PK/O) wire.
   b. **No. (Greater than 4V.)** Go to Test 2.
   c. **No. (Less than 4V.)** Go to Test 3.

## 2. Front O2 Sensor Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between front O2 sensor [138B] terminal 2 (BK/W) and breakout box terminal 26.
4. Is continuity present?
   a. **Yes.** Replace the front O2 sensor.
   b. **No.** Repair open on (BK/W) wire.

## 3. Front O2 Sensor Signal Wire Open Test

1. Test for continuity between front O2 sensor [138B] terminal 1 (PK/O) and breakout box terminal 8.
2. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open (PK/O) wire.

# DTC P0151

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-20. DTC P0151 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Rear O2 sensor malfunction |
| Short to ground in signal circuit |
| Fuel system malfunction |

## 1. Rear O2 Sensor Test

1. Disconnect rear O2 sensor [137].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between rear O2 sensor [137B] terminal 1 (PK/GN) to ground.
4. Is voltage approximately 5V?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 2.

## 2. Rear O2 Sensor Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78].
3. Test for continuity between rear O2 sensor [137B] terminals 1 (PK/GN) and 2 (BK/W).
4. Is continuity present?
   a. **Yes.** Repair short between (PK/GN) and (BK/W) wires.
   b. **No.** Go to Test 3.

## 3. Rear O2 Sensor Signal Wire Shorted to Ground Test

1. Test for continuity between rear O2 sensor [137B] terminal 1 (PK/GN) and ground.
2. Is continuity present?
   a. **Yes.** Repair short between (PK/GN) wire and ground.
   b. **No.** If ECM [78] connections are good, replace ECM.

## 4. Rear O2 Sensor Operation Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Connect O2 sensor.
3. Place transmission in neutral, engine stop switch to RUN and IGN ON. Start engine and allow to reach operating temperature.
4. With engine speed at a steady rpm, measure voltage between ECM breakout box terminals 23 (+) and 26 (-).
5. Is voltage above 0.6V?
   a. **Yes.** Replace ECM.
   b. **No.** Perform fuel pressure test. Look for correct ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace O2 sensor.

# DTC P0152

| PART NUMBER | TOOL NAME |
|---|---|
| HD-43876 | BREAKOUT BOX |

**Table 6-21. DTC P0152 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Rear O2 sensor malfunction |
| Fuel system malfunction |

## 1. Rear O2 Sensor Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.

3. Start the engine and allow it to reach operating temperature.
4. With engine speed at a steady rpm, measure voltage between breakout box terminals 23 and 26.
5. Is voltage less than 0.4V?
   a. **Yes.** Replace the ECM.
   b. **No.** Perform fuel pressure test. Look for correct ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the O2 sensor.

## DTC P0154

| PART NUMBER | TOOL NAME |
|---|---|
| HD-43876 | HARNESS CONNECTOR TEST KIT |

**Table 6-22. DTC P0154 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Rear O2 sensor malfunction |
| Open or short voltage in signal circuit |
| Open sensor ground |

### 1. Rear O2 Sensor Signal Wire Short Circuit Voltage Test

1. Disconnect rear O2 sensor [137].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-43876) and a multimeter, measure voltage between rear O2 sensor [137B] terminal 1 to chassis ground.
4. Is voltage greater than 5.5V?
   a. **Yes.** Repair short to voltage on (PK/GN) wire.
   b. **No. (Greater than 4V.)** Go to Test 2.
   c. **No. (Less than 4V.)** Go to Test 3.

### 2. Rear O2 Sensor Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between rear O2 sensor [137B] terminal 2 (BK/W) and breakout box terminal 26.
4. Is continuity present?
   a. **Yes.** Replace the rear O2 sensor.
   b. **No.** Repair open on (BK/W) wire.

### 3. Rear O2 Sensor Signal Wire Open Test

1. Test for continuity between rear O2 sensor [137B] terminal 1 (PK/GN) and breakout box terminal 23.
2. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (PK/GN) wire.

# DTC P0261, P0262, P0263, P0264 6.9

## DESCRIPTION AND OPERATION

See Figure 6-14. The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and triggered sequentially. The power for the injectors comes from the system relay. The system relay also provides power for the fuel pump and the ignition coil. The ECM provides the path to ground to trigger the injectors.

*NOTE*

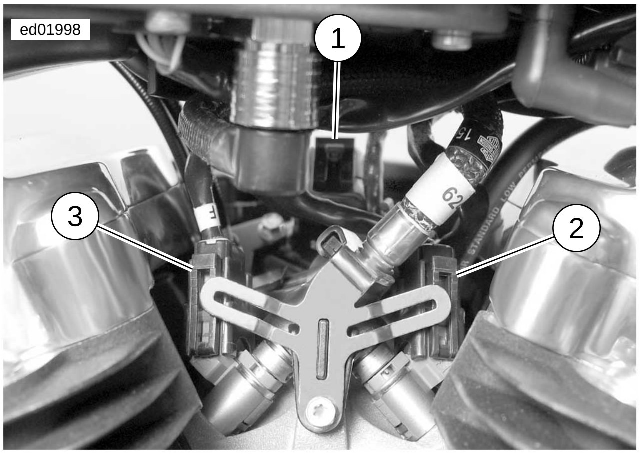
*ECM fuse and system relay failures or wiring harness problems will cause 12V power to be lost to both injectors, ignition coils and fuel pump.*

**Table 6-23. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0261 | Front injector open/low |
| P0262 | Front injector high |
| P0263 | Rear injector open/low |
| P0264 | Rear injector high |

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.




1. **IAC [87]**
2. **Rear fuel injector [85]**
3. **Front fuel injector [84]**

**Figure 6-14. Between Cylinder Heads Left Side**

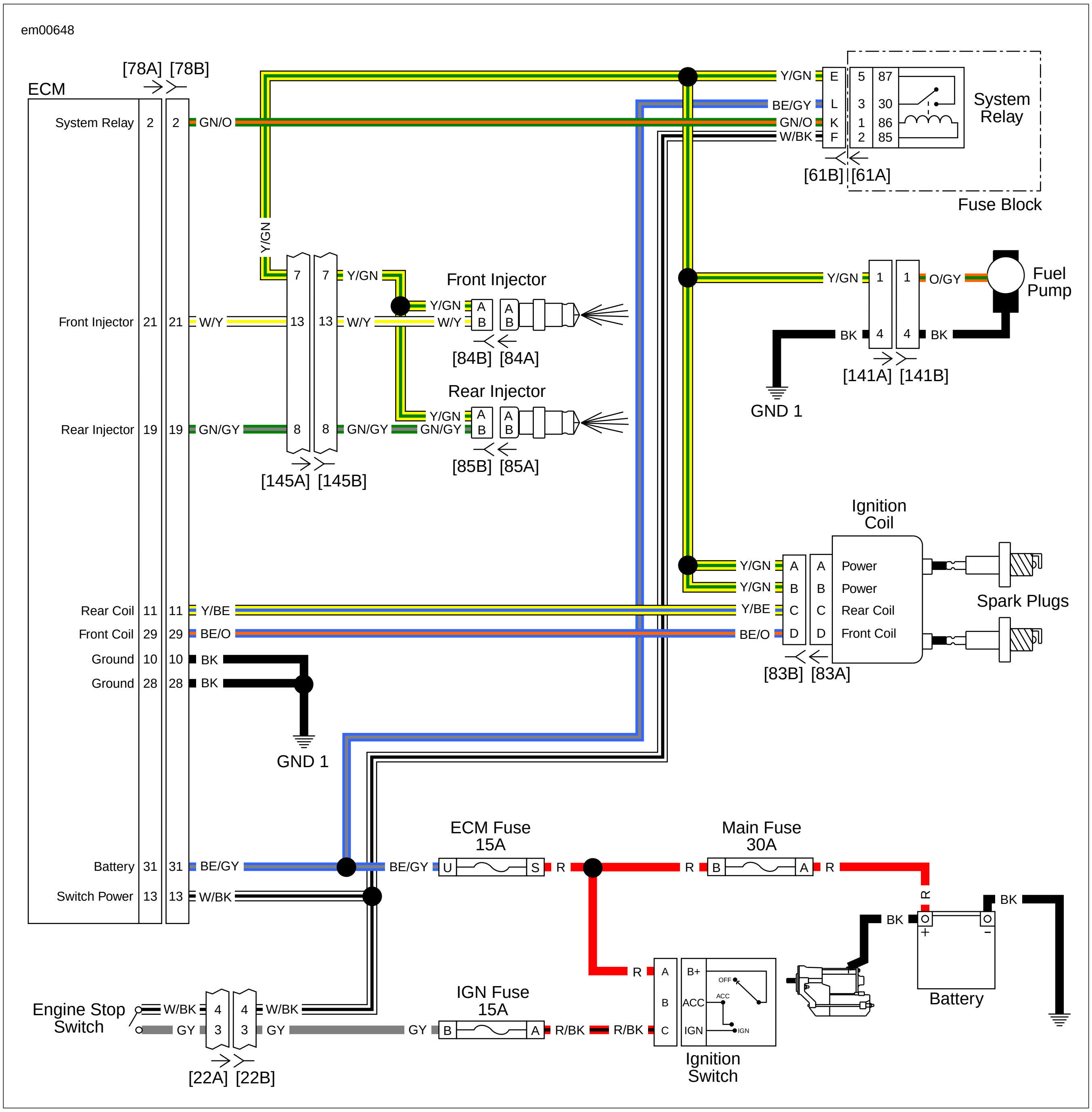



**Figure 6-15. Ignition Circuit**

## DTC P0261

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-24. DTC P0261 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Front fuel injector malfunction |
| Open signal circuit |
| Open power circuit |

### 1. Front Fuel Injector Test

1. Disconnect front fuel injector [84].
2. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [84B].
3. Crank engine.
4. Does light flash when engine is cranking (or running)?
   a. **Yes.** Go to Test 5.
   b. **No, lamp does not illuminate.** Go to Test 2.
   c. **No, lamp is on steady.** Go to Test 6.

### 2. Front Fuel Injector Power Wire Open Circuit Test

1. Turn IGN OFF and engine stop switch to RUN.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-43876) to ECM harness [78B] leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between breakout box terminal 21 and fuel injector [84B] terminal B (W/Y).
5. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open on (W/Y) wire.

### 3. Front Fuel Injector Power Wire Shorted to Ground Test

1. Test for continuity between breakout box terminal 21 and ground.
2. Is continuity present?
   a. **Yes.** Repair short in (W/Y) to ground.
   b. **No.** Go to Test 4.

### 4. Fuel Injector/System Relay Test

1. Remove system relay.
2. Test for continuity between system relay socket [61B] terminal E (Y/GN) wire and front injector [84B] terminal A (Y/GN).
3. Is continuity present?
   a. **Yes.** If connections are good, replace ECM.
   b. **No.** Repair open (Y/GN) wire.

### 5. Injector Resistance Test

1. Test resistance between terminal A and B of injector [84A].
2. Is resistance value between 10-20 Ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace injector.

### 6. Driver Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminal 21 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (W/Y) wire.
   b. **No.** Replace ECM.

## DTC P0262

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-25. DTC P0262 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Front fuel injector malfunction |
| Short to ground in signal circuit |

### 1. Front Fuel Injector Control Wire Shorted to Voltage Test

1. Disconnect front fuel injector [84].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure the voltage between [84B] terminal B (W/Y) and ground.
3. Is voltage less than 1.0V?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair short to voltage on (W/Y) wire.

### 2. Injector Resistance Test

1. Test resistance between terminal A and B of [84A].
2. Is resistance value between 10-20 Ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace front fuel injector.

## DTC P0263

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-26. DTC P0263 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Rear fuel injector malfunction |
| Open signal circuit |
| Open power circuit |

### 1. Rear Fuel Injector Test

1. Disconnect rear fuel injector [85].
2. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [85B].
3. Crank engine.
4. Does lamp flash when engine is cranking (or running)?
   a. **Yes.** Go to Test 5.
   b. **No, lamp does not illuminate.** Go to Test 2.
   c. **No, lamp is on steady.** Go to Test 6.

### 2. Rear Fuel Injector Power Wire Open Circuit Test

1. Turn IGN OFF and engine stop switch to RUN.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-43876) to ECM harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
4. Test for continuity between breakout box terminal 19 and fuel injector [85B] terminal B (GN/GY).
5. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open on (GN/GY) wire.

### 3. Rear Fuel Injector Power Wire Shorted to Ground Test

1. Test for continuity between breakout box terminal 19 and ground.
2. Is continuity present?
   a. **Yes.** Repair short in (GN/GY) to ground.
   b. **No.** Go to Test 4.

### 4. Fuel Injector/System Relay Test

1. Remove system relay.
2. Test for continuity between system relay socket [61B] terminal E (Y/GN) wire and [85B] terminal A (Y/GN).
3. Is continuity present?
   a. **Yes.** If connections are good, replace ECM.
   b. **No.** Repair open (Y/GN) wire.

### 5. Injector Resistance Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test resistance between terminal A and B of [85A].
2. Is resistance value between 10-20 Ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace rear fuel injector.

### 6. Driver Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminal 19 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/GY) wire.
   b. **No.** Replace ECM.

## DTC P0264

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-27. DTC P0264 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Rear fuel injector malfunction |
| Short to ground in signal circuit |

### 1. Rear Fuel Injector Control Wire Shorted to Voltage Test

1. Disconnect rear fuel injector [85].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure the voltage between [85B] terminal B (GN/GY) and ground.
3. Is voltage less than 1.0V?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair short to voltage on (GN/GY) wire.

### 2. Injector Resistance Test

1. Test resistance between terminal A and B of [85A].
2. Is resistance value between 10-20 Ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace rear fuel injector.

# DTC P0373, P0374 6.10

## DESCRIPTION AND OPERATION

If the CKP sensor signal is weak or absent, DTCs P0373 or P0374 will be set. DTC P0373 is usually set when several attempts to crank the engine have failed.

*NOTE*

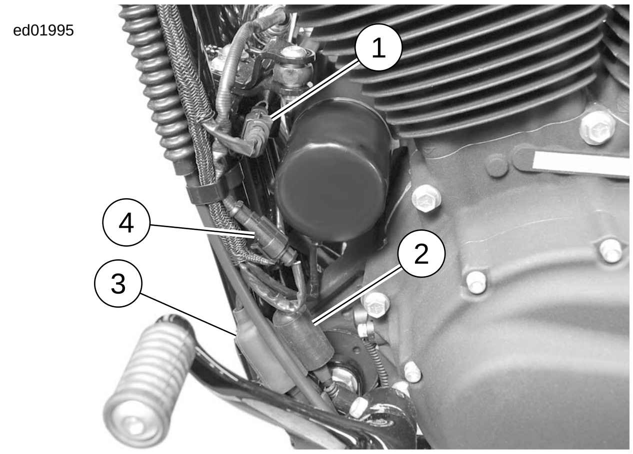
*Engine will not start if signal is not detected or cannot be synchronized.*

**Table 6-28. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0373 | CKP sensor intermittent |
| P0374 | CKP not detected/cannot synchronize |

### Diagnostic Tips

Engine must be cranked for more than five seconds without CKP signal to set P0374 code. Intermittent TMAP wiring or sensor issues may cause these codes to set prior to setting TMAP codes. Verify TMAP wiring and sensor prior to replacing the ECM.




1. **Voltage regulator [77]**
2. **CKP sensor [79]**
3. **JSS (HDI) [133]**
4. **Front O2 sensor [138]**

**Figure 6-16. Lower Left Front**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

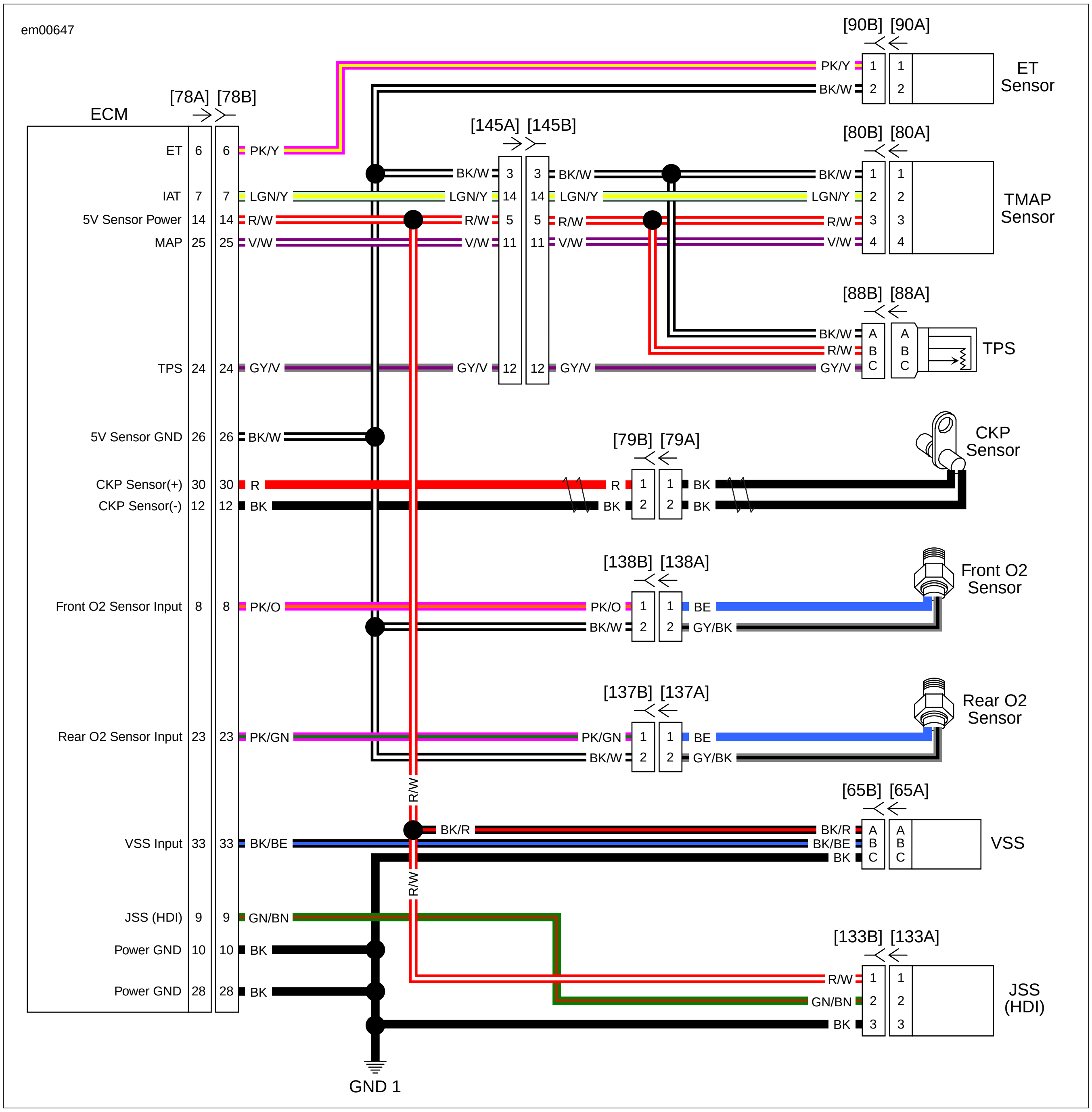



**Figure 6-17. Sensor Circuit**

## DTC P0373

**Table 6-29. DTC P0373 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| CKP sensor malfunction |
| Open or short to ground in signal circuit |

### 1. CKP Sensor Test

1. Clear the DTC. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Start the vehicle.
3. Did DTC P0373 reset?
   a. **Yes.** Inspect and verify battery and starting system. See 3.2 STARTING SYSTEM.
   b. **No.** System functioning properly.

## DTC P0374

| PART NUMBER | TOOL NAME |
|---|---|
| HD-43876 | BREAKOUT BOX |

**Table 6-30. DTC P0374 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| CKP sensor malfunction |
| Open or short to ground in signal circuit |

### 1. CKP Sensor Connections Test

1. With IGN OFF, disconnect ECM [78] and inspect for damaged, corroded or pushed out terminals.
2. Are terminal problems present?
   a. **Yes.** Repair terminals as required.
   b. **No.** Go to Test 2.

### 2. CKP Sensor Signal Wire Continuity Test

1. Disconnect CKP sensor [79].
2. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between breakout box terminal 30 to CKP sensor [79B] terminal 1 (R).
4. Is resistance less than 1.0 Ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open wire (R).

### 3. CKP Sensor Ground Wire Continuity Test

1. Test continuity from breakout box terminal 12 to CKP sensor [79B] terminal 2 (BK).
2. Is resistance less than 1.0 Ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (BK) wire.

### 4. CKP Sensor Signal Wire Shorted to CKP Ground Wire Test

1. Test for continuity between breakout box terminals 30 and 12.
2. Is continuity present?
   a. **Yes.** Repair short between CKP [79B] terminals 1 (R) and 2 (BK).
   b. **No.** Go to Test 5.

### 5. CKP Sensor Low Shorted to Ground Test

1. Test for continuity between breakout box terminals 12 (+) and 28 (-).
2. Is continuity present?
   a. **Yes.** Repair short to sensor ground on (BK) wire.
   b. **No.** Go to Test 6.

### 6. CKP Sensor Output Test

1. Connect CKP sensor [79].
2. Test for AC voltage at breakout box terminals 30 (+) and 12 (-).
3. Place transmission in neutral, turn IGN ON and engine stop switch to RUN.
4. Crank engine for 5 seconds while observing multimeter.
5. Is AC voltage present?
   a. **Yes.** See diagnostic tips before replacement. Replace ECM.
   b. **No.** Go to Test 7.

### 7. CKP Sensor Signal Wire Shorted to Ground Test

1. Disconnect CKP sensor [79].
2. Test for continuity between breakout box terminals 30 (+) and 28 (-).
3. Is continuity present?
   a. **Yes.** Repair shorted (R) wire to ground.
   b. **No.** Replace the CKP sensor.

# DTC P0501, P0502 6.11

## DESCRIPTION AND OPERATION

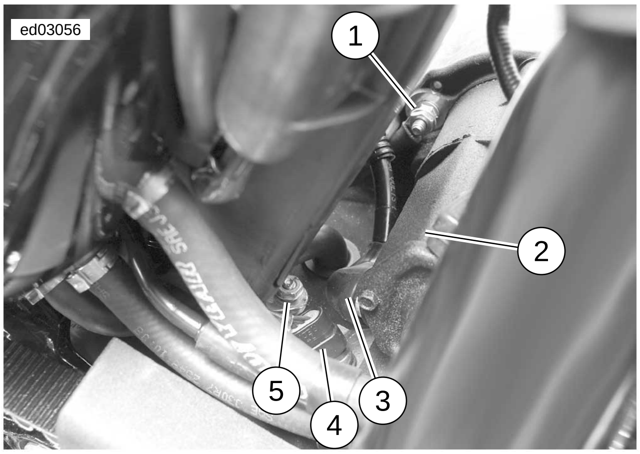
See Figure 6-18. The VSS is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the TSM, TSSM or HFSM, and speedometer through serial data.

*NOTES*

- *The ECM uses VSS input to calculate idle air control position. Therefore problems with the vehicle speed signal can lead to improper operation of the idle air control.*
- *The TMAP, JSS, TPS and VSS sensors are connected to the same reference line (+5V REF). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P0501, P0502, P1501, P1502). Start with the trouble code having the lowest ranking value.*
- *A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs after this test. Be sure to perform this test before replacing a component.*

**Table 6-31. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0501 | VSS low |
| P0502 | VSS high |




1. **Harness ground [GND1]**
2. **Starter**
3. **Battery to starter**
4. **VSS [65]**
5. **Battery ground**

**Figure 6-18. Grounds**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

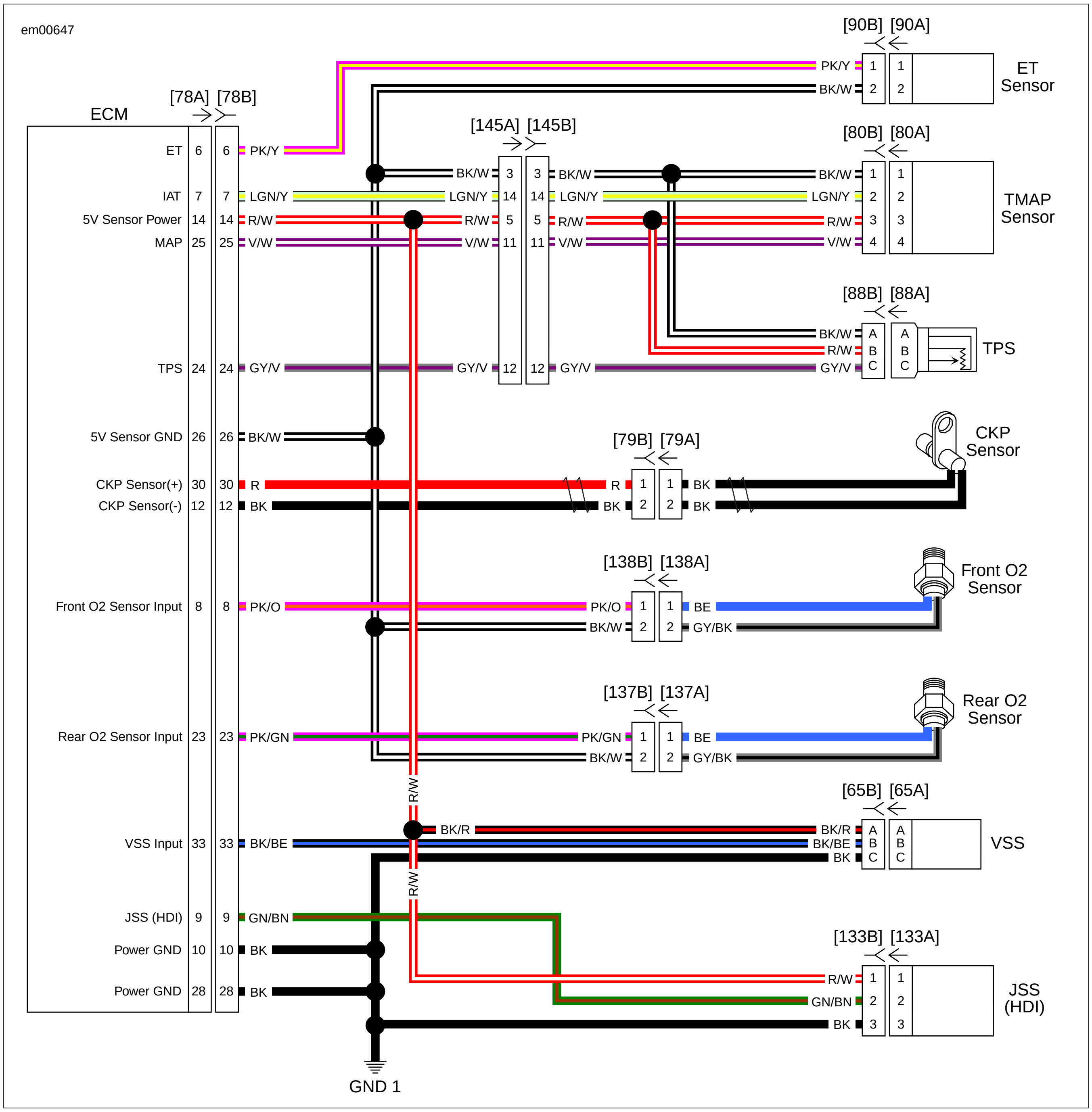



**Figure 6-19. Sensor Circuit**

## DTC P0501

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-32. DTC P0501 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| VSS malfunction |
| Open or short to ground in signal circuit |
| Open or short to ground in 5V reference circuit |

### 1. VSS Connections Test

1. With IGN OFF, disconnect VSS [65].
2. Inspect [65] for damaged terminals, backed out or bent terminals. Repair as necessary.
3. Place transmission in neutral, turn IGN ON and engine stop switch to RUN.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between VSS [65B] terminal A and ground.
5. Is voltage reading approximately 5.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

### 2. VSS Sensor Power Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78].
3. Test continuity between [65B] terminal A and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (BK/R) wire.
   b. **No.** Repair open on (BK/R) wire.

### 3. VSS Signal Wire Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminals 33 and 28.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (BK/BE) wire.
   b. **No.** Go to Test 4.

### 4. VSS Signal Wire Open Test

1. Test for continuity between breakout box terminal 33 and [65B] terminal B.
2. Is continuity present?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open on (BK/BE) wire.

### 5. VSS Dirty or Damaged Test

1. Remove VSS.
2. Check for debris on the sensor tip.
3. Is debris present?
   a. **Yes.** Clean debris from VSS and install.
   b. **No.** If VSS connections are good, replace VSS.

## DTC P0502

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-33. DTC P0502 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| VSS malfunction |
| Short to voltage in signal circuit |
| Open ground |
| 5V reference shorted to battery voltage |

### 1. VSS Sensor Power Shorted to Voltage Test

1. With IGN OFF, disconnect VSS [65].
2. Inspect [65] for damaged, terminals backed out or bent terminals. Repair as necessary.
3. Place transmission in neutral, turn IGN ON and engine stop switch to RUN.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between VSS [65B] terminals A (BK/R) and C (BK).
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage on (BK/R) wire.
   b. **No.** Go to Test 2.

### 2. VSS Signal Wire Short to Voltage Test

1. Measure voltage between VSS [65B] terminal B (BK/BE) and ground.
2. Is voltage above 6.0V?
   a. **Yes.** Repair short to voltage on (BK/BE) wire.
   b. **No.** Go to Test 3.

### 3. VSS Ground Wire Open Test

1. Test continuity between breakout box terminal 28 and VSS [65B] terminal C (BK).
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (BK) wire.

## 4. VSS Signal Wire Shorted to Sensor Power Test

1. With IGN OFF, connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test continuity between breakout box terminals 33 and 14.
3. Is continuity present?
   a. **Yes.** Repair short between (BK/BE) and (BK/R) wires.
   b. **No.** Go to Test 5.

## 5. VSS Test

1. Connect ECM [78A] to breakout box.
2. Verify the VSS [65] is disconnected.
3. Clear the DTC. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
4. Start the vehicle.
5. Did the DTC P0502 return?
   a. **Yes.** Replace the ECM.
   b. **No.** Replace the VSS.

# DTC P0505 6.12

## DESCRIPTION AND OPERATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

See Figure 6-21. The ECM controls engine idle speed by moving the IAC to open or close a passage around the throttle plates. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.

The IAC position can be measured in steps. This can only be done by using DIGITAL TECHNICIAN II (Part No. HD-48650).

- A high number of steps represents a fully retracted pintle and open passage around throttle plate. This correlates with an increase in the amount of air flowing through the throttle body.
- Zero steps represents a fully extended pintle. A zero reading indicates an abnormal condition in which the pintle has been fully extended and has consequently closed the passage around throttle plate.

Each time the ignition is turned OFF, the ECM resets the IAC 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 for the next start event.

*NOTE*

*Idle speed is controlled by the ECM and cannot be adjusted.*

### Diagnostic Trouble Code P0505: Loss of Idle Speed Control

Loss of idle speed control will result if the idle rpm is ±200 from preset idle speed and IAC motor is at zero or maximum for greater than 5 seconds. This DTC may occur with others for a multiple code situation. Resolve the other codes first to correct.

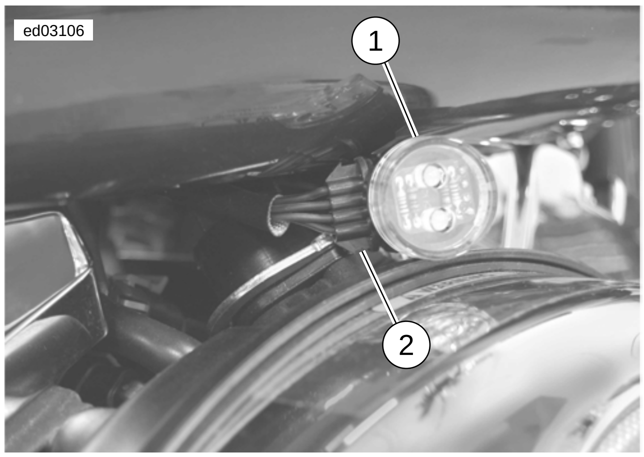
**Table 6-34. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0505 | Loss of idle speed control |

### Diagnostic Tips

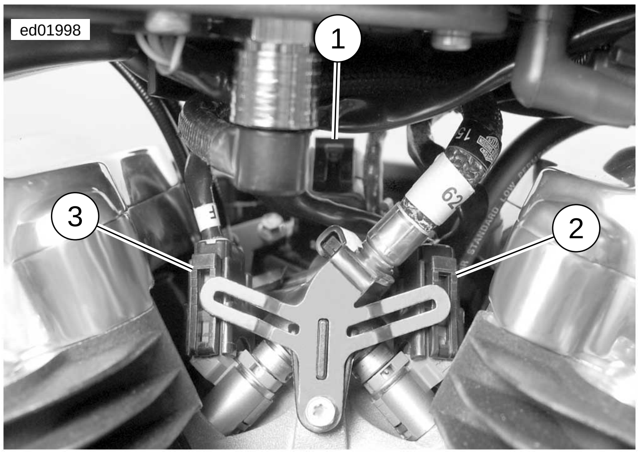
Engine idle speed can be adversely affected by the following:

- A loss of idle speed control does not necessarily imply the IAC actuator or wiring has failed. It can be caused by a number of conditions such as an intake air leak, improperly adjusted throttle stop or a misfiring cylinder.
- A non-O.E engine configuration can lead to idle instability and the generation of the P0505 code.
- 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 box and air filter. Then, with the throttle wide open, turn IGN ON for 2 seconds and then OFF for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores.
- Intake leaks.
- Contaminated fuel.
- TPS reading of greater than 1% (possible throttle cable misadjustment) or battery voltage reading of less than 9V or a VSS greater than 0 will disable idle speed control.
- If there is a loss of battery power at ECM terminal 31, vehicle will start but IAC pintle will not reset at key OFF. Eventually pintle will be out of position causing performance problems.




1. **IAC test light HD-41199-3**
2. **IAC [87]**

**Figure 6-20. IAC Test Light (Part No. HD-41199-3)**




1. IAC [87]
2. Rear fuel injector [85]
3. Front fuel injector [84]

**Figure 6-21. Between Cylinder Heads Left Side**

## Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

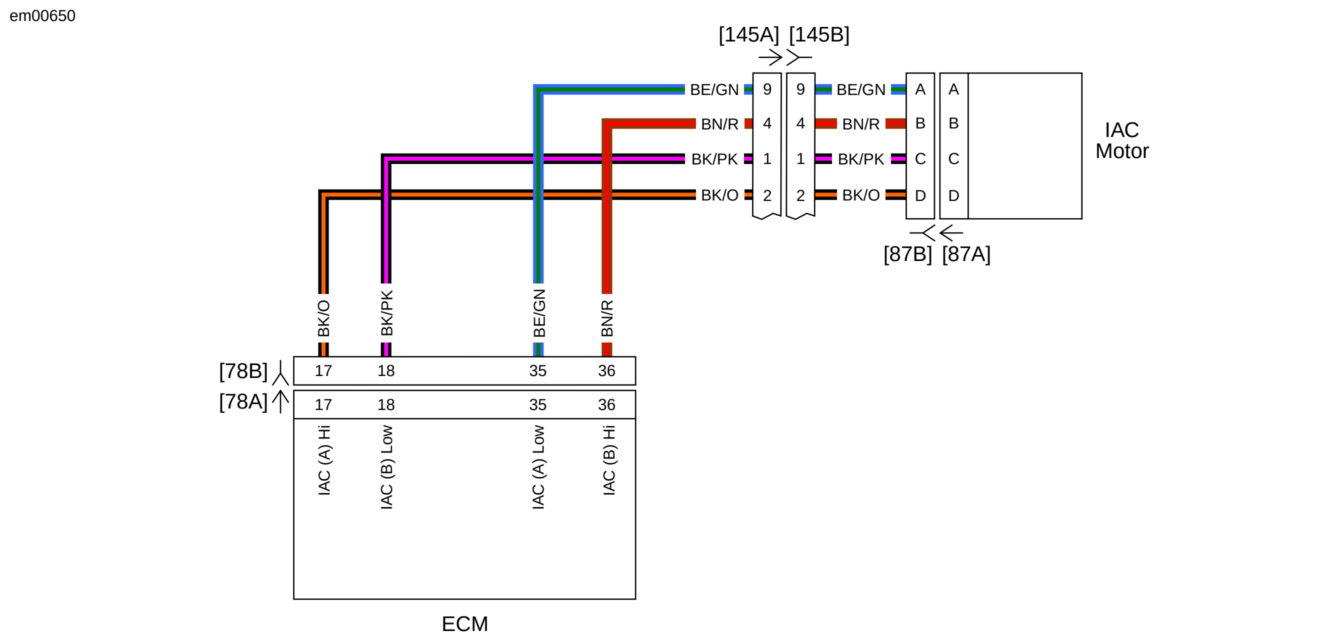



**Figure 6-22. IAC Circuit**

## DTC P0505

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41199-3 | IAC TEST LIGHT |
| HD-43876 | BREAKOUT BOX |

**Table 6-35. DTC P0505 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| IAC malfunction |
| Short to voltage in circuits |
| Short to ground in circuits |
| Open circuits |
| Vacuum/air leaks |
| Fuel system problems |

### 1. IAC Operational Test

1. Remove air cleaner cover and element.
2. Turn IGN ON, then OFF, while watching the IAC pintle for movement.
3. Does the pintle move?
   a. **Yes.** IAC system okay. Check for improperly adjusted throttle stop, vacuum leaks, cylinder misfire, contaminated fuel, leaking injectors and engine mechanical failure.
   b. **No.** Go to Test 2.

### 2. IAC Connector Test

1. Remove air cleaner base.
2. Disconnect IAC motor harness [87].
3. Connect IAC TEST LIGHT (Part No. HD-41199-3) to [87B].
4. Place IGN ON and engine stop switch to RUN.
5. While observing test light, turn IGN OFF.
6. Did both IAC test lights flash alternately?
   a. **Yes.** If connections are good, replace IAC motor.
   b. **No.** Go to Test 3.

**Table 6-36. IAC, Wire Color, ECM**

| IAC [87B] | WIRE COLOR | ECM [78B] |
|---|---|---|
| A | BE/GN | 35 |
| B | BN/R | 36 |
| C | BK/PK | 18 |
| D | BK/O | 17 |

### 3. IAC Circuits Open Test

1. Remove test light.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity on each IAC wire between breakout box and [87B]. Refer to Table 6-36.
4. Is continuity present on all circuits?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in appropriate circuit.

### 4. IAC Circuits Shorted to Ground Test

1. Test for continuity on each IAC wire between breakout box and ground. Refer to Table 6-36.
2. Is continuity present on any circuits?
   a. **Yes.** Repair short to ground on appropriate circuit.
   b. **No.** Go to Test 5.

### 5. IAC Circuits Short to Voltage Test

1. Turn IGN ON.
2. Test for voltage between breakout box and ground on each IAC wire. Refer to Table 6-36.
3. Is voltage present on any circuit?
   a. **Yes.** Repair short to voltage in appropriate circuit.
   b. **No.** Go to Test 6.

### 6. Short between IAC Circuits Test

1. With IGN OFF, test for continuity between each IAC circuit and the other IAC circuits.
2. Is continuity present between any two IAC circuits?
   a. **Yes.** Repair short between IAC circuits.
   b. **No.** Inspect ECM connections. If connections are good, replace the ECM.

# DTC P0603, P0605 6.13

## DESCRIPTION AND OPERATION

See Figure 6-23 and Figure 6-24. The DTCs listed indicate a failure which requires replacement of the ECM. Refer to Table 6-37.

*NOTE*

*After replacing ECM, perform password learning procedure and clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.*

**Table 6-37. Code Description**

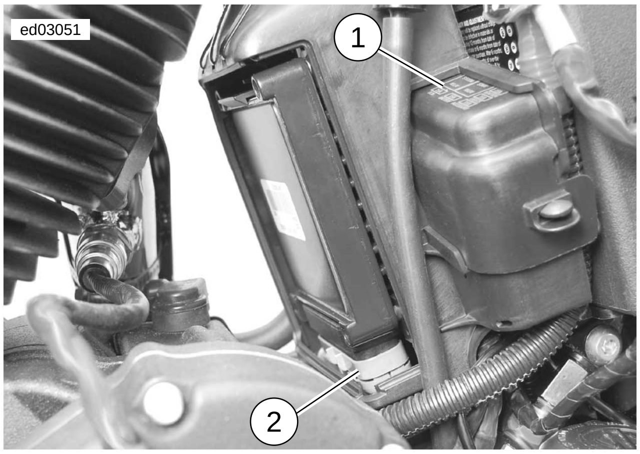
| DTC | DESCRIPTION |
|---|---|
| P0603 | ECM EEPROM error |
| P0605 | ECM flash error |

## DTC P0603 Test

1. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Replace ECM if DTCs reappear.

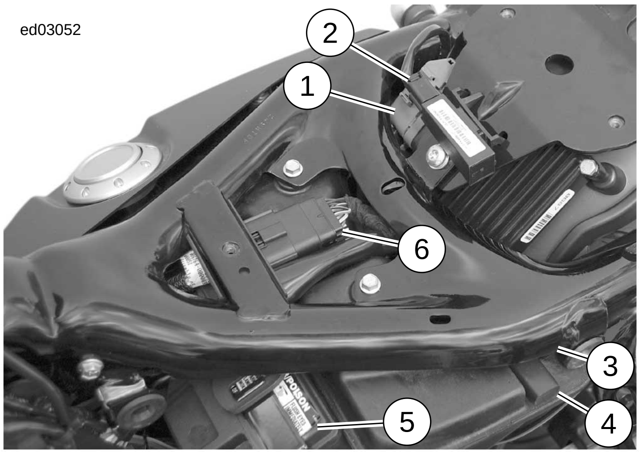
## DTC P0605 Test

1. Clear DTCs using odometer self-diagnostics. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
2. Attempt to program ECM using correct calibration.
3. Restart vehicle. If DTC reappears, replace ECM.




1. **Fuse block [61]**
2. **ECM [78]**

**Figure 6-23. ECM: XL**




1. **ECM [78]**
2. **Security antenna [209]**
3. **P&A battery [160]**
4. **Fuel sender resistor assembly [200]**
5. **Battery**
6. **Engine sensor harness [145]**

**Figure 6-24. ECM: XR**

# DTC P0661, P0662 6.14

## DESCRIPTION AND OPERATION

The active intake solenoid (AIS) is included on XR HDI models only.

See Figure 6-25. AIS regulates the amount of air entering the air cleaner. The AIS opens when vehicle speed exceeds 45 mph (70 km/h) with 50% or greater throttle opening. Once open, active intake will close when vehicle speed falls below 40 mph (65 km/h). The power for the AIS comes from the system relay. The ECM provides the path to ground to trigger the AIS.

**Table 6-38. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P0661 | AIS open/low |
| P0662 | AIS high/shorted |

*NOTE*

*ECM fuse and system relay failures or wiring harness problems will cause 12V power to be lost to both injectors, ignition coils and fuel pump.*

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

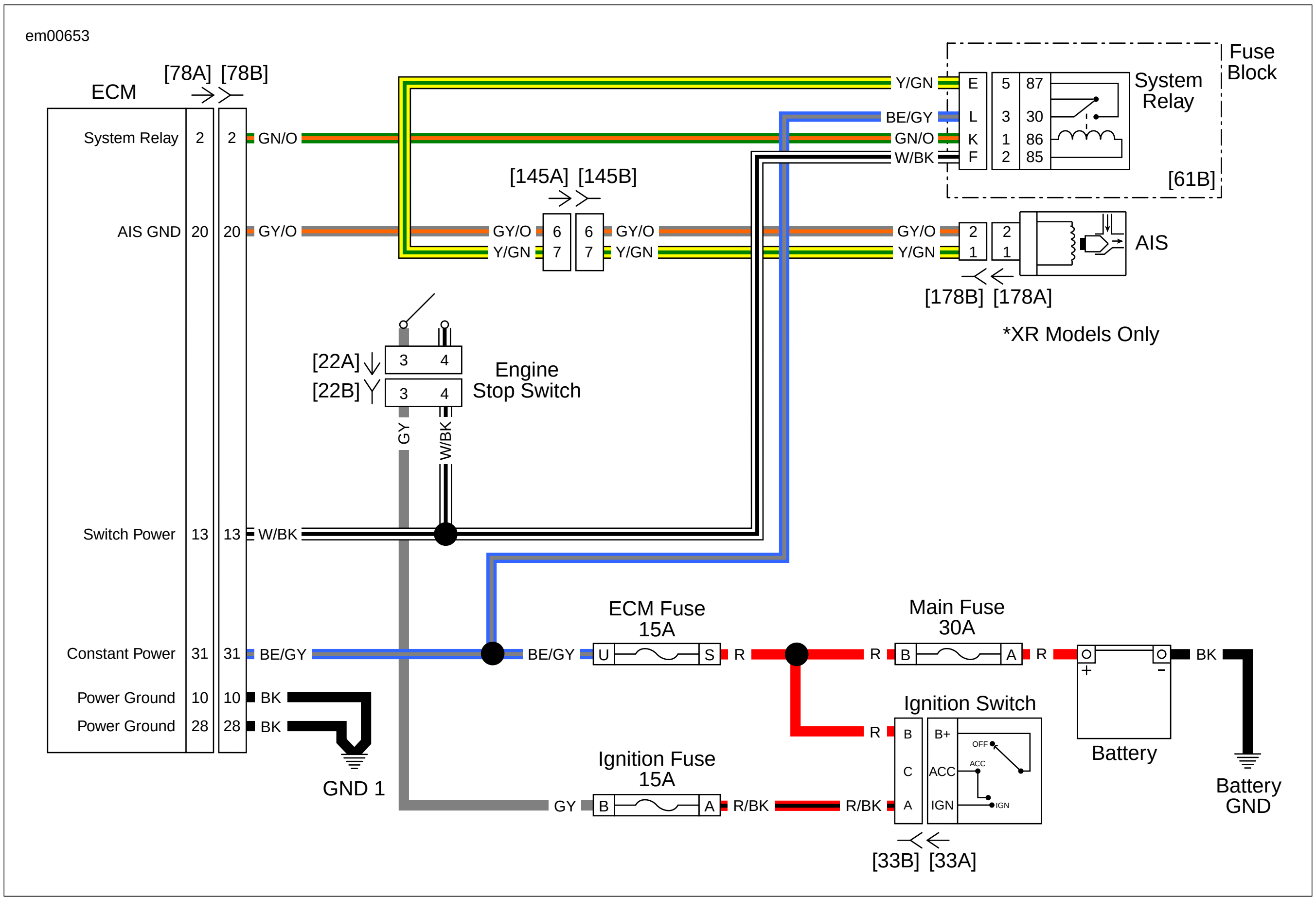



**Figure 6-25. AIS Circuit**

## DTC P0661, P0662

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-39. DTC P0661, P0662 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| AIS malfunction |
| System relay malfunction |
| Shorted high to ground |
| Open low to ground |

### 1. AIS Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to harness [78B], leaving ECM disconnected.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump breakout box terminal 20 to terminal 10 or 28.
3. Turn IGN ON.
4. Does AIS activate immediately?
   a. **Yes.** AIS okay. Replace ECM.
   b. **No.** Go to Test 2.

### 2. AIS Resistance Test

1. Turn IGN OFF and disconnect AIS [178].
2. Measure resistance between [178A] terminals 1 and 2.
3. Is resistance between 16-20 Ohms?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace AIS.

### 3. AIS Open Ground Wire Test

1. Test for continuity from breakout box terminal 20 to AIS [178B] terminal 2 (GY/O).
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open wire (GY/O).

### 4. AIS Low Short to Ground Test

1. Test for continuity from breakout box terminal 20 to ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GY/O) wire.
   b. **No.** Go to Test 5.

### 5. AIS High Short to Ground Test

1. Remove system relay.
2. Test for continuity between system relay [61B] terminal E and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (Y/GN) wire.
   b. **No.** Go to Test 6.

### 6. AIS Open Supply Wire Test

1. Test for continuity between system relay [61B] terminal E to AIS [178B] terminal 1 (Y/GN).
2. Is continuity present?
   a. **Yes.** Perform system relay test. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
   b. **No.** Repair open wire (Y/GN).

# DTC P1009, P1010 6.15

## DESCRIPTION AND OPERATION

### Password Problem

The ECM and TSM, TSSM or HFSM exchange passwords during operation. An incorrect password or missing password will set a DTC. If any U-codes exist, troubleshoot the higher priority codes prior to performing the tests in this section. Refer to Table 2-2.

*NOTE*

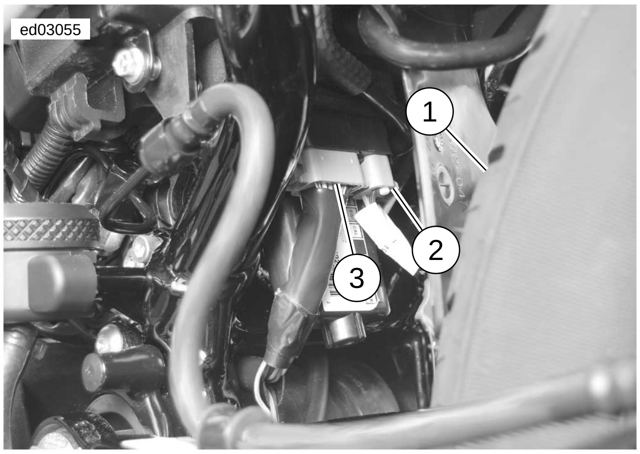
*If the TSM, TSSM or HFSM is not connected to the wiring harness, the vehicle will not start.*

**Table 6-40. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P1009 | Incorrect password |
| P1010 | Missing password |

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.




1. **Rear tire**
2. **HFSM antenna [208]**
3. **TSM, TSSM or HFSM [30]**

**Figure 6-26. TSM, TSSM or HFSM**

## DTC P1009, P1010

**Table 6-41. DTC P1009, P1010 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| ECM malfunction |
| TSM, TSSM or HFSM malfunction |

### 1. Incorrect Password Test

1. Program password.
2. Does DTC P1009 or P1010 set?
   a. **Yes.** Go to Test 2.
   b. **No.** System okay.

### 2. TSM, TSSM or HFSM Replacement Test

1. Replace TSM, TSSM or HFSM.
2. Program password.
3. Does DTC P1009 or P1010 set?
   a. **Yes.** Install original TSM, TSSM or HFSM and replace ECM.
   b. **No.** System okay.

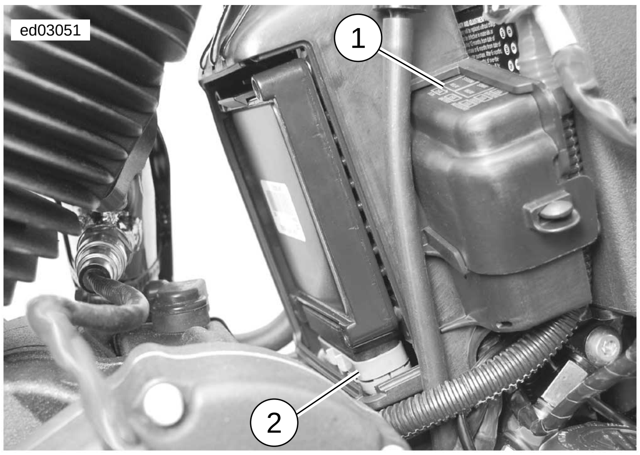
# DTC P1001, P1002, P1003, P1004 6.16

## DESCRIPTION AND OPERATION

See Figure 6-27 and Figure 6-28. With IGN ON and the engine stop switch at RUN, the ECM will energize the system relay to complete the circuit to the in-tank fuel pump, ignition coils and fuel injectors. They will remain powered as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after ignition is ON or engine has stalled, or immediately after the ignition is shut OFF.

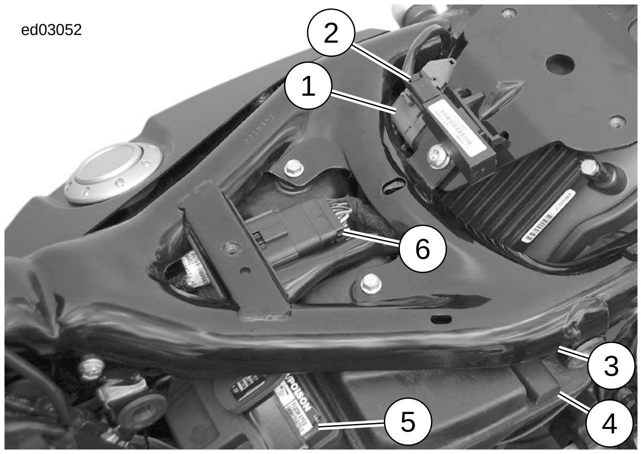
**Table 6-42. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P1001 | System relay coil open/low |
| P1002 | System relay coil high/shorted |
| P1003 | System relay contacts open |
| P1004 | System relay contacts closed |




1. **Fuse block [61]**
2. **ECM [78]**

**Figure 6-27. ECM: XL**




1. **ECM [78]**
2. **Security antenna [209]**
3. **P&A battery [160]**
4. **Fuel sender resistor assembly [200]**
5. **Battery**
6. **Engine sensor harness [145]**

**Figure 6-28. ECM: XR**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

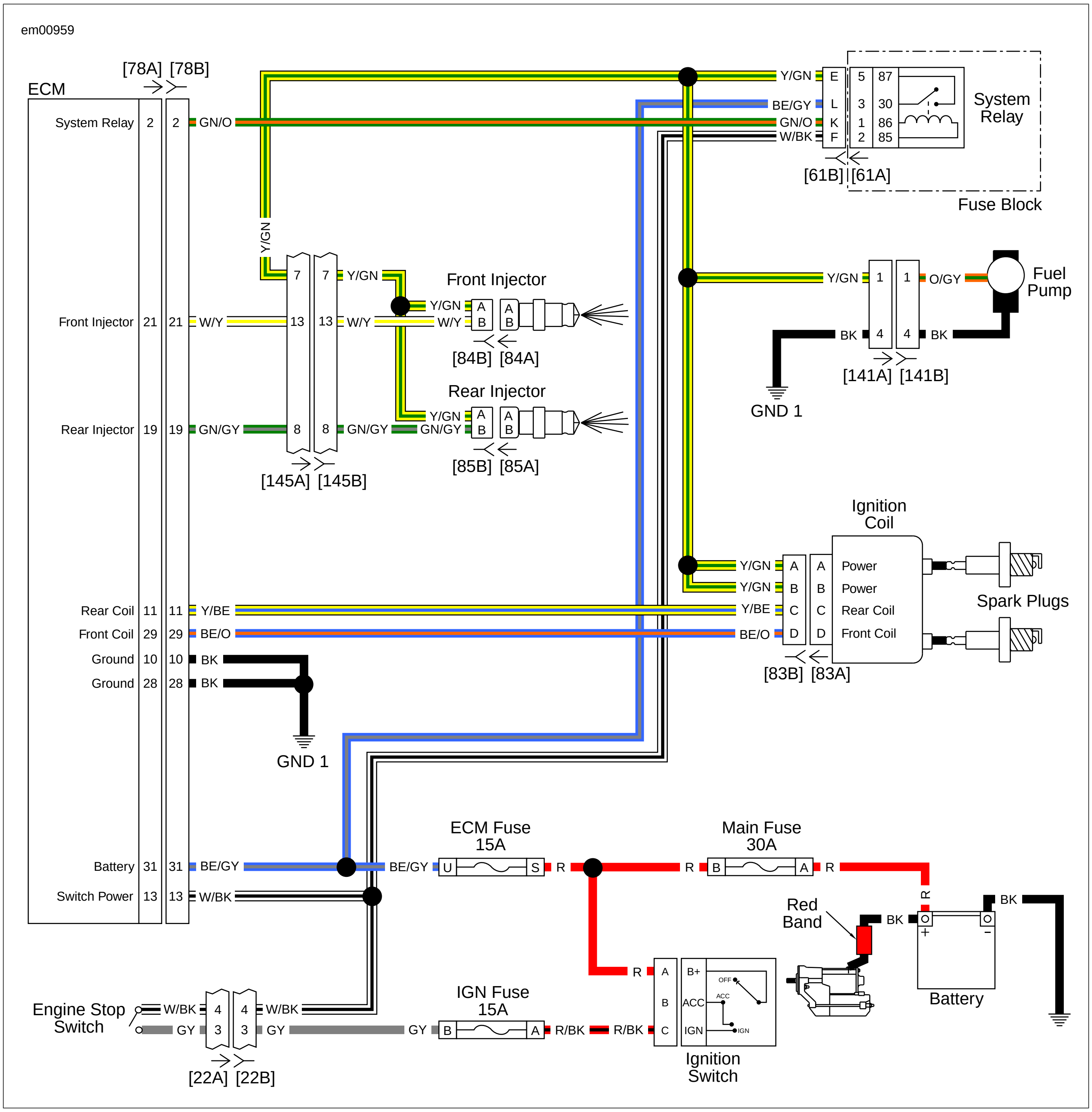



**Figure 6-29. Ignition Circuit**

## DTC P1001

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-43. DTC P1001 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Relay malfunction |
| Open in coil supply circuit |
| Short to ground in coil control circuit |
| Open in coil control circuit |

### 1. System Relay Test

1. Remove the system relay.
2. Test the system relay. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
3. Is the system relay OK?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the system relay.

### 2. System Relay Coil Power Circuit Test

1. With IGN ON and the engine stop switch in RUN, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage at system relay [61B] socket terminal F.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (W/BK) wire.

### 3. System Relay Coil Control Short to Ground Test

1. With IGN OFF, disconnect the ECM [78].
2. Test for continuity from [61B] socket terminal K to ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/O) wire.
   b. **No.** Go to Test 4.

### 4. System Relay Coil Control Circuit Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between [61B] socket terminal K and breakout box terminal 2.
3. Is continuity present?
   a. **Yes.** Replace the ECM.
   b. **No.** Repair open in (GN/O) wire.

## DTC P1002

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-44. DTC P1002 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Relay malfunction |
| Short to voltage in coil control circuit |

### 1. System Relay Test

1. Remove the system relay.
2. Test the system relay. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
3. Is the system relay OK?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the system relay.

### 2. System Relay Coil Short to Voltage Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between system relay [61B] socket terminal K and ground.
2. Is voltage present?
   a. **Yes.** Repair short to voltage in (GN/O) wire.
   b. **No.** Replace the ECM.

## DTC P1003

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-45. DTC P1003 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Relay malfunction |
| Open in switch output circuit |
| Short to ground in the switch supply circuit |
| Open in switch supply circuit |

### 1. System Relay Test

1. Remove the system relay.
2. Test the system relay. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
3. Is the system relay OK?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the system relay.

### 2. System Relay Power Supply Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between system relay [61B] socket terminal L and ground.

2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 4.

## 3. System Relay Switch Side Circuit Test

1. Disconnect the rear fuel injector [85].
2. Test for continuity between [61B] socket terminal E and [85B] terminal A.
3. Is continuity present?
   a. **Yes.** Replace the ECM.
   b. **No.** Repair open in (Y/GN) wire.

## 4. System Relay Power Supply Circuit Test

1. Test for continuity between system relay [61B] socket terminal L and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (BE/GY) wire and replace ECM fuse.
   b. **No.** Repair open in power supply to system relay. This includes the (BE/GY) wire, ECM fuse and the (R) wire between the ECM and 30A main fuse.

# DTC P1004

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-46. DTC P1004 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Relay malfunction |
| Short to voltage in the switch circuit |
| Short to ground in coil control circuit |
| Short to voltage rear coil control circuit |
| Short to voltage front coil control circuit |

## 1. System Relay Test

1. Remove the system relay.
2. Test the system relay. See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Relay Diagnostics.
3. Is the system relay OK?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the system relay.

## 2. System Relay Switch Side Short to Voltage Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage on system relay [61B] socket terminal E.
2. Is voltage present?
   a. **Yes.** Repair short to voltage in (Y/GN) wire.
   b. **No.** Go to Test 3.

## 3. System Relay Coil Short to Ground Test

1. Disconnect the ECM [78].
2. Test for continuity between [61B] socket terminal K and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/O) wire.
   b. **No.** Go to Test 4.

## 4. Rear Coil Short to Voltage Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. With IGN ON, test for voltage on breakout box terminal 11 to ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage on (Y/BE) wire.
   b. **No.** Go to Test 5.

## 5. Front Coil Short to Voltage Test

1. With IGN ON, test for voltage on breakout box terminal 29 to ground.
2. Is voltage present?
   a. **Yes.** Repair short to voltage on (BE/O) wire.
   b. **No.** Replace the ECM.

# DTC P1351, P1352, P1354, P1355 6.17

## DESCRIPTION AND OPERATION

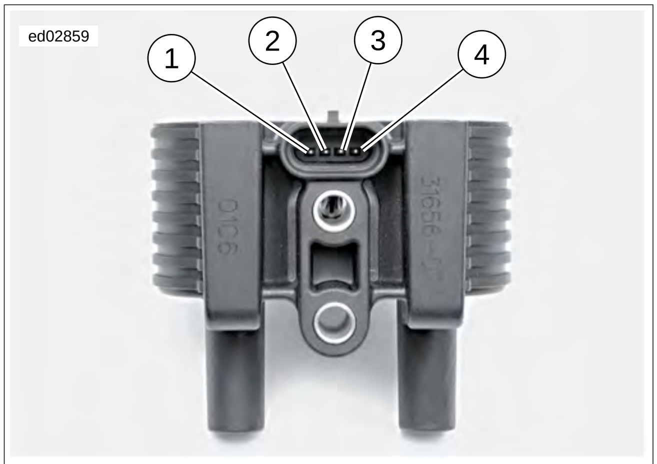
Ignition coil DTCs will set if the ignition coil primary voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If front and rear DTCs are set simultaneously, it is likely a coil power failure or a coil failure.

The coil receives power from the system relay at the same time that the fuel pump and injectors are activated. The system relay is active for the first 2 seconds after the ignition switch is turned ON and then shuts off until rpm is detected from the CKP sensor, at which time system relay is reactivated. The ECM is responsible for turning on the system relay by providing the ground to activate the relay, which in turn powers the coil.

**Table 6-47. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P1351 | Front ignition coil open/low |
| P1352 | Front ignition coil high/shorted |
| P1354 | Rear ignition coil open/low |
| P1355 | Rear ignition coil high/shorted |


**Figure 6-30. Ignition Coil Circuit Test**




1. **Pin A: coil primary battery (+)**
2. **Pin B: coil primary battery (+)**
3. **Pin C: coil B primary**
4. **Pin D: coil A primary**

**Figure 6-31. Ignition Coil**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

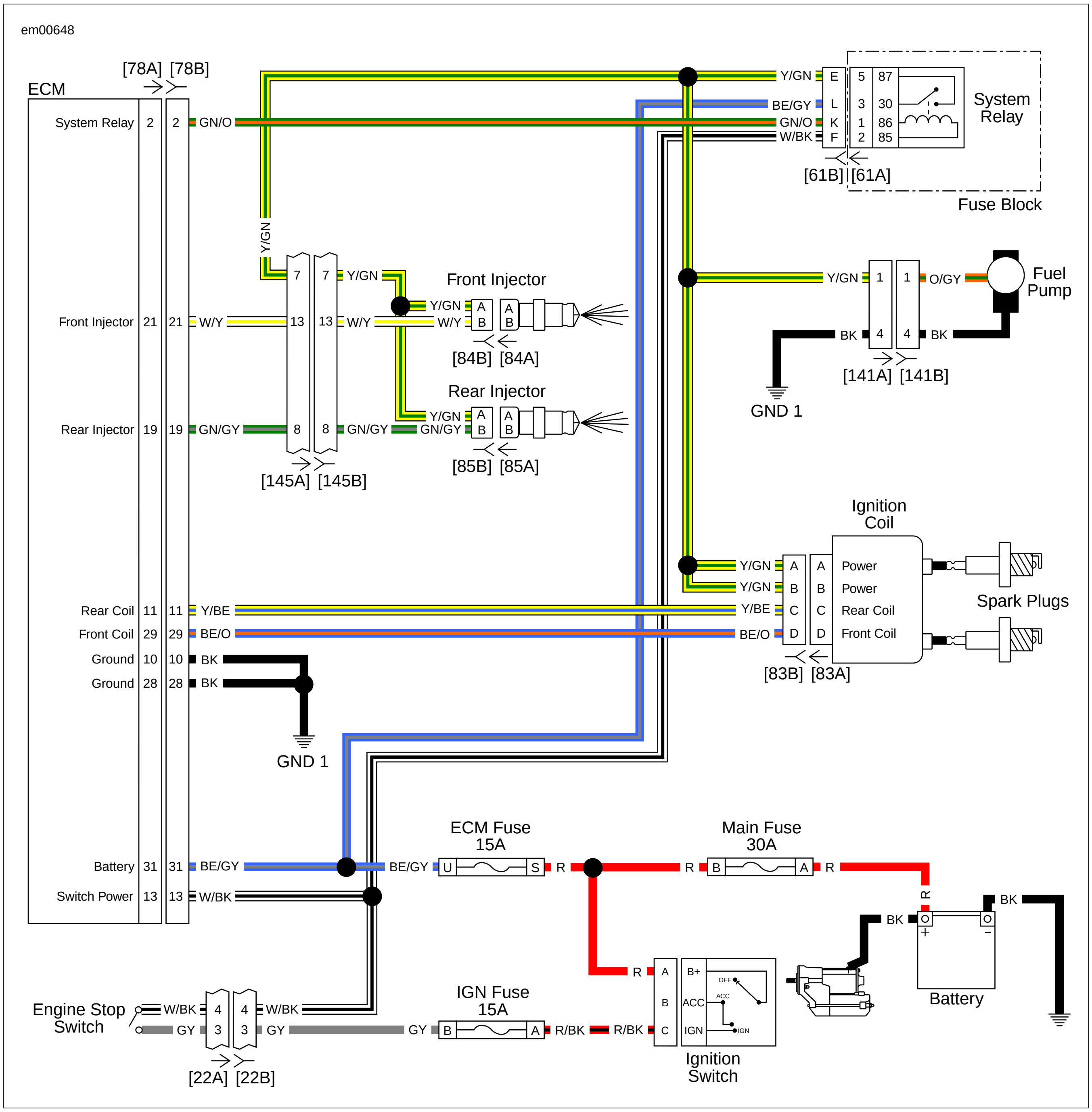



**Figure 6-32. Ignition Circuit**

## DTC P1351

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-48. DTC P1351 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Ignition coil malfunction |
| Open or short to ground in signal circuit |
| Open power circuit |

### 1. Ignition Coil Test

1. Disconnect ignition coil [83]. Inspect for damaged or backed out terminals and corrosion. Repair as required.
2. See Figure 6-30. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) to connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [83B] terminals B and D.
3. Turn IGN ON and engine stop switch to RUN.
4. Does lamp flash when engine is cranked?
   a. **Yes.** Replace ignition coil.
   b. **No.** Go to Test 2.

### 2. Ignition Coil Input Voltage Test

1. Turn IGN ON. Voltage will only be present for 2 seconds after ignition is turned on.
2. Test for battery voltage at ignition coil [83B] terminals A and B to ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open (Y/GN) wire between [83B] and system relay [61B] terminal E.

### 3. Ignition Coil Control Wire Continuity Test

1. Turn IGN OFF and engine stop switch to RUN.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between breakout box terminal 29 and ignition coil [83B] terminal D (BE/O).
4. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open (BE/O) wire.

### 4. Ignition Coil Control Wire Shorted to Ground Test

1. Disconnect ECM [78A] from breakout box.
2. Test for continuity between breakout box terminals 29 and 28.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (BE/O) wire.
   b. **No.** Replace ECM.

## DTC P1352

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-49. DTC P1352 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Ignition coil malfunction |
| Short to voltage in signal circuit |

### 1. Ignition Coil Shorted to Voltage Test

1. Disconnect ignition coil [83].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), measure voltage between [83B] terminal D and ground.
4. Is voltage more than 1.0V?
   a. **Yes.** Repair short to voltage on (BE/O) wire.
   b. **No.** Go to Test 2.

### 2. Ignition Coil Open Test

1. Test resistance between ignition coil [83A] terminals B and D.
2. Is resistance greater than 4.0 Ohms?
   a. **Yes.** If ECM connections are good, replace ECM.
   b. **No.** Replace ignition coil.

## DTC P1354

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34730-2E | FUEL INJECTOR TEST LIGHT |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-50. DTC P1354 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Ignition coil malfunction |
| Open or short to ground in signal circuit |
| Open power circuit |

### 1. Ignition Coil Test

1. Disconnect ignition coil [83]. Inspect for damaged or backed out terminals and corrosion. Repair as required.

2. See Figure 6-30. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) to connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [83B] terminals A and C.
3. Turn IGN ON and engine stop switch to RUN.
4. Does lamp flash when engine is cranked?
   a. **Yes.** Replace ignition coil.
   b. **No.** Go to Test 2.

## 2. Ignition Coil Input Voltage Test

1. Turn IGN ON. Voltage will only be present for 2 seconds after ignition is turned on.
2. Test for battery voltage at ignition coil [83B] terminals A and B to ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open (Y/GN) wire between [83B] and system relay [61B] terminal E.

## 3. Ignition Coil Control Wire Continuity Test

1. Turn IGN OFF and engine stop switch to RUN.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools.
3. Test for continuity between breakout box terminal 11 and ignition coil [83B] terminal C (Y/BE).
4. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open (Y/BE) wire.

## 4. Ignition Coil Control Wire Shorted to Ground Test

1. Disconnect ECM [78A] from breakout box.
2. Test for continuity between breakout box terminals 11 and 28.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (Y/BE) wire.
   b. **No.** Replace ECM.

# DTC P1355

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-51. DTC P1355 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Ignition coil malfunction |
| Short to voltage in signal circuit |

## 1. Ignition Coil Shorted to Voltage Test

1. Disconnect ignition coil harness [83].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), measure voltage between [83B] terminal C and ground.
4. Is voltage more than 1.0V?
   a. **Yes.** Repair short to voltage on (Y/BE) wire.
   b. **No.** Go to Test 2.

## 2. Ignition Coil Open Test

1. Measure resistance between ignition coil [83A] terminals B and C.
2. Is resistance greater than 4.0 Ohms?
   a. **Yes.** If ECM connections are good, replace ECM.
   b. **No.** Replace ignition coil.

# DTC P1501, P1502 6.18

## DESCRIPTION AND OPERATION

See Figure 6-33. The Jiffy Stand Sensor (JSS) uses a Hall-effect sensor to monitor jiffy stand position. When the jiffy stand is fully retracted the sensor picks up the presence of the metal tab mounted to the jiffy stand. The metal tab is moved away from the sensor as the jiffy stand is extended. When the jiffy stand is extended the engine will only start and run if the TSM, TSSM or HFSM determines the transmission is in neutral. Otherwise the engine will stall as the clutch is released. This is done by monitoring the neutral switch input to the TSM, TSSM or HFSM and communicating that input over the serial data circuit to the ECM.

The JSS is powered and monitored by the ECM. The ECM supplies the 5V reference to the JSS. The JSS sends a signal back to the ECM. This signal is used by the ECM to determine when the jiffy stand is retracted or extended. The JSS is grounded through the ECM.

The JSS also has a Fail Enable Mode. This mode allows the engine to start and run if the system recognizes a problem with the JSS circuit. When a problem exists or if the transmission is put in gear with the jiffy stand extended, the odometer will display "SIdE Stand". DTC P1501 or P1502 will set if the JSS circuits are out of range.

**Table 6-52. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P1501 | JSS low |
| P1502 | JSS high |

*NOTE*

*The ECM supplies 5V reference voltage to the VSS, TPS and MAP sensors, in addition to the JSS. Problems on the 5V reference will cause other DTCs.*

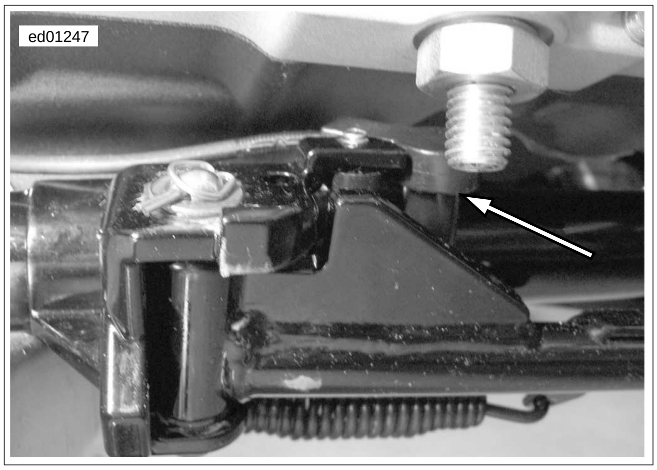



**Figure 6-33. JSS**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

[HOME](#)

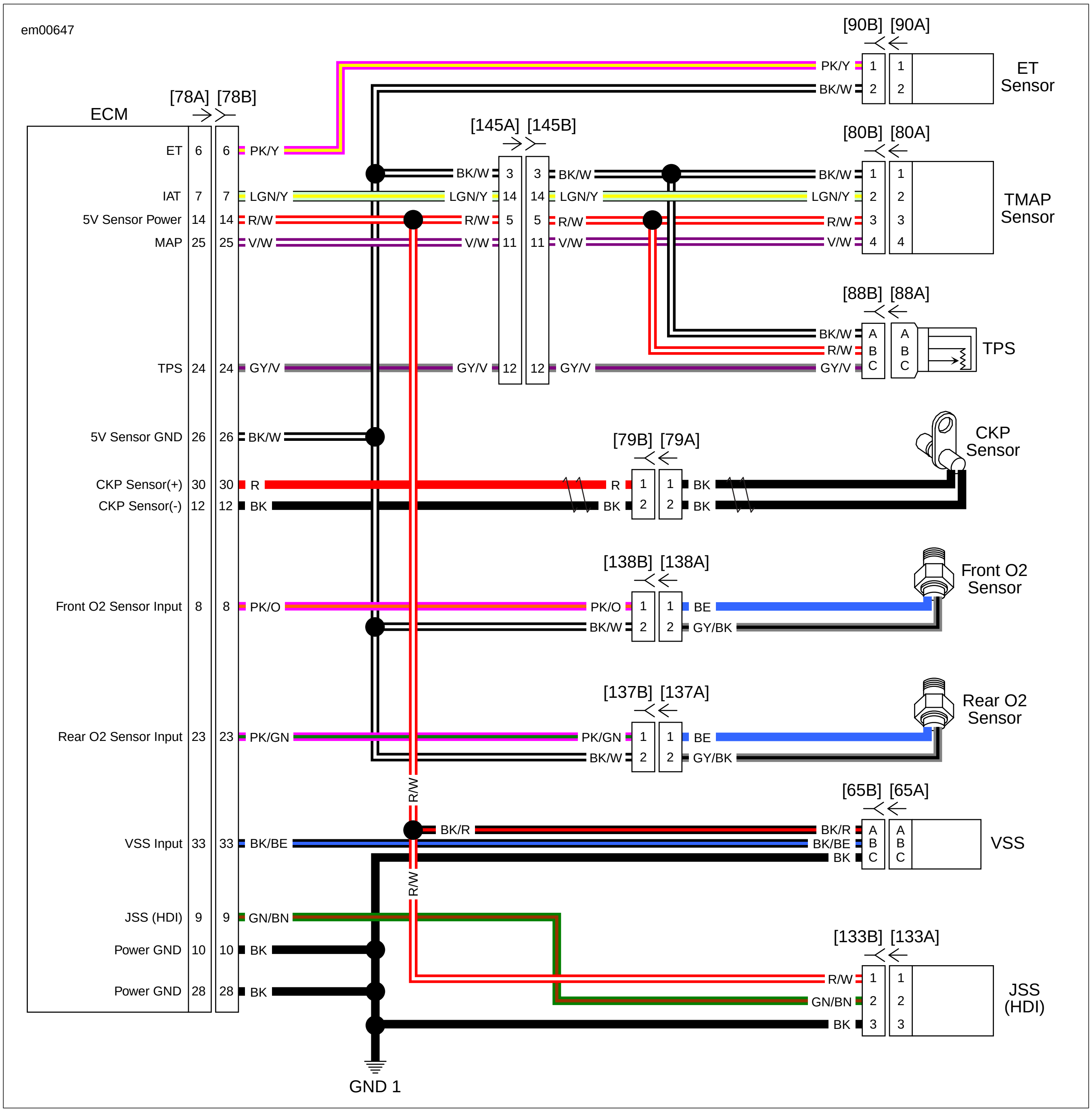



**Figure 6-34. Sensor Circuit**

## DTC P1501

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-53. DTC P1501 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| JSS malfunction |
| Open or short to ground in 5V reference circuit |
| Open or short to ground in signal circuit |

### 1. JSS 5V Reference Open Circuit Test

1. Disconnect the JSS [133].
2. Inspect the connection for corrosion or backed out terminals. Repair as required.
3. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
4. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity between breakout box terminal 14 and JSS [133B] terminal 1 (R/W).
5. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open on (R/W) wire.

### 2. JSS 5V Reference Shorted to Ground Test

1. Test for continuity between JSS [133B] terminal 1 (R/W) to ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (R/W) wire.
   b. **No.** Go to Test 3.

### 3. JSS Signal Wire Shorted to Ground Test

1. Test for continuity between breakout box terminal 9 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/BN) wire.
   b. **No.** Go to Test 4.

### 4. JSS Signal Wire Open Circuit Test

1. Test for continuity between breakout box terminal 9 and JSS [133B] terminal 2 (GN/BN).
2. Is continuity present?
   a. **Yes.** Replace JSS.
   b. **No.** Repair open on (GN/BN) wire.

## DTC P1502

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-54. DTC P1502 Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| JSS malfunction |
| Short to voltage in signal circuit |
| Open ground |
| Short to voltage in 5V reference circuit |

### 1. JSS Ground Wire Test

1. Disconnect the JSS [133].
2. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity between terminal 3 of [133B] and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (BK) wire.

### 2. JSS 5V Reference Wire Short to Voltage Test

1. Test for voltage at [133B] terminal 1 (R/W) wire.
2. Is voltage greater than 6V?
   a. **Yes.** Repair short to battery voltage on (R/W).
   b. **No.** Go to Test 3.

### 3. JSS Signal Wire Short to Voltage Test

1. Test for voltage on [133B] terminal 2.
2. Is voltage greater than 5V?
   a. **Yes.** Repair short to battery voltage in (GN/BN) wire.
   b. **No.** Go to Test 4.

### 4. JSS 5V Reference and Signal Shorted Together Test

1. With IGN OFF, disconnect the ECM [78].
2. Test for continuity between terminals 1 and 2 of [133B].
3. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (GN/BN) wires.
   b. **No.** Replace JSS.

## SIDE STAND DISPLAYED ON ODOMETER

**Table 6-55. Side Stand Displayed on Odometer Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Jiffy stand is down |
| Jiffy stand out of adjustment |

## 1. Starts, Then Stalls Test

1. Check for DTCs and diagnose them first.
2. Does the engine start and stall?
   a. **Yes.** See 6.22 STARTS, THEN STALLS.
   b. **No.** Go to Test 2.

## 2. Neutral Test

1. Verify the transmission is in neutral.
2. Is the neutral indicator on?
   a. **Yes.** Go to Test 3.
   b. **No.** See 4.5 INDICATOR LAMPS.

## 3. JSS Clearance Test

1. Inspect the JSS and the jiffy stand for correct mounting and clearance to the jiffy stand tab.
2. Is the clearance less than 0.18 in (4.5 mm)?
   a. **Yes.** Replace the JSS.
   b. **No.** Install the JSS and jiffy stand correctly.

# DTC P1653, P1654 6.19

## DESCRIPTION AND OPERATION

DTCs P1653 and P1654 are associated with terminal 3 from the ECM. This terminal supports a tachometer output that is not used from the factory. If either of these codes appear when checking for DTCs, inspect for any aftermarket components or systems wired into terminal 3 of the ECM.

**Table 6-56. Code Description**

| DTC | DESCRIPTION |
|---|---|
| P1653 | Tachometer low |
| P1654 | Tachometer high |

An issue with the wiring or component using this terminal could cause the codes to set. If no wiring is present in this terminal, clear the codes and perform a road test. If the codes return, replace the ECM.

# ENGINE CRANKS, BUT WILL NOT START 6.20

## DESCRIPTION AND OPERATION

If the starter will not crank the engine, the problem is not EFI related. See 3.2 STARTING SYSTEM or 5.9 SECURITY SYSTEM.

With the IGN ON and the engine stop switch at RUN, the ECM will energize the system relay to complete the circuit to the intank fuel pump. It will remain on as long as the engine is cranking or running and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after ignition is turned on or the engine has stalled, or immediately after the ignition is shut off.

The fuel pump delivers fuel to the injectors. The pressure regulator controls system pressure.

See Figure 6-38. When the engine is stopped, the pump can be turned on by applying battery voltage to the terminal B and ground to the terminal D wire of the fuel pump connector [86A]. Improper fuel system pressure may contribute to the following symptoms:

- Engine cranks, but will not run.
- Engine cuts out (may feel like ignition problems).
- Hesitation, loss of power.

There may be DTCs associated with this problem. Check for DTCs and resolve them before proceeding with this test.

*NOTE*

*After turning ignition off, wait 10 seconds before turning the ignition back on to get the fuel pump to reprime. This time-out period is necessary for the fuel pump and IAC to reset. To set a CKP DTC, a start attempt must last at least five seconds.*

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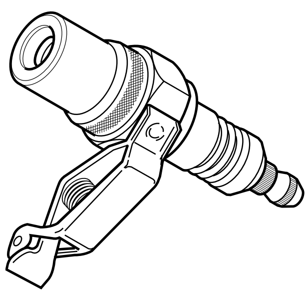

**Figure 6-35. Spark Tester**

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**Figure 6-36. Ignition Coil Circuit Test**

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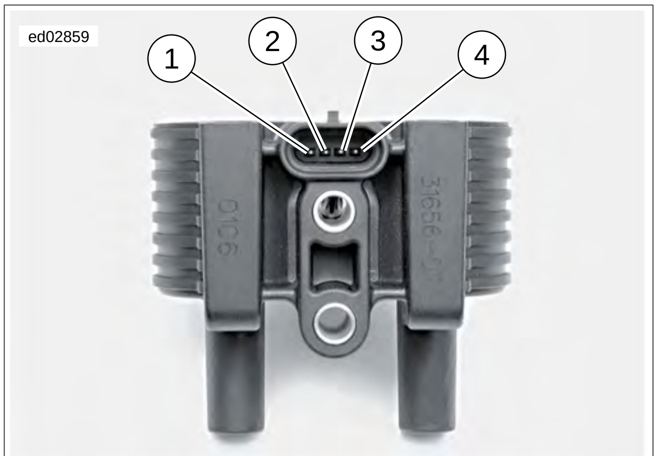



1. **Pin A: coil primary battery (+)**
2. **Pin B: coil primary battery (+)**
3. **Pin C: coil B primary**
4. **Pin D: coil A primary**

**Figure 6-37. Ignition Coil**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

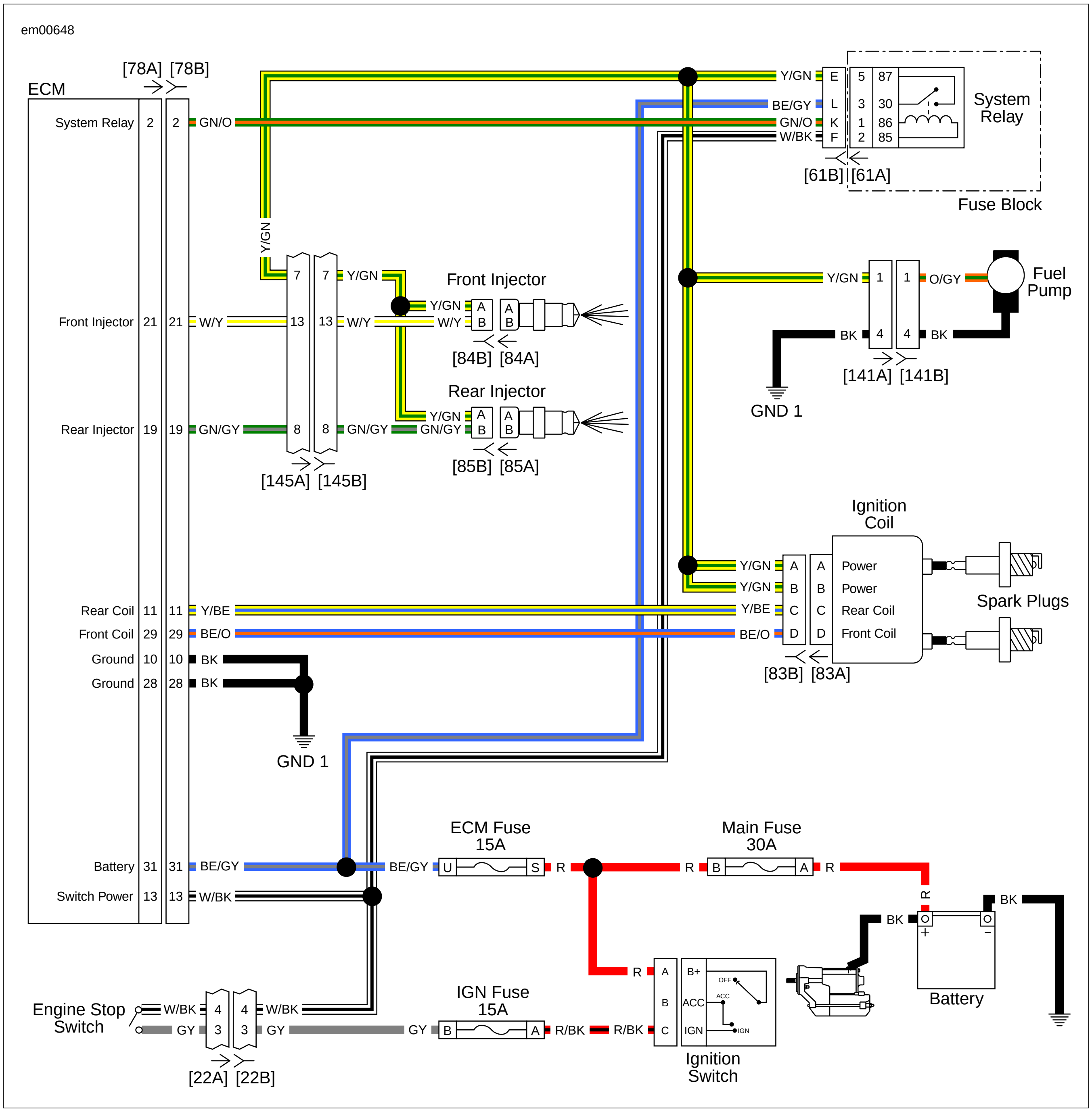



**Figure 6-38. Ignition Circuit**

## ENGINE CRANKS BUT WILL NOT START

| PART NUMBER | TOOL NAME |
|---|---|
| HD-26792 | SPARK TESTER |
| HD-41404 | HARNESS CONNECTOR TEST KIT |

**Table 6-57. Engine Cranks But Will Not Start Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Battery voltage too low |
| Ignition system issues |
| Fuel system issues |
| Electrical system issues |
| No or low compression |
| Open ground circuit |

### 1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify there are no blown fuses.
3. Verify fuel in the tank is fresh and not contaminated.
4. Verify spark plug wires are firmly connected the coil and plugs.
5. Verify fuel injectors are not clogged.
6. Check for DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics. If DTCs are present, see the appropriate DTC procedure.
7. Perform battery test. See 6.21 NO ECM POWER.
8. Did battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

### 2. Check Engine Lamp Test

1. Turn IGN ON and engine stop switch to RUN.
2. Does check engine lamp illuminate for 4 seconds immediately after key ON?
   a. **Yes.** Go to Test 3.
   b. **No.** See 6.12 DTC P0505.

### 3. Spark Present Test

1. Check spark plug condition and replace if fouled.
2. Using SPARK TESTER (Part No. HD-26792), check spark at both plugs while cranking engine.
3. Is spark present?
   a. **Yes.** Go to Test 4.
   b. **No.** The spark plugs will not spark if there is low or no compression. If spark is not present, test compression before troubleshooting ignition circuit. Once good compression is confirmed, check condition of ignition coils, coil primary wiring and spark plug boots. See 6.10 DTC P0373, P0374 or 3.1 BATTERY TESTING.

### 4. Compression Test

1. Perform compression test.
2. Does engine pass compression test?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair engine loss of compression.

### 5. Fuel Pump Voltage Test

1. Disconnect fuel pump connector [141].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [141A] terminals 1 and 4 during the first 2-3 seconds after IGN ON.
3. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 7.

### 6. Fuel System Test

1. Check fuel system and perform fuel pressure test.
2. Does fuel pressure meet specification?
   a. **Yes.** Inspect and clean throttle body and repair as needed.
   b. **No.** Inspect fuel inlet sock and fuel filter for obstruction. Inspect internal fuel hose for leaks. If no issues are found, replace fuel pump assembly.

### 7. Fuel Pump Open Circuit Test

1. Turn IGN OFF.
2. Remove system relay [61A].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) , test for continuity between [141A] terminal 1 and [61B] terminal E.
4. Is continuity present?
   a. **Yes.** Repair open on (BK) wire to ground.
   b. **No.** Repair open (Y/GN) wire.

# NO ECM POWER 6.21

## DESCRIPTION AND OPERATION

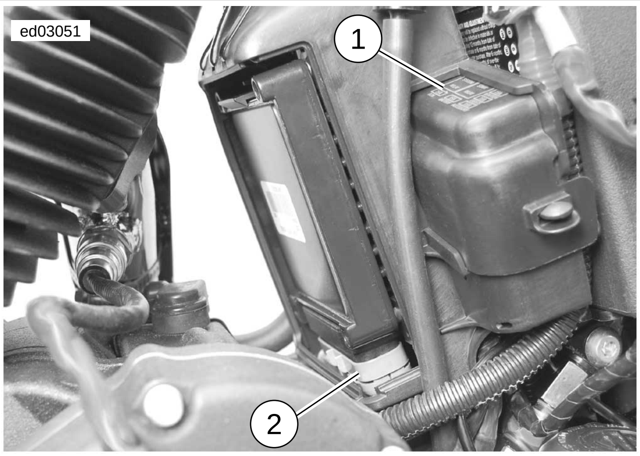
Constant power is supplied to the ECM through terminal 31. The ECM turns on when power is applied to terminal 13 of connector [78]. The ECM goes through an initialization sequence every time power is removed and re-applied to terminal 13. The only visible part of this sequence is the check engine lamp. Upon starting, the check engine lamp will illuminate for 4 seconds and then (if parameters are normal) go out.

If battery power is absent at ECM terminal 31:

- DTCs cannot be cleared. Tool will show them as cleared but will be present next time ignition key is cycled.
- ECM cannot be re-flashed.
- Vehicle will start but IAC pintle will not reset at key OFF. Eventually pintle will be out of position causing performance problems.

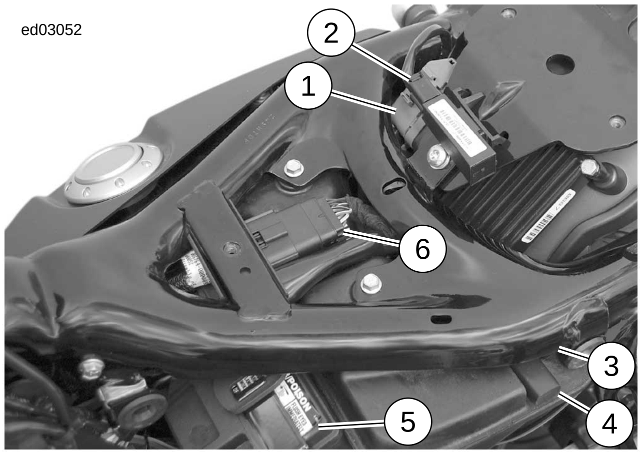
*NOTE*

*The IGN ON sequence also activates the idle air control motor. If power from terminal 31 is disrupted (open fuse, etc.) always turn IGN OFF wait 10 seconds then turn IGN ON to reset the motor to the default position.*




1. **Fuse block [61]**
2. **ECM [78]**

**Figure 6-39. ECM: XL**




1. **ECM [78]**
2. **Security antenna [209]**
3. **P&A battery [160]**
4. **Fuel sender resistor assembly [200]**
5. **Battery**
6. **Engine sensor harness [145]**

**Figure 6-40. ECM: XR**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

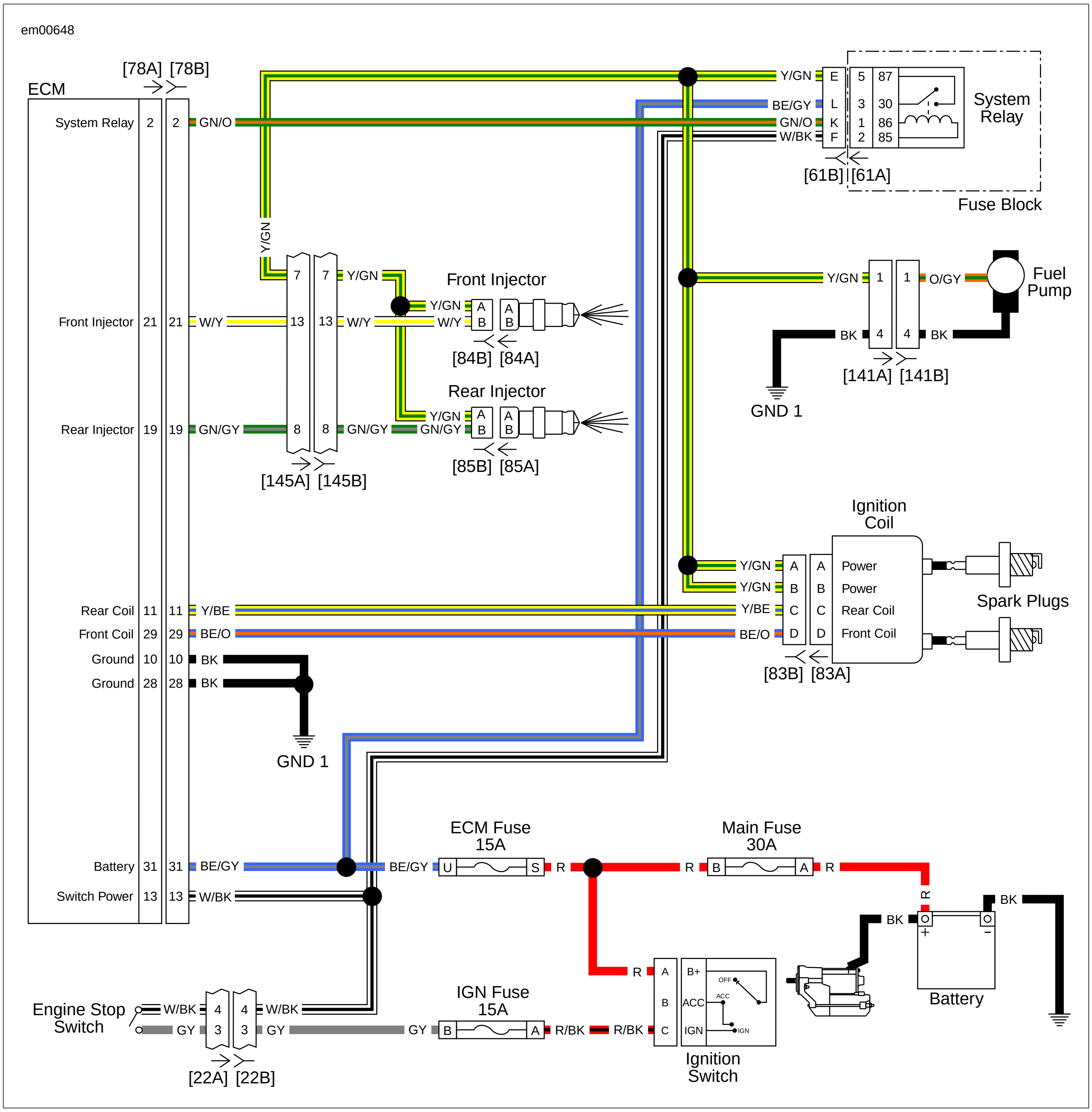



**Figure 6-41. Ignition Circuit**

## NO ECM POWER

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-58. No ECM Power Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Short to ground in ECM power circuit |
| Open in ECM switched power circuit |
| Open ECM ground circuit |
| Engine stop switch malfunction |

### 1. ECM Fuse Test

1. Check ECM fuse.
2. Is fuse good?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair short to ground on (BE/GY) wire and replace fuse.

### 2. IGN Fuse Test

1. Check IGN fuse.
2. Is fuse good?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair short to ground on (GY) or (W/BK) wire and replace IGN fuse.

### 3. ECM Connector Test

1. With IGN OFF, disconnect ECM [78].
2. Check for backed out, damaged and corroded terminals. Repair terminal damage as required.
3. Connect ECM [78].
4. Turn IGN ON.
5. Does ECM have power?
   a. **Yes.** Problem solved.
   b. **No.** Go to Test 4.

### 4. ECM Battery Wire Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for battery voltage between breakout box terminal 31 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (BE/GY) wire. **(5041)**

### 5. ECM Switched Voltage Test

1. Turn IGN ON and engine stop switch in RUN.
2. Measure voltage between breakout box terminal 13 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open (W/BK) wire. If wire is okay, then continue with tests. Go to Test 7.

### 6. ECM Ground Wires Test

1. Measure voltage between positive battery terminal and breakout box terminals 10 and 28.
2. Is battery voltage present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (BK) wire.

### 7. Engine Stop Switch Battery Voltage Test

1. Disconnect right hand controls [22].
2. Turn IGN ON.
3. Measure voltage on [22B] terminal 3 (GY) and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair open wire (GY).

### 8. Engine Stop Switch Test

1. Turn IGN OFF and engine stop switch in RUN.
2. Measure the resistance between [22A] terminals 3 and 4.
3. Is resistance less than 1.0 Ohm?
   a. **Yes.** Repair open in (W/BK) wire from terminal 4 of [22B] and ECM (78B).
   b. **No.** Repair or replace engine stop switch.

# STARTS, THEN STALLS 6.22

## DESCRIPTION AND OPERATION

The starts, then stalls condition may be created by the fuel system, the idle air control system or an ECM failure. When this condition exists, see 2.4 DTC U1300, U1301 OR BUS ER.

There may be DTCs set causing this condition. Solve the problems with the DTCs before performing the tests in this section. The DTCs that may be involved with starts, then stalls are:

- Fuel injectors: DTCs P0261, P0262, P0263 and P0264
- Ignition coils: DTCs P1351, P1352, P1354 and P1355
- IAC actuator: DTC P0505
- Password problem: DTCs P1009 and P1010
- TPS: DTCs P0122 and P0123
- JSS: DTCs P1501, P1502 and P1503
- Neutral switch: DTC P1155
- All modes: DTCs P0603 and P0605

### Diagnostic Tips

- The vehicle will stall on HDI models if the jiffy stand is extended when the transmission is in gear and the clutch is released.
- If serial data is shorted, U1300 and U1301 will automatically set the check engine light.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.
- If this condition is fuel related, perform Fuel Pressure Test.
- If the fuel system passes the pressure test, perform the Fuel System Electrical Test. See 6.23 HESITATION, LOSS OF POWER.

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

## STARTS, THEN STALLS

**Table 6-59. Starts, Then Stalls Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Fuel system malfunction |
| Idle air control system malfunction |
| Open serial data circuit |
| Neutral switch malfunction |

### 1. Throttle Test

1. Will engine start with the throttle partially opened and then stall when closed?
   a. **Yes.** Check IAC for proper operation. If necessary, perform IAC test. See 6.12 DTC P0505.
   b. **No, SidE StAnd displayed on odometer.** Go to Test 2.
   c. **No.** Go to Test 4.

### 2. Jiffy Stand Test

1. Turn IGN OFF.
2. Raise jiffy stand.
3. Turn IGN ON and engine stop switch to RUN.
4. Does odometer display SidE StAnd?
   a. **Yes.** Inspect JSS for correct mounting and clearance to jiffy stand tab (0.18 in (4.5 mm). If sensor is mounted correctly, replace sensor.
   b. **No.** Go to Test 3.

### 3. Neutral Switch Test

1. Verify neutral switch circuit operation.
2. Is neutral switch circuit operating normally?
   a. **Yes.** Replace TSM, TSSM or HFSM.
   b. **No.** Replace neutral switch.

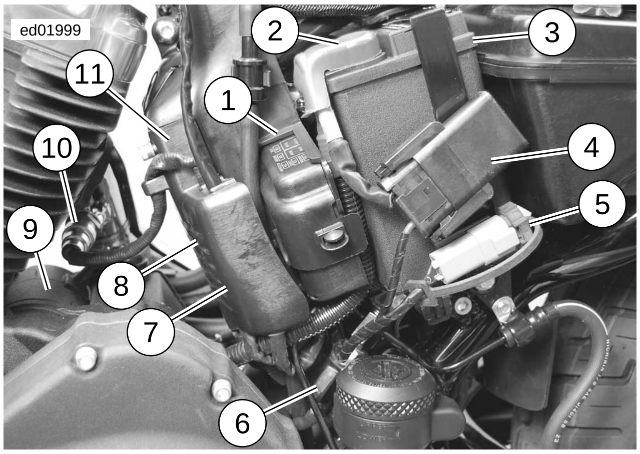
### 4. Fuel System Test

1. Perform Fuel Pressure test.
2. Is fuel pressure normal?
   a. **Yes.** If fuel injectors are okay, replace ECM.
   b. **No.** Repair fuel pressure problem.

# HESITATION, LOSS OF POWER 6.23

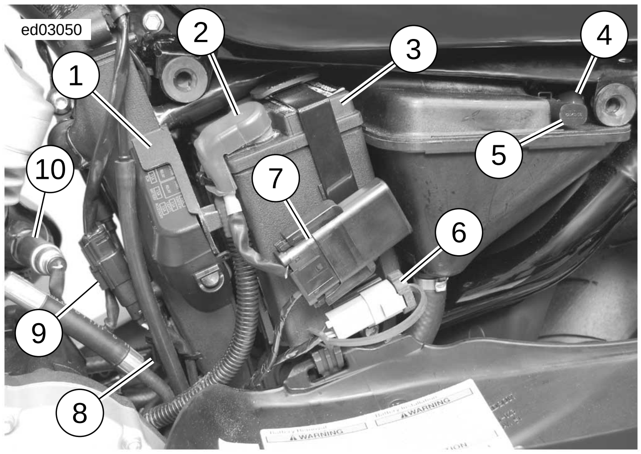
## DESCRIPTION AND OPERATION

Improper fuel system pressure may contribute to hesitation, loss of power.




1. Fuel block [61]
2. Positive battery cable
3. Battery
4. Main fuse [5]
5. DLC [91]
6. Rear stop lamp switch (XL models) [121]
7. Fuel pump and low fuel switch [141]
8. Rear O2 sensor [137]
9. Starter
10. Rear O2 sensor
11. ECM

**Figure 6-42. Under Left Side Cover: XL**




1. Fuse block [61]
2. Positive battery cable
3. Battery
4. P&A battery [160]
5. Fuel sender resistor assembly [200]
6. DLC [91]
7. Main fuse [5]
8. Rear O2 sensor [137]
9. Fuel pump and low fuel switch [141]
10. Rear O2 sensor

**Figure 6-43. Under Left Side Cover: XR**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

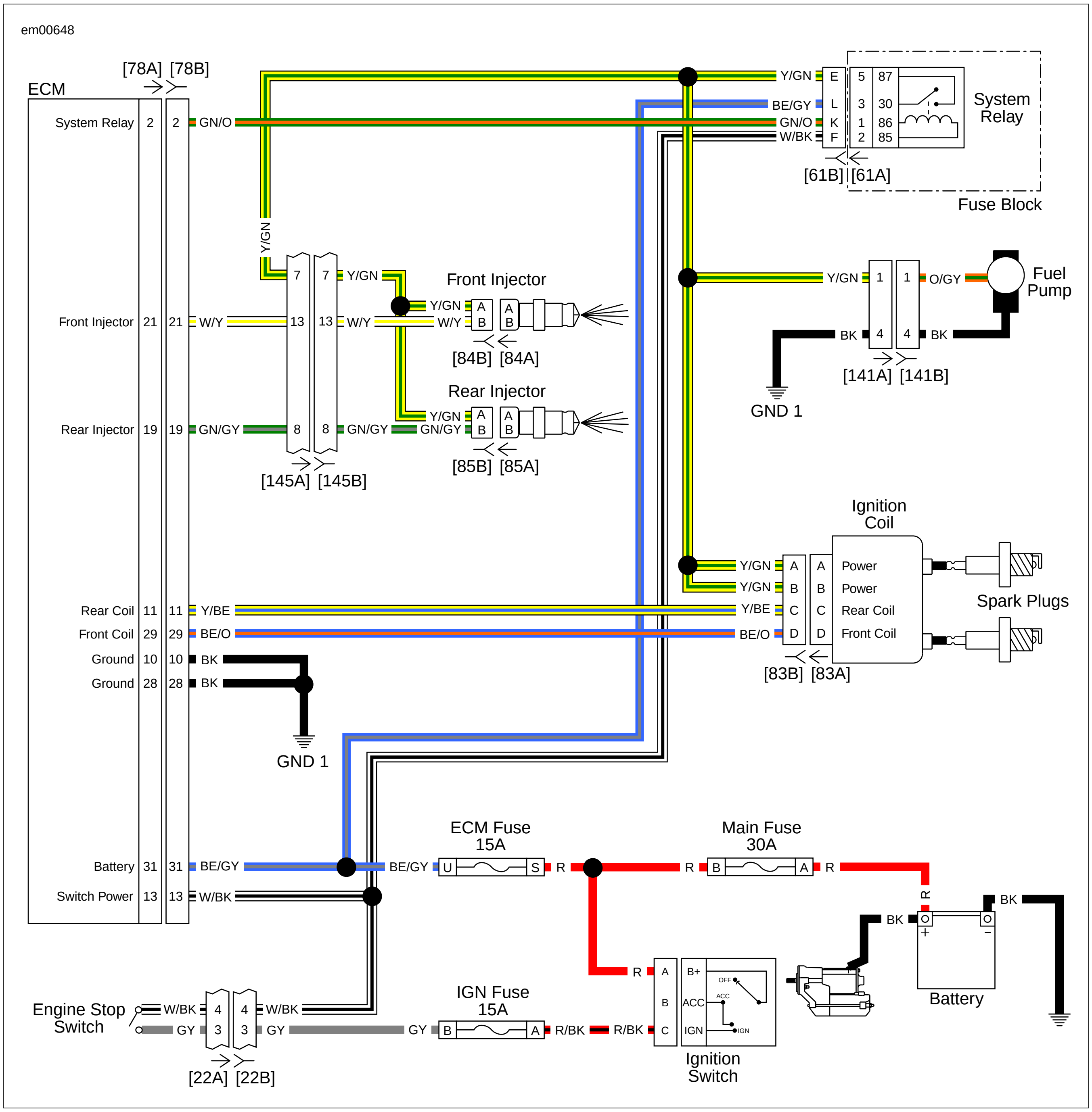



**Figure 6-44. Ignition Circuit**

## HESITATION, LOSS OF POWER TEST

| PART NUMBER | TOOL NAME |
|---|---|
| HD-26792 | SPARK TESTER |

**Table 6-60. Hesitation, Loss of Power Test Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Loss of engine compression |
| Fuel system issues |

## 1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify there are no blown fuses.
3. Verify fuel in the tank is fresh and not contaminated.
4. Verify spark plug wires are firmly connected the coil and plugs.
5. Verify fuel injectors are not clogged.
6. Check for DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics. If DTCs are present, see the appropriate DTC procedure.

7. Perform battery test. See 3.1 BATTERY TESTING.
8. Did battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

## 2. Vacuum Leak Test

1. Start the motorcycle and check for vacuum leaks.
2. Were any leaks found?
   a. **Yes.** Repair the vacuum leak.
   b. **No.** Go to Test 3.

## 3. Spark Present Test

1. Check spark plug condition and replace if fouled.
2. Using SPARK TESTER (Part No. HD-26792), check spark at both plugs while cranking engine.
3. Is spark present?
   a. **Yes.** Go to Test 4.
   b. **No.** The spark plugs will not spark if there is low or no compression. If spark is not present, test compression before troubleshooting ignition circuit. Once good compression is confirmed, check condition of ignition coils, coil primary wiring and spark plug boots. See 6.10 DTC P0373, P0374 or 6.17 DTC P1351, P1352, P1354, P1355.

## 4. Compression Test

1. Perform compression test.
2. Does engine pass compression test?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair engine loss of compression.

## 5. Fuel System Test

1. Check fuel system and perform fuel pressure test.
2. Does fuel pressure meet specification?
   a. **Yes.** Inspect and clean throttle body. Repair as needed.
   b. **No.** Inspect fuel inlet sock and fuel filter for obstruction. Inspect internal fuel hose for leaks. If no issues are found, replace fuel pump assembly.

HOME

# MISFIRE AT IDLE OR UNDER LOAD 6.24

## DESCRIPTION AND OPERATION

Misfire conditions may be caused by:

- Battery condition and connections.
- Fuel system problems. Refer to Table 6-1, Table 6-2 and Table 6-3.
- Ignition system faults.

### Diagnostic Tips

**⚠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)**

When performing the steps in the diagnostic tests, a known good part can be used to verify whether a suspected part is faulty. The ignition coil does not require full installation to be functional. Verify faulty ignition coil by performing resistance test. See 6.17 DTC P1351, P1352, P1354, P1355.

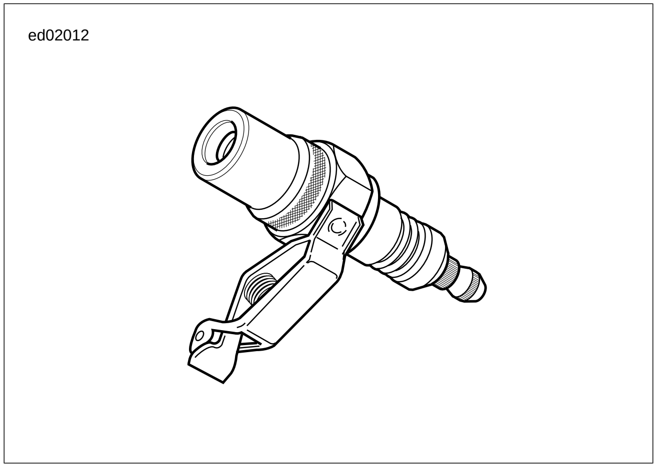



**Figure 6-45. Spark Tester**

## IN-LINE SPARK TESTER

| PART NUMBER | TOOL NAME |
|---|---|
| YA840 | SNAP-ON IN-LINE SPARK TESTER |

See Figure 6-45. The use of a SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) or equivalent can help determine whether a problem exists in the ignition or fuel systems. If the test light flashes without interruption on both cylinders during the misfire event, verify spark plug condition and gap, and inspect the fuel system for proper operation. If the test light does not flash, or the flash is interrupted during the misfire event, the problem is ignition related.

1. Turn IGN OFF.
2. Remove front spark plug cable and install SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) between spark plug cable and spark plug.
3. Start engine and inspect tester light. The light will flash on each spark event if power is transmitted to the plug.
4. Install and repeat procedure on rear cylinder.

*NOTE*

*A SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) can also be used in conjunction with a dynamometer capable of loaded testing to diagnose misfire under load.*


**Figure 6-46. In-line Spark Tester**

### Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

HOME

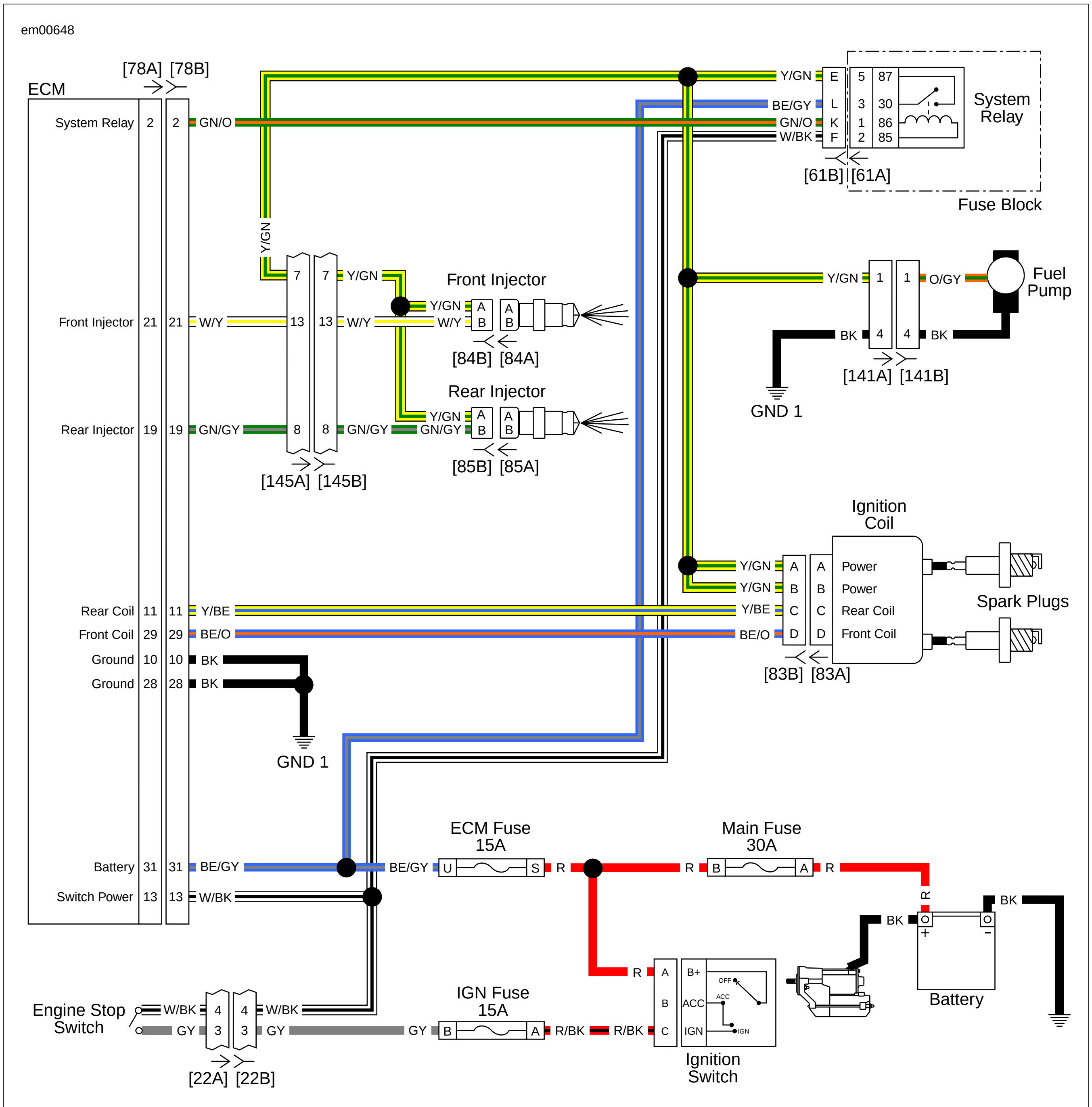



**Figure 6-47. Ignition Circuit**

## MISFIRE AT IDLE OR UNDER LOAD

| PART NUMBER | TOOL NAME |
|---|---|
| HD-26792 | SPARK TESTER |
| HD-41404 | HARNESS CONNECTOR TEST KIT |
| HD-43876 | BREAKOUT BOX |

**Table 6-61. Misfire At Idle or Under Load Diagnostic Faults**

| POSSIBLE CAUSES |
|---|
| Ignition system malfunction |
| Fuel system malfunction |
| IAC malfunction |
| Electrical system malfunction |

### 1. Power Ground Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness [78B] and ECM [78A]. See 1.2 DIAGNOSTIC TOOLS.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, check for continuity between breakout box terminals 10 and then 28, to ground.
3. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair poor ground on (BK) wire.

### 2. Spark Test

1. Connect SPARK TESTER (Part No. HD-26792) between front spark plug cable and ground. See 1.2 DIAGNOSTIC TOOLS.
2. Crank engine for a few seconds.
3. Remove tester from front spark plug cable and connect rear spark plug cable and ground.
4. Did spark jump gap on both cables?
   a. **Yes.** Check for faulty, worn, or cracked spark plugs, plug fouling due to mechanical problems, or faulty connection at plug or coils. Repair as required.
   b. **No.** Go to Test 3.

### 3. Spark Plug Cable Test

1. Disconnect the spark plug cable.
2. Measure the resistance of the spark plug cable.
3. Is the front and rear spark plug cable resistance within the specified range? Refer to Table 1-5.
   a. **Yes.** Go to Test 4.
   b. **No.** Replace the out of range spark plug cable.

### 4. Carbon Tracking Inspection Test

1. Inspect top of ignition coils for carbon tracking.
2. Is carbon tracking present?
   a. **Yes.** Replace ignition coil.
   b. **No.** Switch ignition coil with known good unit and perform Test 2. If spark jumps gap, replace ignition coil. If not, then continue with tests. Go to Test 5.

### 5. Ignition Coil Primary Wire Continuity Test

1. Turn IGN OFF.
2. Remove system relay and disconnect ignition coil [83].
3. Measure resistance between fuse block [61B] socket terminal E and [83B] terminal A, and then between [61B] socket terminal E and [83B] terminal B. Wiggle connectors while measuring.
4. Is resistance continuously less than 0.5 Ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair intermittent on (Y/GN) wire.

### 6. Battery to System Relay Voltage Drop Test

1. Reconnect ignition coil and install system relay.
2. Turn IGN ON, start engine.
3. With engine running, measure voltage drop between battery (+) and system relay [61B] socket terminal E (underside of fuse/relay block). See 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
4. Is voltage drop less than 1.0V?
   a. **Yes.** Problem is fuel related. Recheck symptoms.
   b. **No.** Go to Test 7.

### 7. Battery to System Relay Contact Voltage Drop Test

1. With engine running, measure voltage drop between battery (+) and system relay [61B] socket terminal L (underside of fuse/relay block).
2. Is voltage drop less than 1.0V?
   a. **Yes.** Replace system relay.
   b. **No.** Go to Test 8.

### 8. Battery to ECM Fuse Voltage Drop Test

1. With engine running, measure voltage drop between battery (+) and [61B] socket terminal U.
2. Is voltage drop less than 1.0V?
   a. **Yes.** Repair (BE/GY) wire or connections.
   b. **No.** Go to Test 9.

### 9. Battery to Fuse Block Voltage Drop Test

1. With engine running, measure voltage drop between battery (+) and [61B] socket terminal S.

2. Is voltage drop less than 1.0V?
   a. **Yes.** Repair ECM fuse connections or replace ECM fuse.
   b. **No.** Go to Test 10.

## 10. Battery to Fuse Block Voltage Drop Test

1. With engine running, measure voltage drop between battery (+) and main fuse [5B] terminal A.
2. Is voltage drop less than 1.0V?
   a. **Yes.** Repair (R) wire.
   b. **No.** Go to Test 11.

## 11. Battery to Main Fuse Block Voltage Drop Test

1. With engine running, measure voltage drop between battery (+) and main fuse [5B] terminal B.
2. Is voltage drop less than 1.0V?
   a. **Yes.** Repair main fuse connections or replace main fuse.
   b. **No.** Repair (R) wire between battery and main fuse [5B] terminal B, including connections at starter.

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# NOTES

# AUTOFUSE UNSEALED ELECTRICAL CONNECTORS A.1

## AUTOFUSE UNSEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| GA500A | SNAP-ON TERMINAL PICK |

### General

Autofuse Unsealed connector terminals are found in ignition switches and some fuse blocks.

### Disassembly

1. See Figure A-1 or Figure A-2. Insert smallest pair of pins on the SNAP-ON TERMINAL PICK (Part No. GA500A) into chamber on mating end of socket housing to press tangs on each side of terminal simultaneously.
2. Gently pull on wire to remove terminal from wire end of socket housing.
3. If necessary, crimp **new** terminals on wires.

### Assembly

1. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.
2. With the open side of the terminal facing rib on wire end of socket housing, insert terminal into chamber until it locks in place.

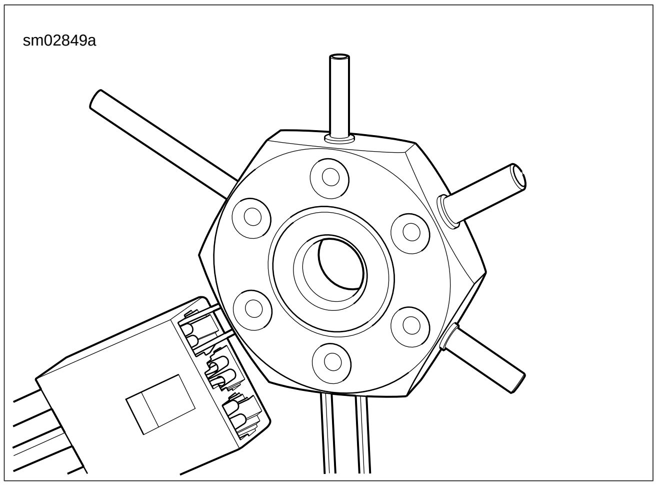



**Figure A-1. Removing Autofuse Unsealed Terminal from Ignition Switch**

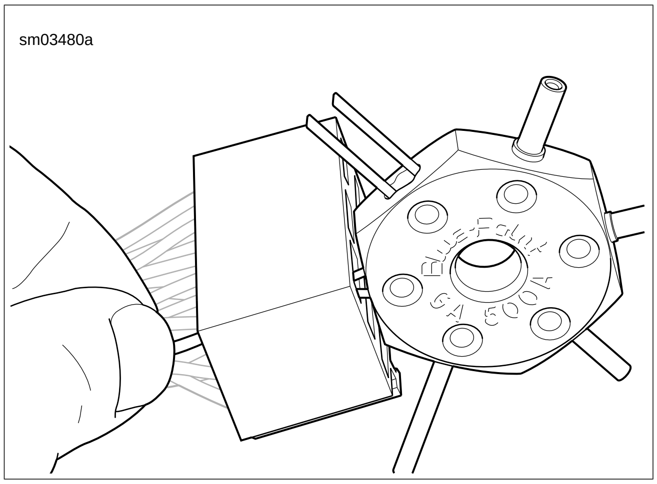



**Figure A-2. Removing Autofuse Unsealed Terminal from Fuse Block**

# BOSCH COMPACT 1.1M CONNECTOR A.2

## BOSCH COMPACT 1.1M CONNECTOR

| PART NUMBER | TOOL NAME |
|---|---|
| GA500A | SNAP-ON TERMINAL PICK |

### General

See Figure A-3. The Bosch Compact 1.1M connector is found on MAP sensors on Sportster and Touring Models.

### Housings

**Separate:** Snap back the secondary lock. Press on the latch while pulling the socket connector from the MAP sensor.

**Join:** Align the sockets with the MAP connect and press the housings together until the latch snaps. Snap in the secondary lock.

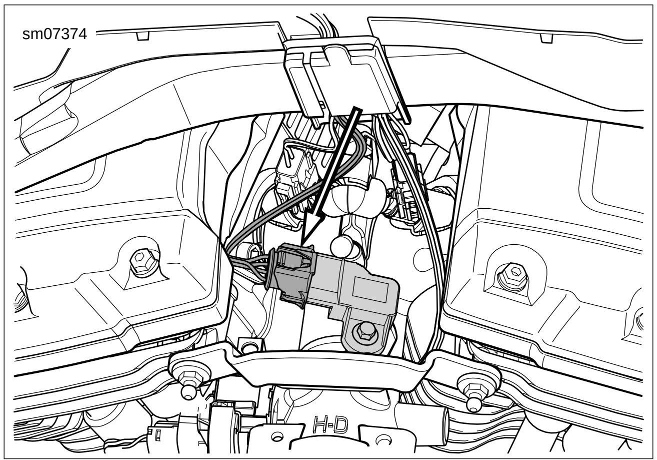



**Figure A-3. Bosch Compact 1.1M Connector**

### Removing Socket Terminal

1. See Figure A-4. Slide the locking bar off the terminal housing.
2. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the socket to compress the tangs on each side of the terminal.
3. Gently pull on the wire to remove the terminal.

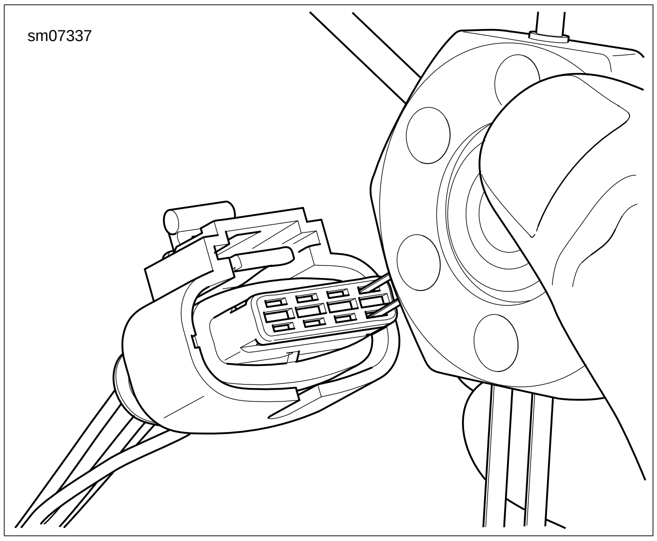



**Figure A-4. Terminal Removal: Bosch Compact 1.1M Connector**

### Installing Socket Terminal

1. See Figure A-5. Use a hobby knife to bend the tangs on each side of the terminal outward.
2. Align terminal to socket housing. Press terminal into housing until it snaps.

*NOTE*

*The teeth on the locking bar face down.*

3. Slide the locking bar onto the connector.

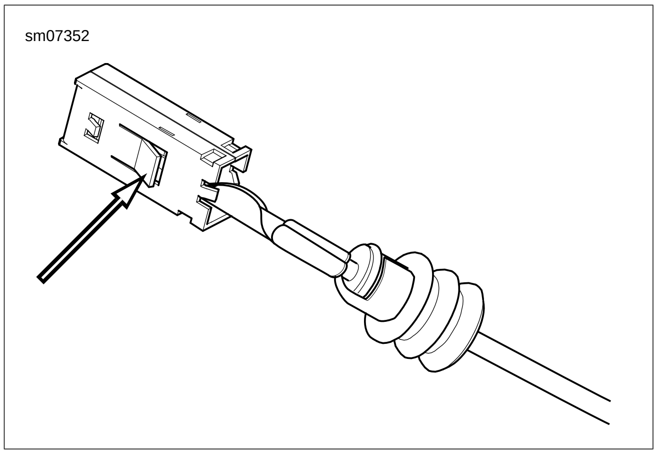



**Figure A-5. Tangs: Bosch Compact 1.1M Socket Terminal**

# DELPHI 100W MICRO-PACK SEALED CONNECTOR A.3

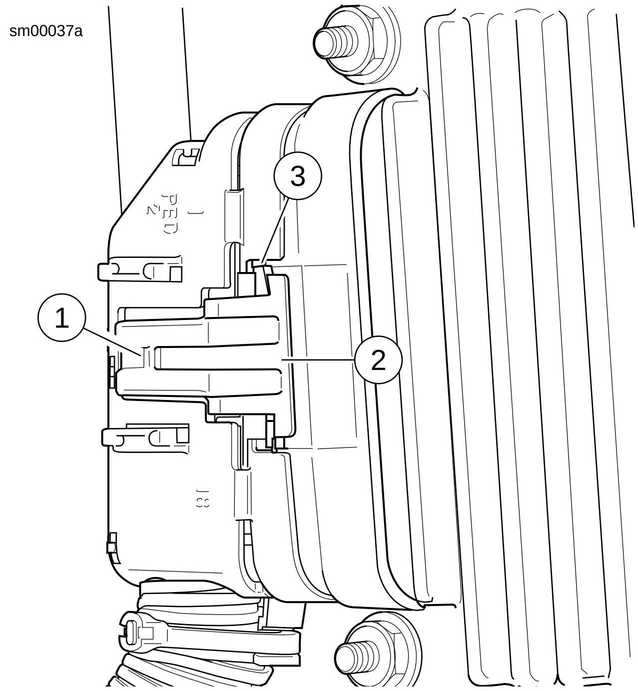
## DELPHI 100W MICRO-PACK SEALED CONNECTOR REPAIR

### General

A Delphi 100W Micro-Pack Sealed connector connects the electronic control module (ECM) to the main harness.

### Separating Socket Housing From ECM

See Figure A-6. While pressing the connector into the ECM, press the thumb lever (1) against the connector until the latch (2) pops out of the catch (3) on the ECM.

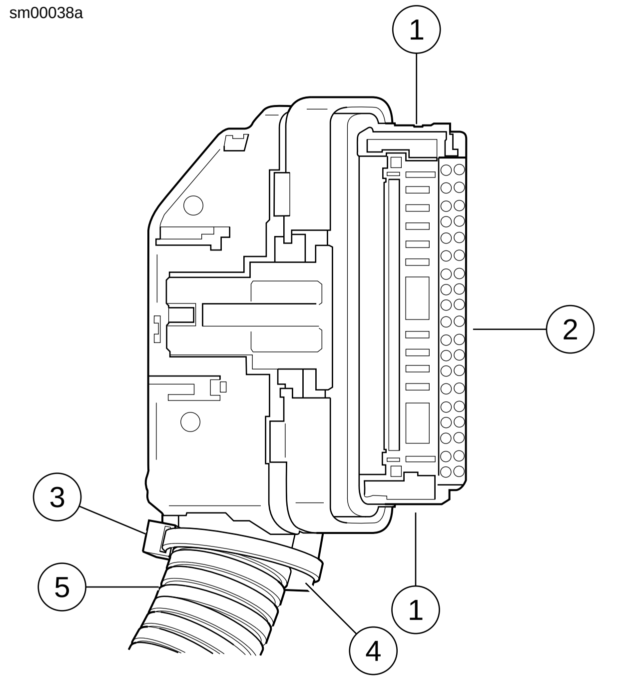



1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

**Figure A-6. Delphi 100W Micro-Pack Sealed Connector to ECM**

### Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.




1. **Latch**
2. **Secondary lock**
3. **Cable strap**
4. **Strain relief collar**
5. **Conduit**

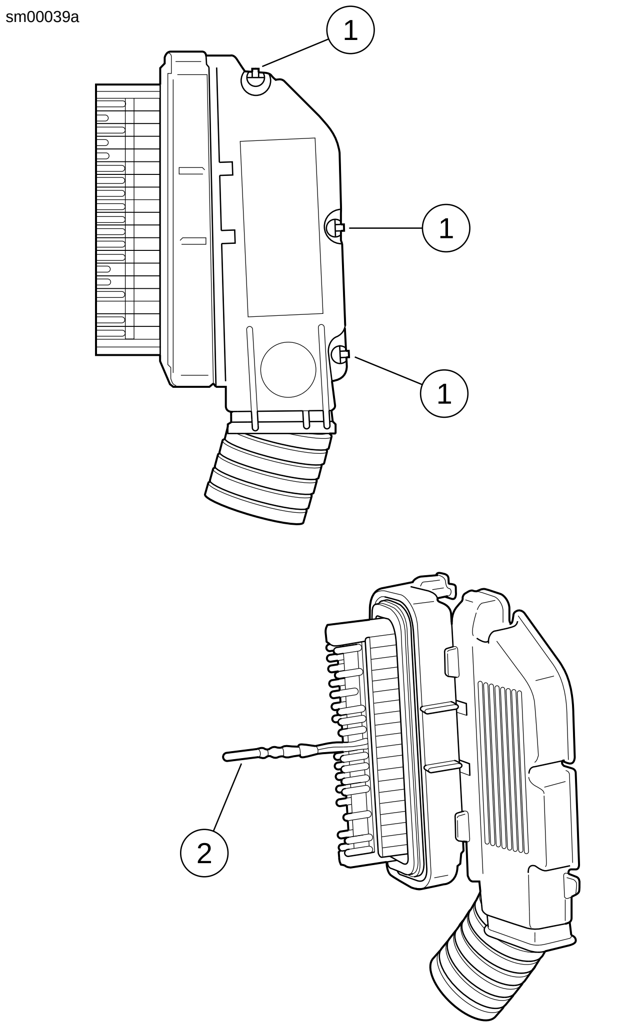
**Figure A-7. Delphi 100W Micro-Pack Sealed Connector**

### Removing Socket Terminal

1. See Figure A-7. To remove, gently press latch (1) on each side of the clear plastic secondary lock (2). For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-8. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

### Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.




1. **Pins**
2. **Socket terminal**

**Figure A-8. Delphi 100W Micro-Pack Sealed Connector: Separate Halves of Socket Housing**

## CRIMPING TERMINALS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50120 | UNIVERSAL CRIMPER SET |
| HD-50120-2 | HAND CRIMP FRAME |
| HD-50120-7 | DELPHI 100W MICRO-PACK SEALED DIE |

1. Strip the wire insulation to specification. Refer to Table A-1.
2. Install the DELPHI 100W MICRO-PACK SEALED DIE (Part No. HD-50120-7) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2) of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the **new** terminal in the specified nest.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal.

**Table A-1. Delphi 100W Micro-Pack Crimper Die (Part No. HD-50120-7)**

| TERMINAL | PART NO. | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| Socket: 18 AWG | 72076-00 | 0.200 | 5.1 | B |
| Socket: 20-22 AWG | 72568-08 | 0.200 | 5.1 | C |

# DELPHI 150 METRI-PACK SEALED CONNECTORS A.4

## DELPHI 150 METRI-PACK SEALED CONNECTOR REPAIR

### General

Delphi 150 Metri-Pack Sealed 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. Push the pin and socket halves of the connector together.

### Removing Socket Terminal

1. See Figure A-9 for pull-to-seat connector or Figure A-10 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. The tangs are on the same side as the external latch.*

3. Gently insert a small diameter straight 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. This indicates the tang is pressed in.

*NOTE*

*After repeated terminal extractions, the click may not be heard, but pivot the pin as if the click was heard at least three 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.

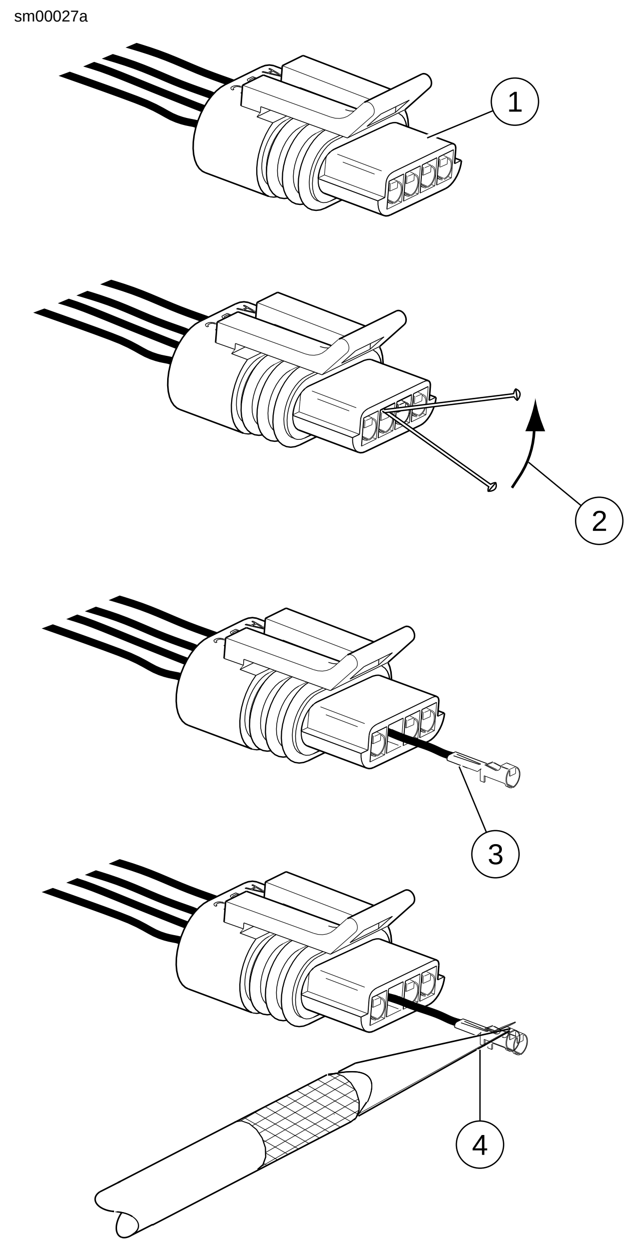
### Inserting Socket Terminal

*NOTE*

*For wire location purposes, alpha characters are stamped into the socket housings.*

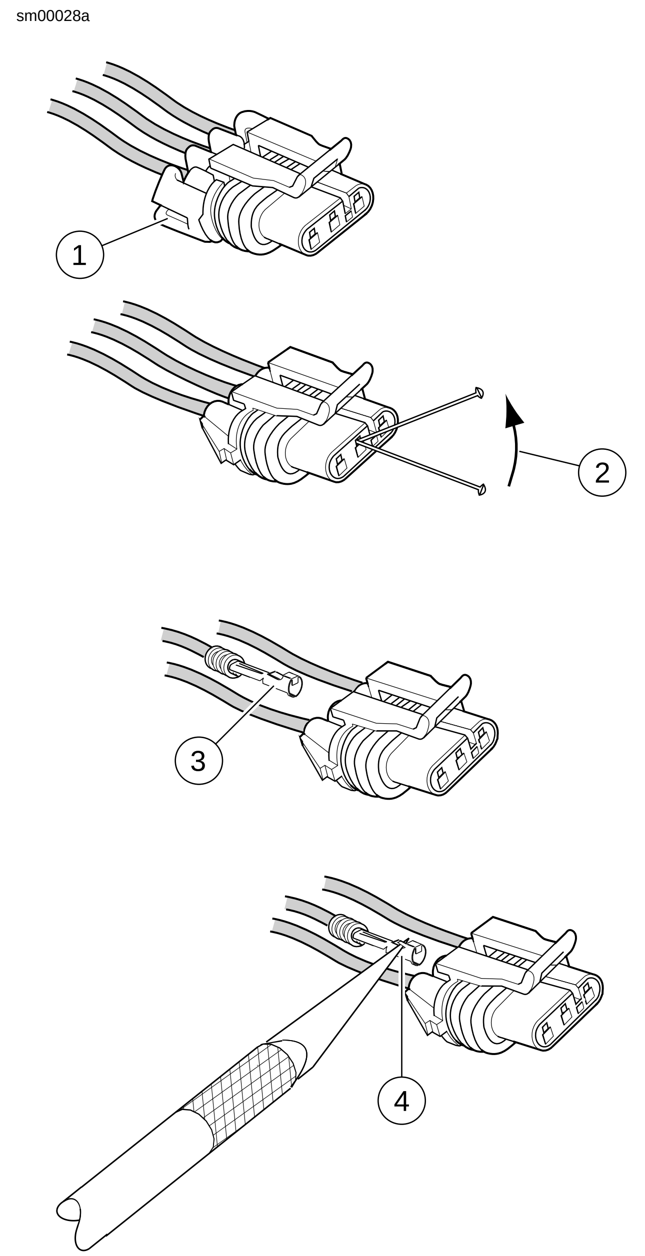
1. See Figure A-9 for pull-to-seat connector or Figure A-10 for push to seat connector. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is 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-10. 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 release tang
3. Push to remove
4. Raise tang to install

**Figure A-9. Delphi 150 Metri-Pack Sealed Connector: Pull-to-Seat**




1. Remove wire lock
2. Pivot pin to release tang
3. Pull to remove
4. Raise tang to install

**Figure A-10. Delphi 150 Metri-Pack Sealed Connector: Push-to-Seat**

HOME

# DELPHI 280 METRI-PACK UNSEALED CONNECTORS A.5

## FUSE BLOCK REPAIR

### Removing Socket Terminals

1. See Figure A-11. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

*NOTE*

*For best results, start with locking wedge on outboard side of secondary lock.*

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Use the thin flat blade from a hobby knife. Gently push tang away from terminal and tug on wire to back terminal out.

### Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

*NOTES*

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-12. Alpha (1) and numeric (2) coordinates identify the main fuse block terminal cavity. Refer to the main harness wiring diagram.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot between rows. Push down until it bottoms.

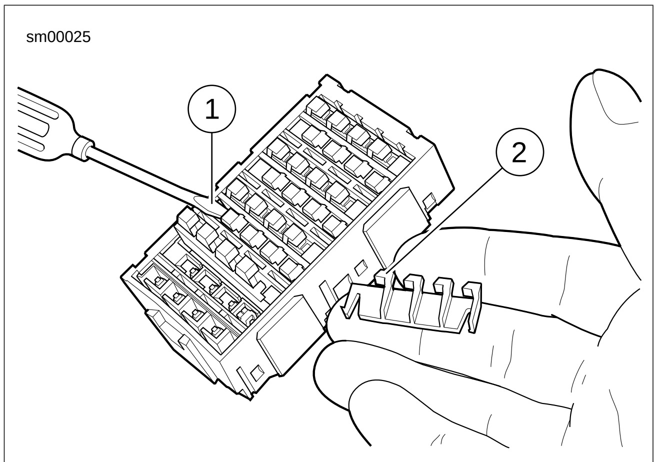
### Crimping Terminals

Terminals are crimped twice: once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

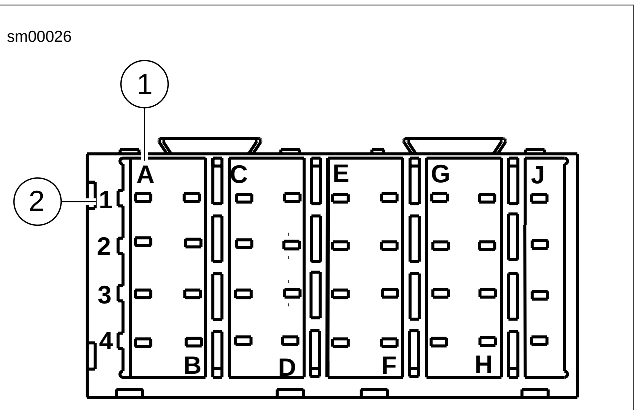
*NOTE*

*The wiring diagram indicates when one socket terminal is be crimped to two wire leads.*




1. **Pry up secondary lock**
2. **Lip of locking wedge**

**Figure A-11. Fuse Block: Remove Secondary Locks**




1. **Alpha**
2. **Numeric**

**Figure A-12. Fuse Block: Coordinates (typical)**

# DELPHI 480 METRI-PACK UNSEALED CONNECTORS A.6

## DELPHI 480 METRI-PACK UNSEALED CONNECTOR REPAIR

### General

A 480 Metri-Pack connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

See Figure A-13. An AFL housing (5) is used on many ignition/light switches. The secondary lock (4) must be opened before removing the terminal from the housing.

### Separating Pin and Socket Housings

*NOTES*

- *Record position of cable straps anchoring wire conduits of the pin and socket housing before removing them.*
- *Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.*

See Figure A-13. Using small flat blade screwdriver, press button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

### Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

### Removing Socket Terminals

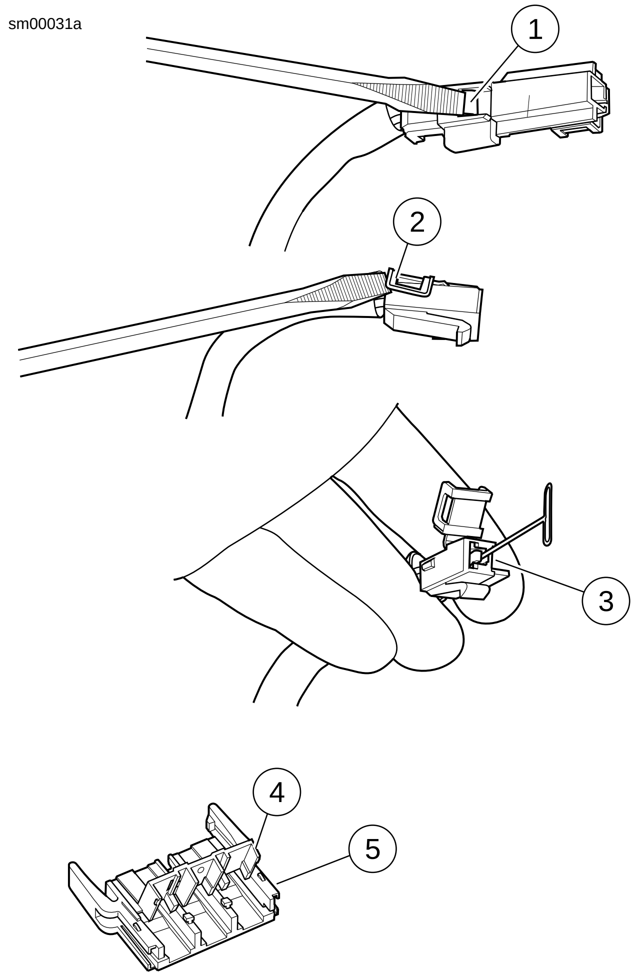
1. See Figure A-13. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to press the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.9 DELPHI METRI-PACK TERMINAL REPAIR.

### Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it clicks in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

*NOTE*

*If removed, install **new** anchored cable strap in original equipment location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in (25.4 mm) from housings.*




**1. Button on pin housing**
**2. Secondary lock latch**
**3. Opening between tang and chamber wall**
**4. Secondary lock (shown open)**
**5. AFL housing**

**Figure A-13. Delphi 480 Metri-Pack Unsealed Connector: Remove Socket Terminal**

# DELPHI 630 METRI-PACK UNSEALED CONNECTORS A.7

## DELPHI 630 METRI-PACK UNSEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| SNAP-ON TT600-3 | SNAP-ON PICK |

### 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. 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, find the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to press 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.9 DELPHI METRI-PACK TERMINAL REPAIR.

### 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. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.
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.

# DELPHI 800 METRI-PACK SEALED MAIN FUSE HOUSING A.8

## DELPHI 800 METRI-PACK SEALED MAIN FUSE HOUSING REPAIR

### Removing Socket Terminals

**WARNING**

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

1. Disconnect battery.
2. See Figure A-14. Disengage slots (1) on secondary lock (2) from tabs (3) and remove secondary lock.
3. Insert flat blade of pick or small screwdriver into opening (4) until it stops.
4. Tug on cable to pull socket from connector housing. Pivot the pick toward the terminal body to release the latch if necessary.
5. Repeat to remove remaining socket terminal.

*NOTE*

*The battery positive cable and power wire for the main fuse are crimped together at the starter ring terminal. Replace both as an assembly if either requires replacement.*

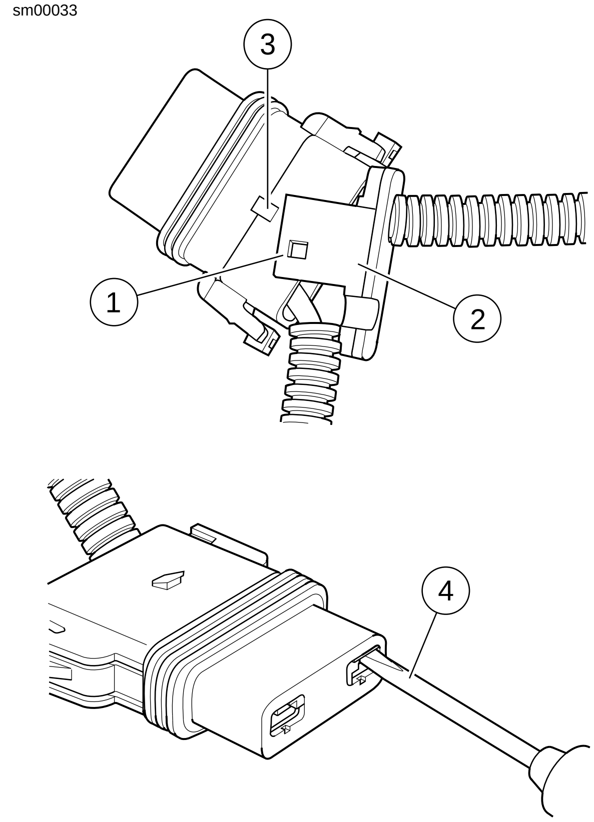
### Installing Socket Terminals

1. See Figure A-15. Carefully bend tang outward away from the terminal body.
2. Properly orient terminal to the cavity in the housing. Push terminal into connector housing until it clicks in place. Verify that socket will not back out of chamber.
3. Push rubber seal into connector housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto connector housing. Verify slots engage tabs on sides of connector housing.

**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)**

6. Connect battery cables.




1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

**Figure A-14. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Remove Socket Terminals**

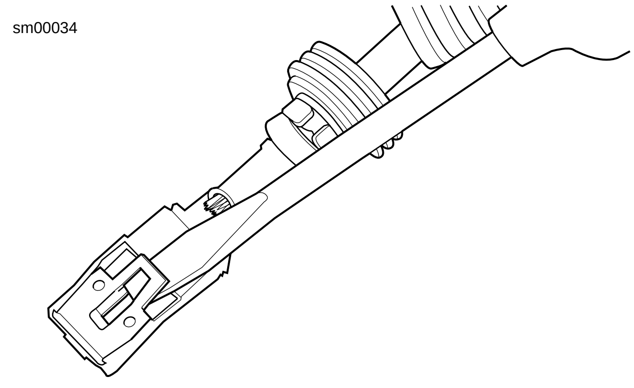



**Figure A-15. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Bend Tang**

## METRI-PACK TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-38125-6 | PACKARD TERMINAL CRIMP TOOL |
| HD-38125-7 | PACKARD TERMINAL CRIMPER |
| HD-38125-8 | PACKARD CRIMPING TOOL |

### 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-16. A crimp can require two crimping dies. The dies are found on the PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and the PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal and the wire gauge 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

Strip 5/32 in (4.0 mm) of insulation from the wire lead.

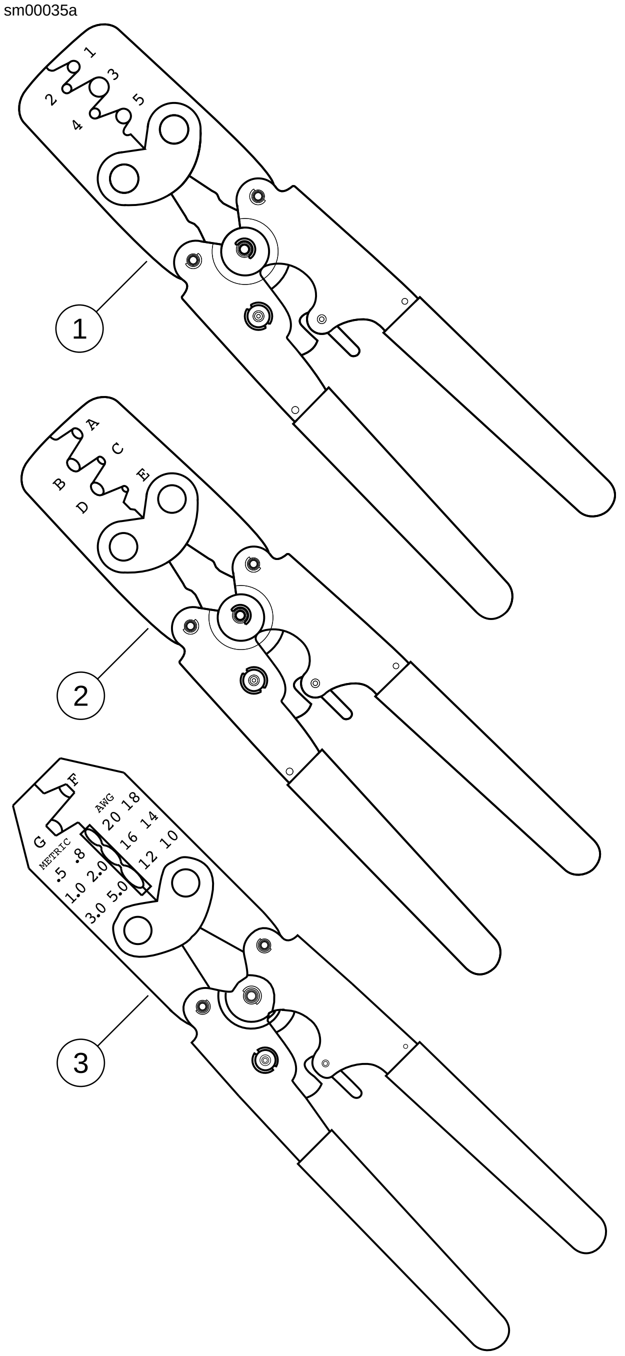
### Crimping Wire Core

*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.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.

sm00035a




1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

**Figure A-16. Metri-Pack Terminal Crimp Tools**

### Crimping Insulation/Seal

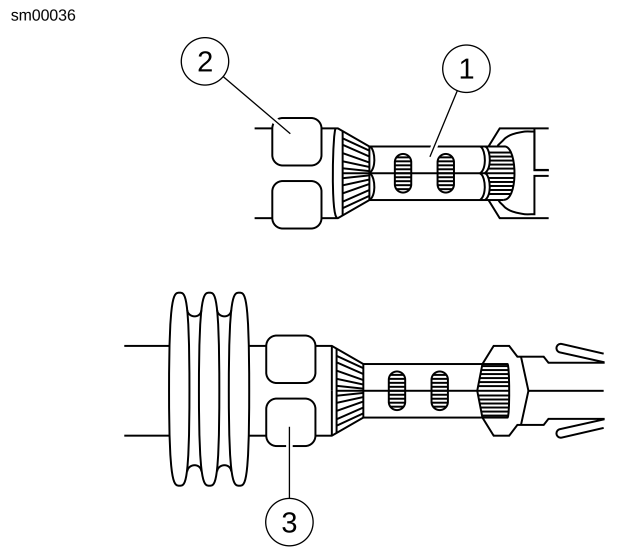
*NOTE*

*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-17. 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-17. 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.




1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

**Figure A-17. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps**

# DELPHI MICRO 64 SEALED CONNECTORS A.10

## DELPHI MICRO 64 SEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45928 | TERMINAL REMOVER |
| HD-45929 | TERMINAL CRIMPER |

### General

Delphi Micro 64 Sealed connectors are frequently found on speedometers, tachometers and the ECM of Touring Models.

### Separating Pin and Socket Housings

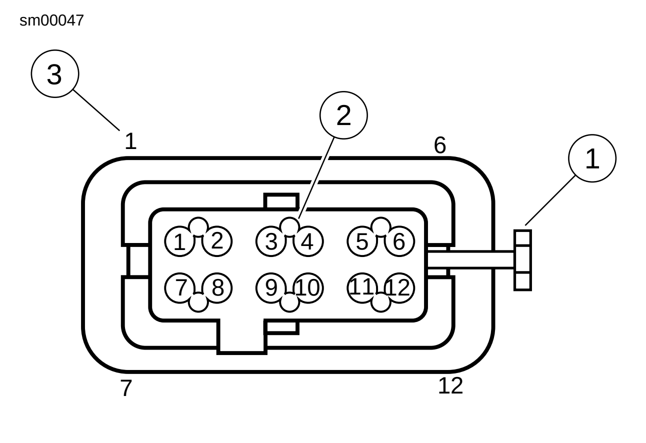
Bend back the external latches slightly and separate the pin and socket housings.

### Mating Pin and Socket Housings

Orient the wire lead colors. Align pin and socket housings. Push the pin and socket housings of the connector together until the latches click.

### Removing Terminal

1. See Figure A-18. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.




1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

**Figure A-18. Delphi Micro-64 Sealed Connector: Housing**

4. See Figure A-19. Obtain the TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-20. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.


**Figure A-19. Terminal Remover (HD-45928)**

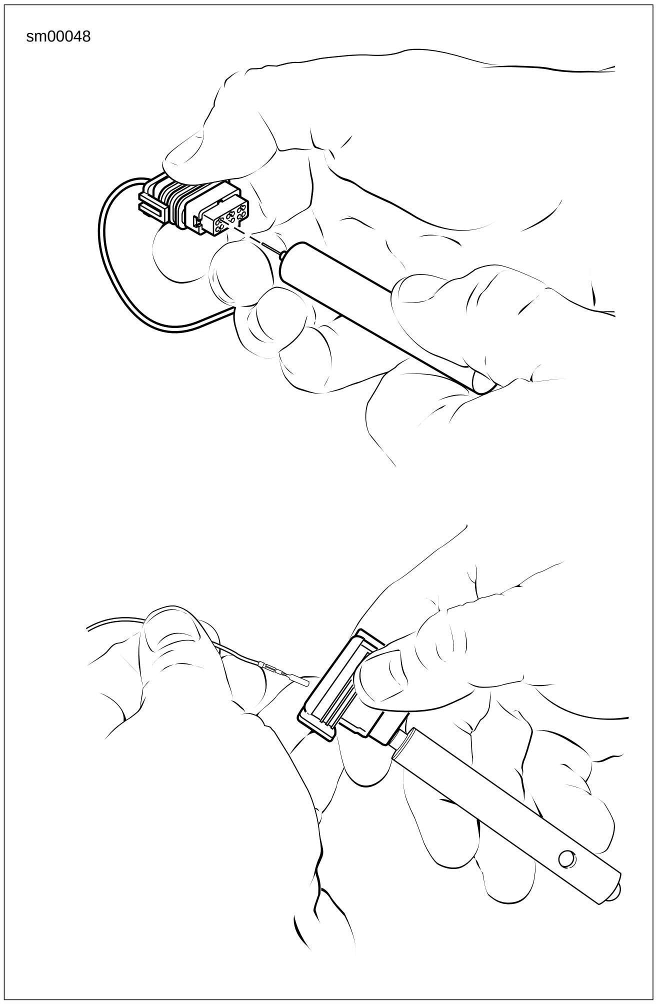



**Figure A-20. Delphi Micro-64 Sealed Connector: Insert Tool and Remove Terminal**

## Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

*NOTE*

*See Figure A-18. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.*

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

*NOTE*

*Once removed, the terminal may not lock in place when first installed. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.*

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.
4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

## Preparing Wire Leads for Crimping

Strip 1/8 in (3.0 mm) of insulation from the wire lead.

## Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.
2. See Figure A-22. Squeeze the handles of the TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).
3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).
4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).
5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.
6. Insert wires between crimp tails until ends make contact with locking bar. Position wire that the wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.
8. Raise locking bar and barrel holder to remove contact.

## Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.

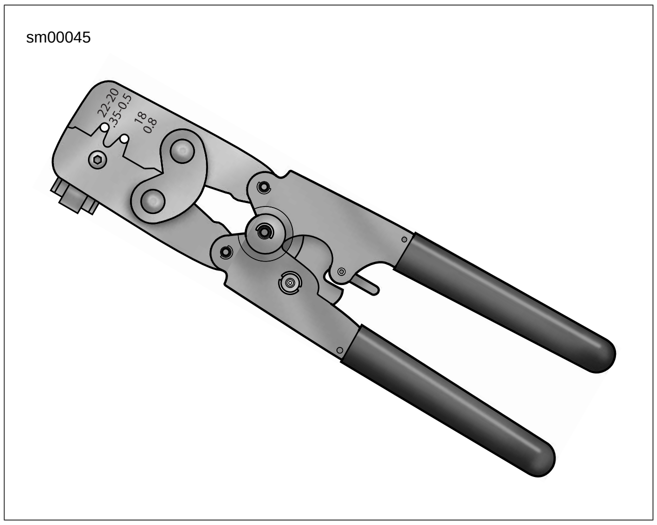
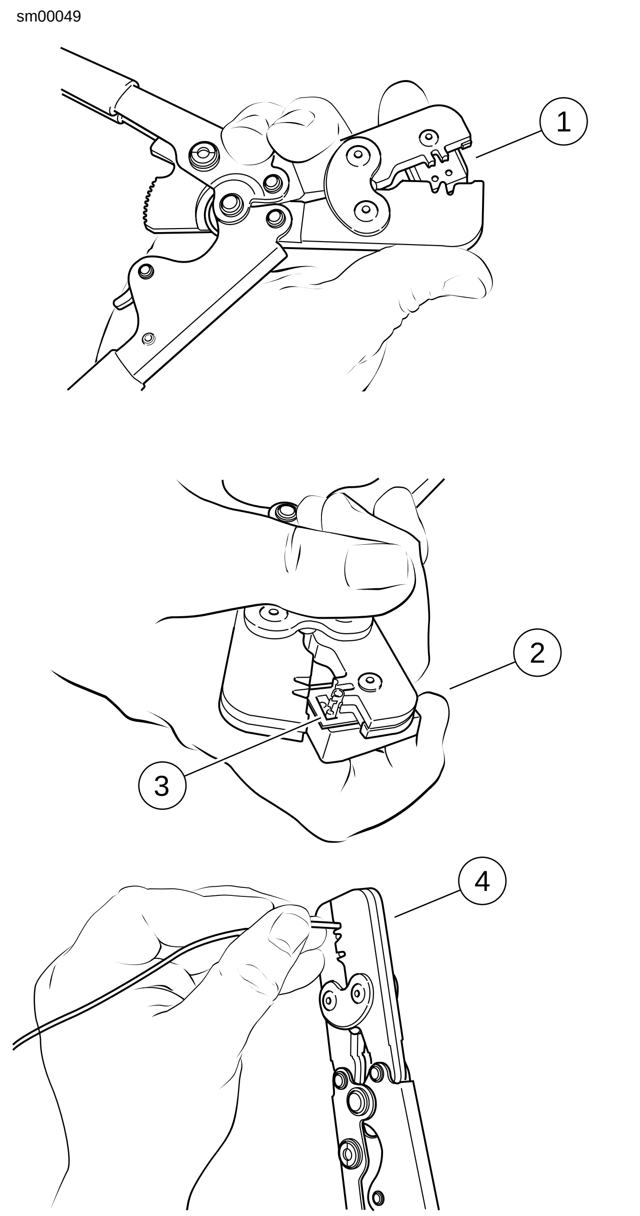



**Figure A-21. Terminal Crimper (HD-45929)**




1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

**Figure A-22. Delphi Micro-64 Sealed Connector: Terminal in Crimper**

# DELPHI GT 150 SEALED CONNECTORS A.11

## DELPHI GT 150 SEALED CONNECTOR REPAIR

### General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch or terminal block.

### Separating Pin and Socket Housings

See Figure A-23. 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.*

1. See Figure A-24. If present, free one side of wire lock (1) from ear on wire end of socket housing. Release the other side if necessary. Release wires from channels in wire lock. Remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose. Remove from mating end of socket housing.
3. Use the thin flat blade from a hobby knife. Gently pry tang (3) outward away from terminal. 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, preventing it from backing 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.

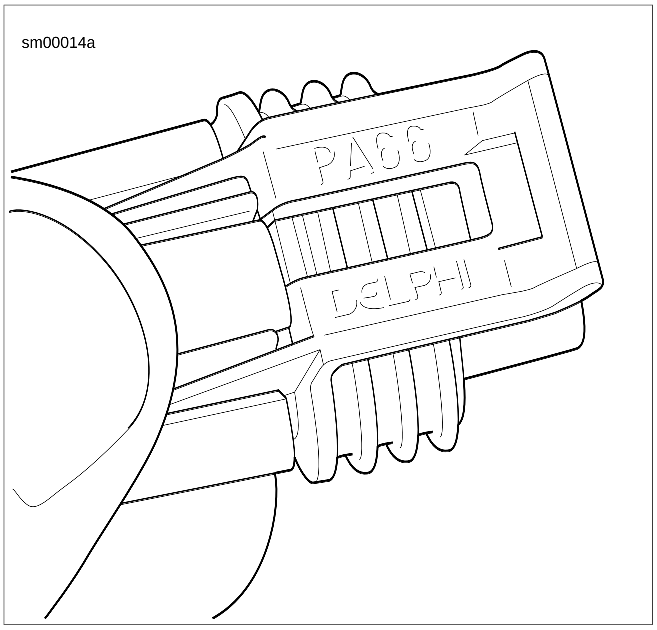
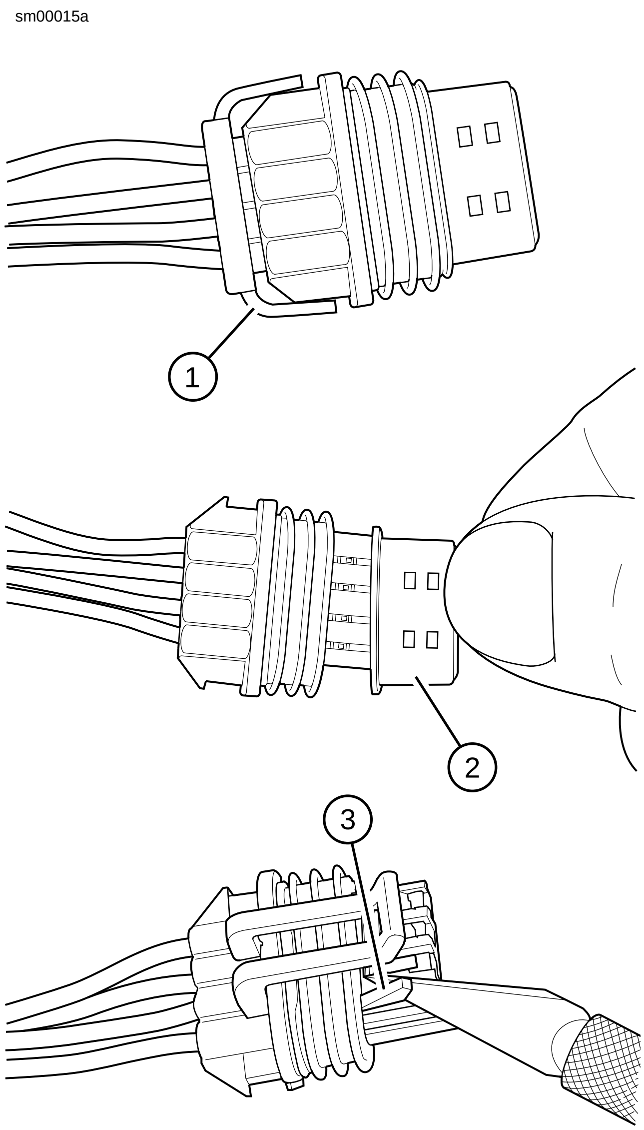



**Figure A-23. Delphi GT 150 Sealed Connector: Socket Housing Latch**




1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

**Figure A-24. Delphi GT 150 Sealed Connector: Removing Socket Terminals**

# DELPHI GT 280 SEALED 73-TERMINAL ECM CONNECTOR A.12

## DELPHI GT 280 SEALED 73-TERMINAL ECM CONNECTOR

NOTE

*Do not operate latch lever when connector is not mated to ECU. Damage will occur.*

### Separating Socket Housing From ECM

See Figure A-25. Remove strap (1). Press the latch (2). Rotate lock lever to the released position (3).

### Mating Socket Housing To ECM

Push the connector into the ECM. Rotate the lock lever to the locked position.

### Socket Terminal

1. Cut cable strap to release harness from strain relief collar of connector housing.
2. See Figure A-26. Release latches (4) that retain cover (3) to housing (2) and remove cover.
3. Remove and service the Micro-64 terminals. See A.10 DELPHI MICRO 64 SEALED CONNECTORS.
4. Install connector housing cover. Verify all wires are within the confines of the cover and that the cover latches are engaged.
5. Install **new** cable strap cable to the strain relief of the connector.

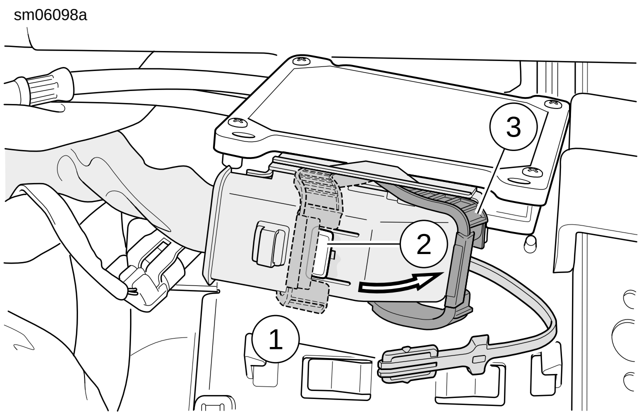
### ECM Ground Terminal

1. See Figure A-26. Remove secondary lock (1).
2. See Figure A-27. Using a thin blade screwdriver, gently pry ground terminal retainer from connector housing.
3. See Figure A-28. Using a thin blade screwdriver, release latch and pull ground wire, wire seal and terminal from cover side of housing.
4. Follow instructions in A.9 DELPHI METRI-PACK TERMINAL REPAIR to replace the terminal or wire seal.
5. Push the terminal into place from the cover side of the connector housing until the latch engages. Pull on wire to verify terminal is secure.

NOTE

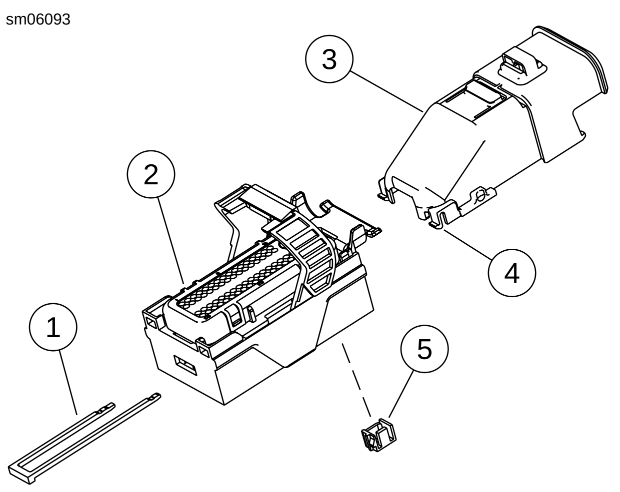
*See Figure A-26. Secondary lock has one short leg and one long leg. Install as shown.*

6. See Figure A-26. Install ground secondary lock (5) and install secondary lock (1) as shown.




1. **Strap**
2. **Latch**
3. **Lock lever released**

**Figure A-25. Unlatch ECM Connector**




1. **Secondary lock**
2. **Terminal housing**
3. **Cover**
4. **Cover latch**
5. **Ground secondary lock**

**Figure A-26. Delphi 73-Terminal ECM Connector**

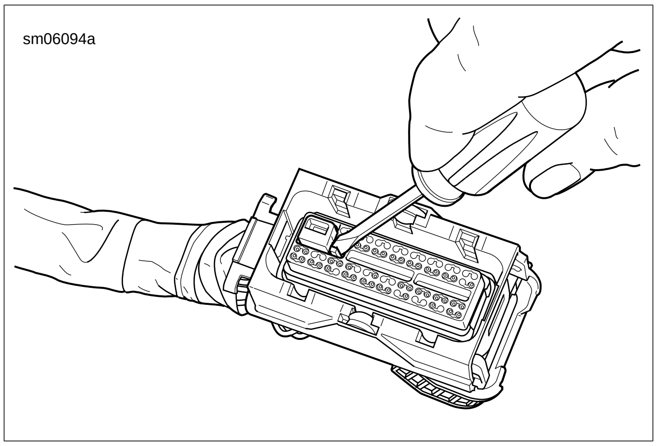



Figure A-27. Remove Ground Secondary Lock

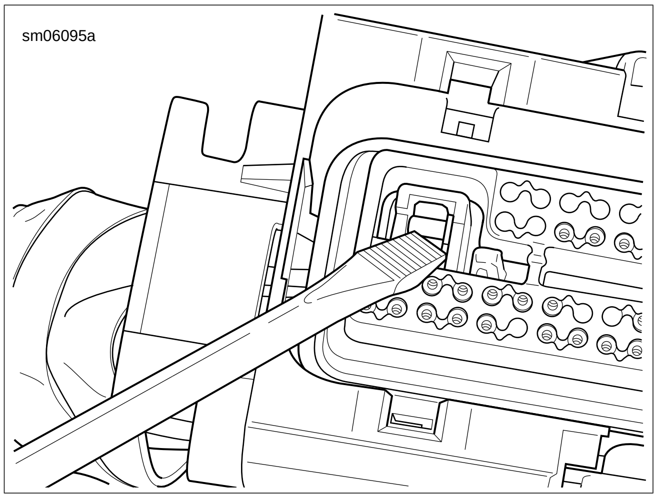



Figure A-28. Remove ECM Ground Terminal

# DEUTSCH DT SEALED CONNECTORS A.13

## DEUTSCH DT SEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41475 | DEUTSCH TERMINAL REPAIR KIT |
| HD-41475-100 | FLAT BLADE L-HOOK |

### General

Deutsch DT sealed connectors are colored coded for location purposes. DT connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other DT connectors are **black**.

*NOTE*

*A DEUTSCH TERMINAL REPAIR KIT (Part No. HD-41475) contains a selection of seals and seal plugs, locking wedges, attachment clips and terminals.*

*Also included is a FLAT BLADE L-HOOK (Part No. HD-41475-100) used to remove locking wedges, compartmented storage box and carrying case.*

### Separating Pin and Socket Housings

See Figure A-29. To separate the connector halves, Press 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 attached to the wiring harness.*
- *Six-place and smaller 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.*

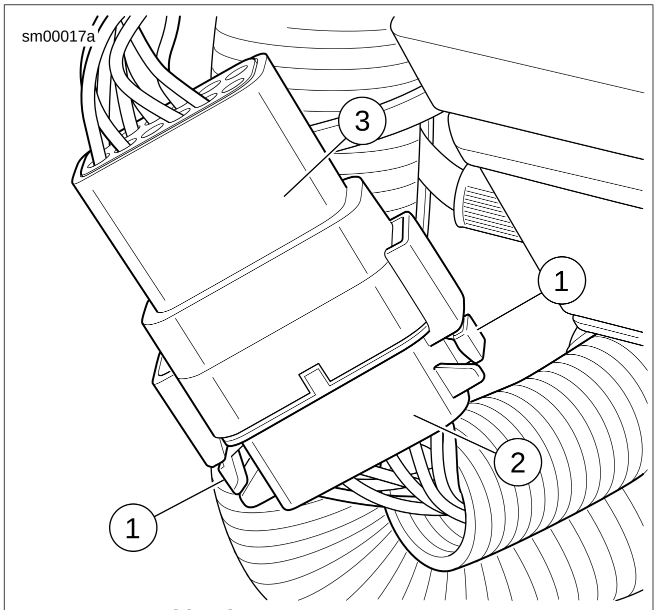
### Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** Six-place and smaller Deutsch connectors have one external latch on the socket housing. To join the housings, align the latch on the socket side with the latch cover on the pin side.
   b. **For Two External Latches:** 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.

*NOTE*

***For Two External Latches:** 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.




1. **External latch**
2. **Socket housing**
3. **Pin housing**

**Figure A-29. Deutsch DT Sealed Connector**

### Removing Socket Terminals

1. See Figure A-30. 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-33. Use a pick or small screwdriver to press 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-32. 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*

*Install seal plugs (6) into 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-31. While rectangular wedges do not require a special orientation, align arrow (1) on conical secondary locking wedge towards external latch for three-place connectors.*
- *If the secondary locking wedge does not slide into position easily, check the installation of all the terminals. Unseated terminals prevent the locking wedge from proper installation.*

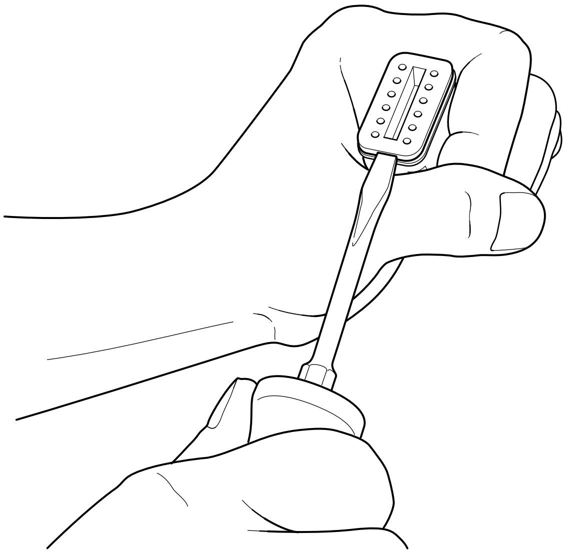
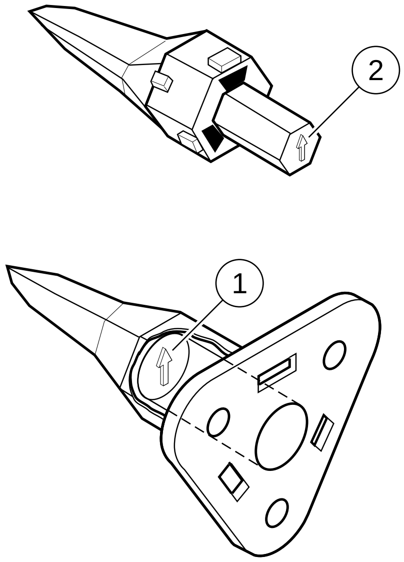
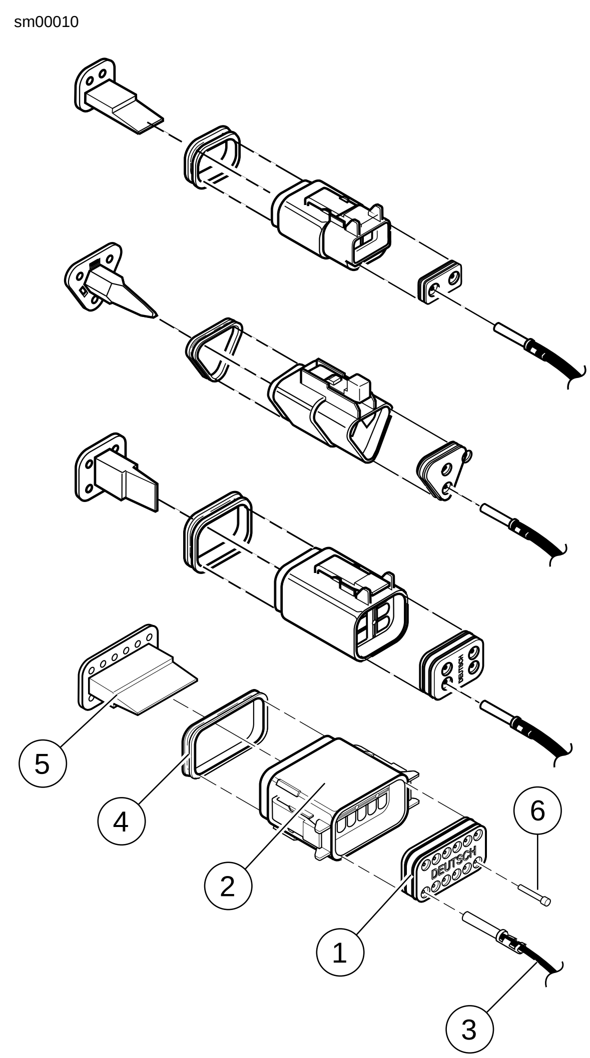



**Figure A-30. Deutsch DT Sealed Connector: Remove Secondary Locking Wedge**




1. **Arrow on socket locking wedge**
2. **Arrow on pin locking wedge**

**Figure A-31. Deutsch DT Sealed Connector: 3-Place Locking Wedges**




1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

**Figure A-32. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Socket Housings**

## 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 Press terminal latches inside pin housing and back out pins through holes in wire seal.

*NOTES*

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *The 8-place and 12-place gray and black connectors are not interchangeable. If replacing both the socket and pin housings, the black may be substituted for the gray.*
- *The socket and pin housings of all other connectors are interchangeable. Black may be mated with the gray since the alignment tabs are absent and the orientation of the external latch is the same.*

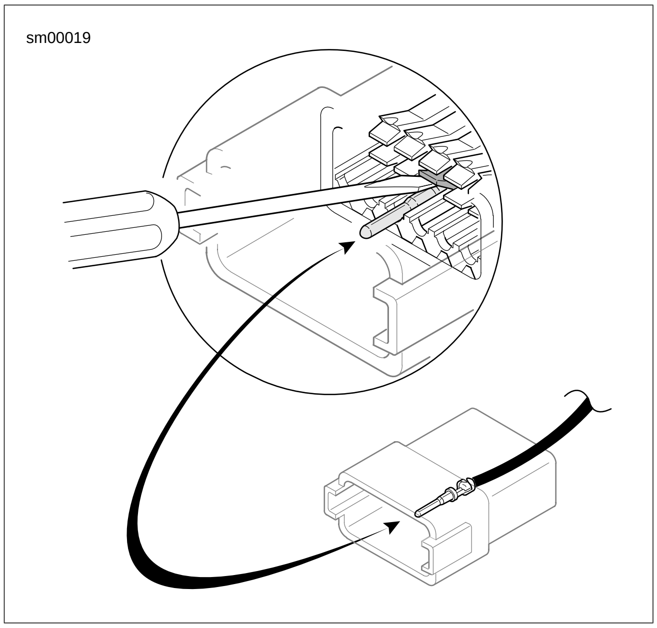



**Figure A-33. Deutsch DT Sealed Connector: Press Terminal Latch and Back Out Pin**

## Installing Pin Terminals

1. See Figure A-34. Fit wire seal (1) into back of pin housing (2).

2. Grasp wire lead approximately 1.0 in (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

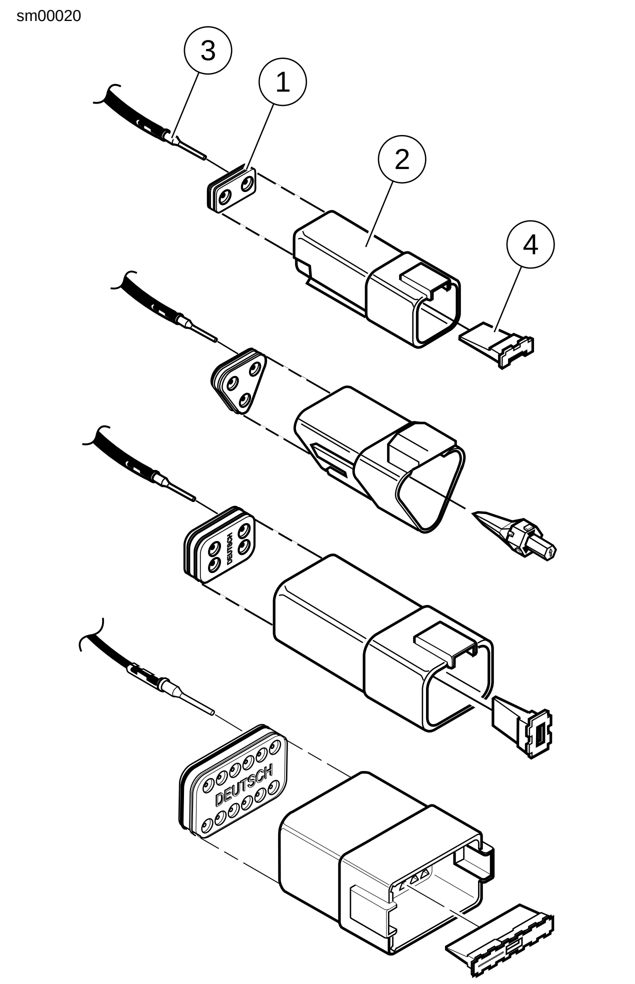
*NOTE*

*A tug on the wire lead will confirm that a pin is locked in place.*

3. Insert tapered end of secondary locking wedge (4) into pin housing. Press down until it snaps in place.

*NOTES*

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-31. While rectangular wedges do not require a special orientation, align arrow (1) on conical secondary locking wedge towards external latch for three-place connectors.*
- *If the secondary locking wedge does not slide into position easily, check the installation of all the terminals. Unseated terminals prevent the locking wedge from proper installation.*




1. Wire seal
2. Pin housing
3. Pin terminal
4. Locking wedge

**Figure A-34. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Pin Housings**

## Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector. Follow the corresponding crimping instructions. Refer to Table A-2.

**Table A-2. Deutsch Connector: Terminal Crimping Instructions**

| TYPE | CRIMPING INSTRUCTIONS |
|---|---|
| DT Sealed (with crimp tails) | A.14 DEUTSCH DT SEALED TERMINAL REPAIR |
| DTM Mini Sealed Terminal (solid barrel) | A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR |
| DTM Mini Sealed Terminal (with crimp tails) | A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR |

# DEUTSCH DT SEALED TERMINAL REPAIR A.14

## DEUTSCH DT SEALED TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-39965-A | DEUTSCH TERMINAL CRIMP TOOL |

### Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip 5/32 in (4.0 mm) of insulation from the wire lead.

### Crimping Terminal to Lead

1. See Figure A-35. 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. Match the wire gauge to the crimp tool die. Refer to Table A-3.

*NOTE*

*Rest the rounded side of the contact barrel in the nest (concave split level area) with the crimp tails facing up.*

3. Insert (2) terminal (socket/pin) through hole of the locking bar.
4. Release locking bar to lock terminal in die.

*NOTE*

*If the crimp tails are slightly out of alignment, the crimp tool rotates the terminal to face the tails upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.*

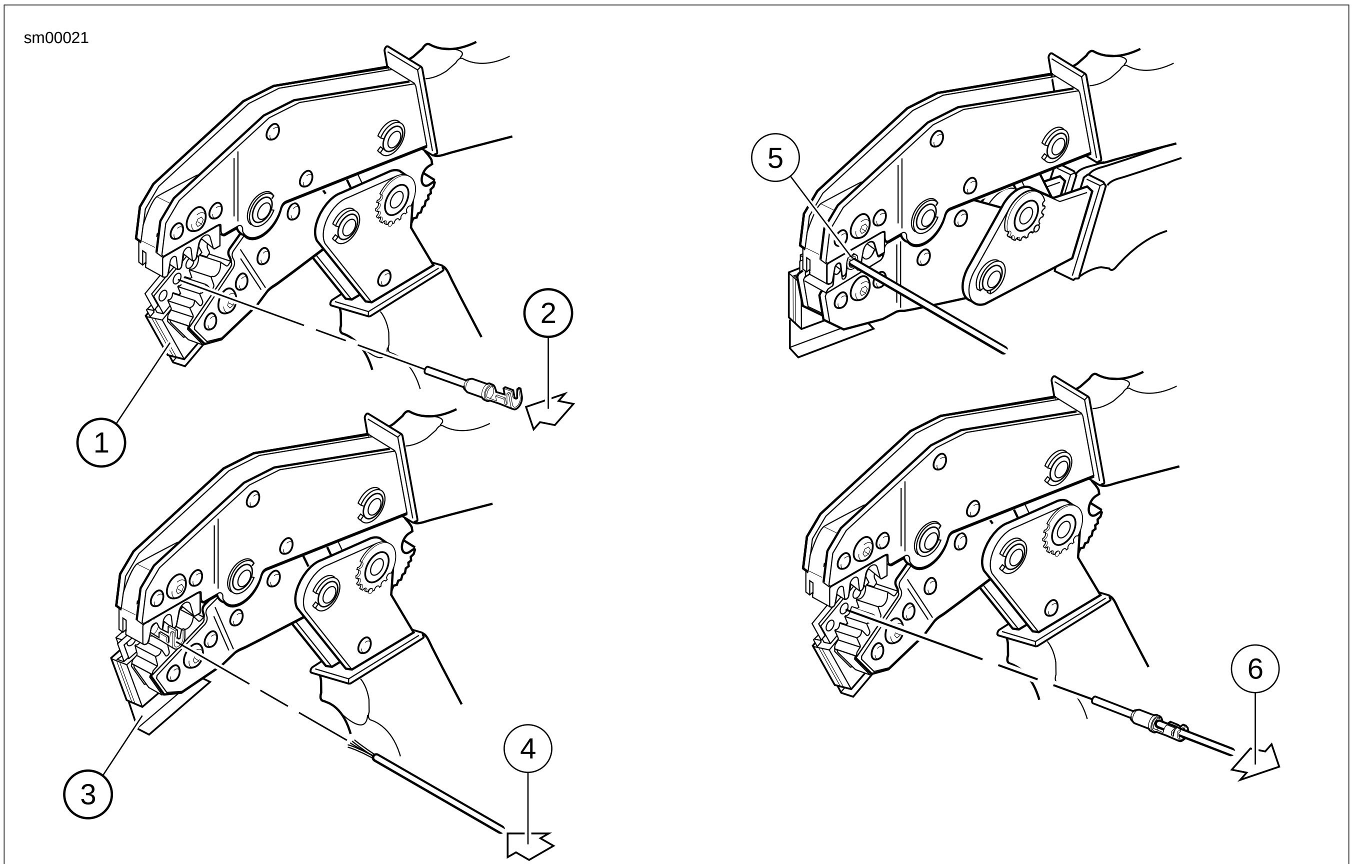
5. Insert stripped wire core between crimp tails until ends make contact with locking bar. Position wire that the wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
6. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
7. Raise locking bar up to remove wire lead and terminal.

### Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

**Table A-3. Deutsch DT Sealed Terminal Crimp: Wire Gauge To Die**

| WIRE GAUGE (AWG) | CRIMP TOOL DIE |
|---|---|
| 20 | Front |
| 16-18 | Middle |




1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar to remove terminal**

**Figure A-35. Crimping a Deutsch DT Sealed Terminal**

# DEUTSCH DTM SEALED MINI TERMINAL REPAIR A.15

## DEUTSCH DTM SEALED MINI TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-38125-7 | PACKARD TERMINAL CRIMPER |

### Preparing Wire Leads for Crimping

Strip 5/32 in (4.0 mm) of insulation from the wire lead.

### Crimping a Mini Terminal to Wire Lead

1. See Figure A-36. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

*Always perform core crimp before insulation crimp.*

2. Position the core crimp on die E (1) of the crimper. Verify the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire that the short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

NOTE

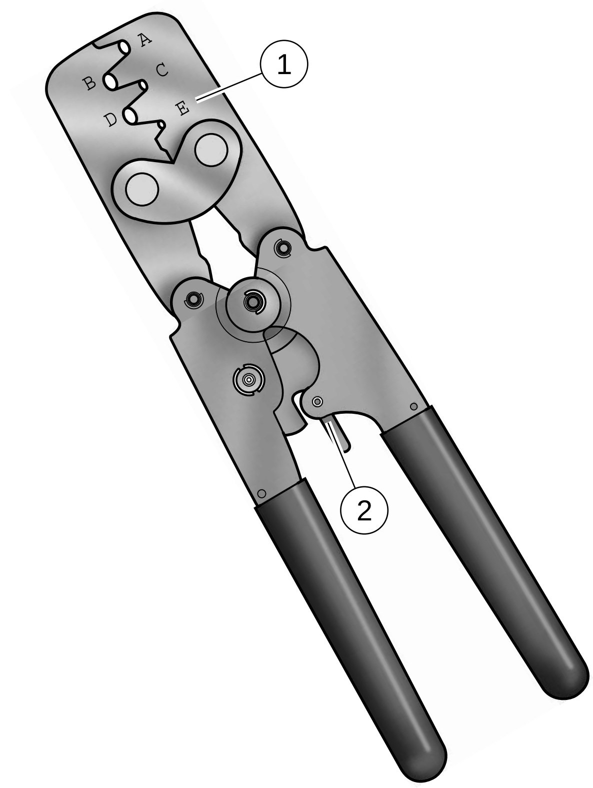
*If the crimper does not open, squeeze the ratchet trigger (2).*

6. Position the insulation crimp on nest C of the crimper. Verify the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

### Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.

sm00022




1. **E die**
2. **Crimper ratchet trigger**

**Figure A-36. Packard Terminal Crimper (HD-38125-7)**

# DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR A.16

## DEUTSCH DTM SEALED SOLID BARREL TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42879 | ELECTRICAL CRIMPER TOOL |

### Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip 1/4 in (6.4 mm) of insulation from the wire lead.

### Adjusting Crimper Tool

1. See Figure A-37. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob. Roate knob until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

### Crimping a Barrel Contact To Wire Lead

1. See Figure A-38. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of recess in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact centers between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

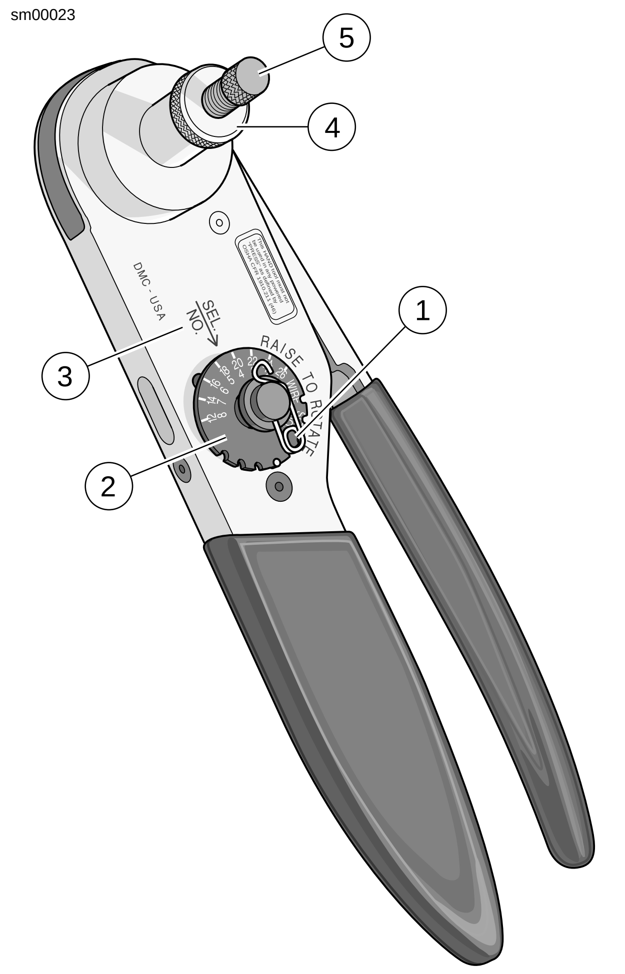
NOTE

*Adjust the crimper tool for each contact/wire size.*

6. Install pin to lock selector knob.

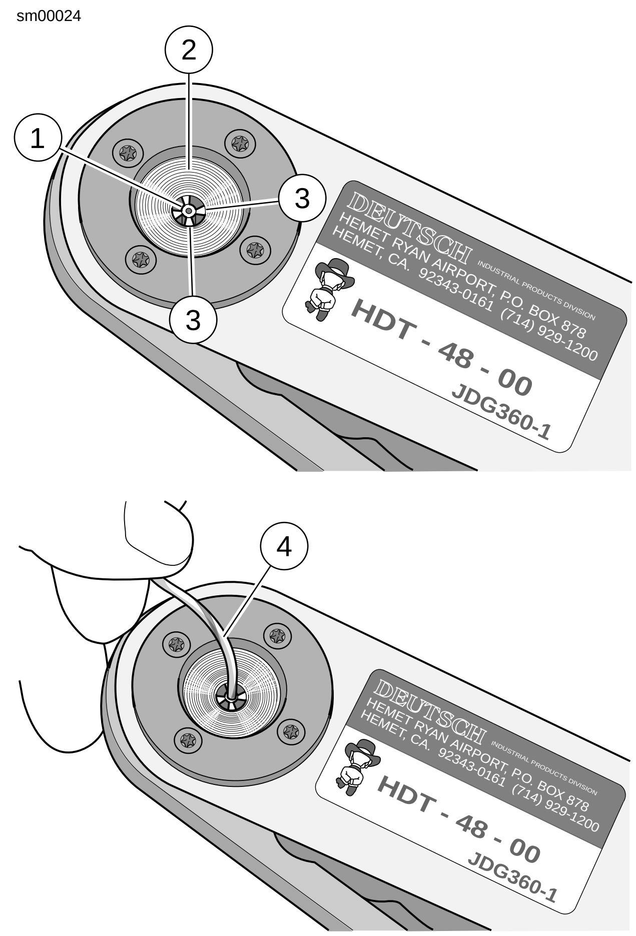
### Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.




1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

**Figure A-37. Electrical Crimper Tool (HD-42879)**




1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

**Figure A-38. Deutsch Solid Barrel**

# JAE MX19 SEALED CONNECTORS A.17

## JAE MX19 SEALED CONNECTORS

| PART NUMBER | TOOL NAME |
|---|---|
| B-50085 | TERMINAL EXTRACTOR |

### Connector Housings

**Separate Housings:** See Figure A-39. Press the two release buttons on each side of the housing to separate the connector.

**Connect Housings:** Align housings. Press together until the locking tabs click.

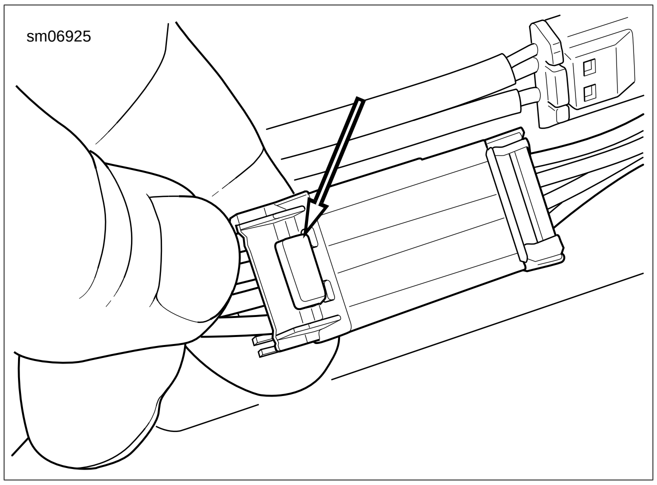


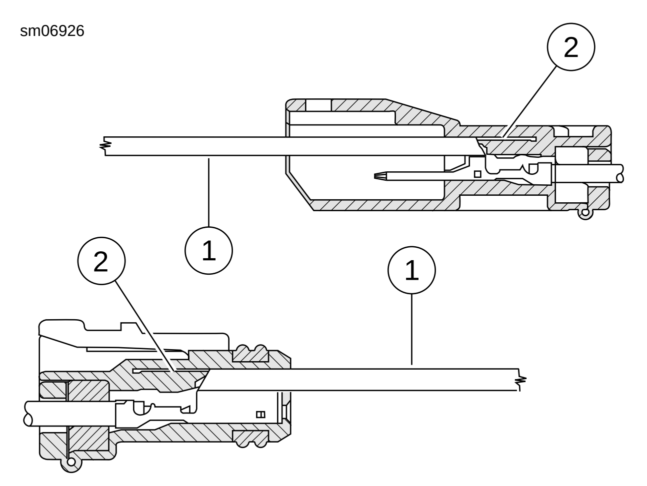

**Figure A-39. Release Buttons: JAE MX19 Sealed Connector**

### Removing Terminals

1. Modify a TERMINAL EXTRACTOR (Part No. B-50085) by filing the front edge to 45 degrees.
2. See Figure A-40. Insert the extractor (1) into the opening above the terminal and press the plastic molding (2) up and out of the way.
3. Pull the wire lead and terminal out of the back of the housing.

### Installing Terminals

1. Inspect the plastic molding and replace the connector housing if necessary.
2. Orient the terminal to the housing. Push terminal into housing until it clicks into place.




1. **Extractor**
2. **Plastic molding**

**Figure A-40. JAE MX19 Terminal Removal**

## CRIMPING TERMINALS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50120 | UNIVERSAL CRIMPER SET |
| HD-50120-2 | HAND CRIMP FRAME |
| HD-50120-6 | JAE DIE |

1. Strip the wire insulation to specification. Refer to Table A-4.
2. Install the JAE DIE (Part No. HD-50120-6) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2) of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the **new** terminal in the specified nest.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal.

**Table A-4. JAE MX19 Crimper Die (Part No. HD-50120-6)**

| TERMINAL | PART NO. | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| Socket | 72910-11 | 0.051-0.098 | 2.0-2.5 | B |
| Pin | 72909-11 | 0.051-0.098 | 2.0-2.5 | A |

# MOLEX CMC SEALED CONNECTORS A.18

## MOLEX CMC SEALED CONNECTORS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50423 | 0.6 MM TERMINAL EXTRACTOR TOOL |
| HD-50424 | 1.5 MM TERMINAL EXTRACTOR TOOL |

### Separating the Connector

**Release:** See Figure A-41. Press the catch and rotate the lever arm down.

**Connect:** Press on the front guard to release the latch and rotate the lever arm up until the catch clicks in place.

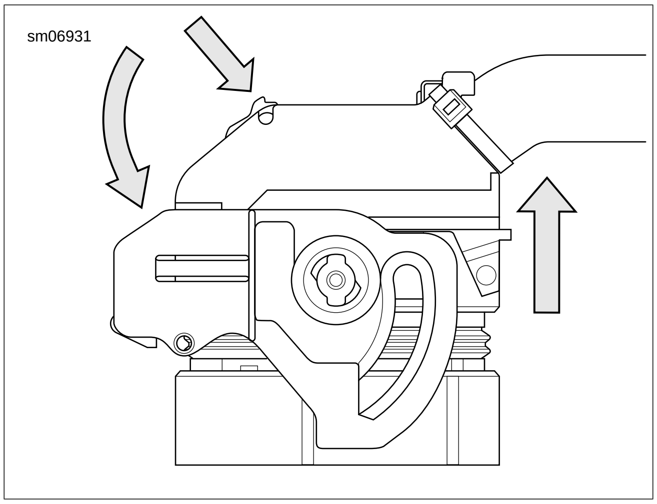


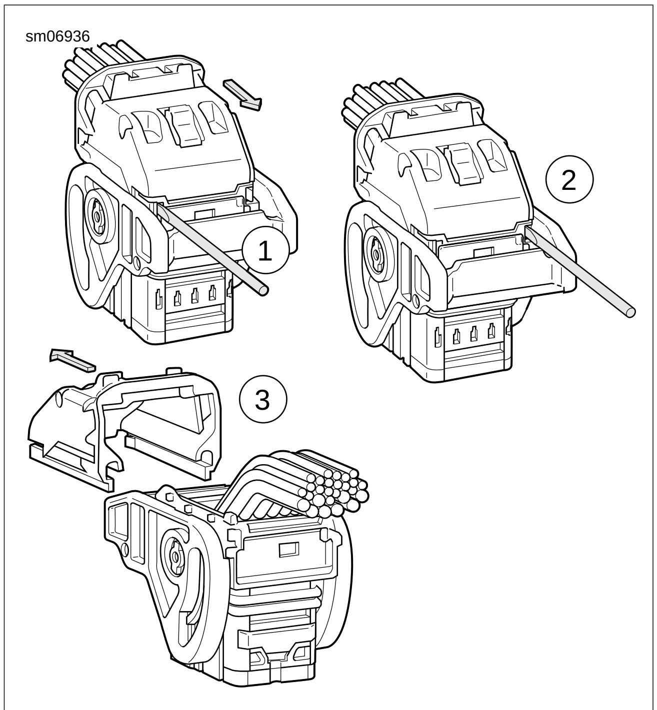

**Figure A-41. Release**

### Removing Terminals

1. With the lever arm open, cut the cable strap around the wire bundle.
2. See Figure A-42. Open a wire cap latch (1) with a small screwdriver.
3. Maintain pressure on the cap and open the opposite latch (2) with the screwdriver.
4. Slide the cap off (3).
5. See Figure A-43. Use the screwdriver to open the secondary lock. Pull the locking bar all the way out.
6. See Figure A-44. Locate the wire lead cavity by the alphanumeric coordinates.
7. Identify the size of the terminal and select either the CMC extractor 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423) or the 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424).
8. See Figure A-45. Insert the pins of the CMC extractor tool (1) into the access slots (2) of the terminal cavity and retract the lead and terminal.

### Installing Terminals

1. Orient the terminal to the housing cavity. Snap the terminal in place.
2. Slide the cap over the lead bundle. Snap the cap in place.
3. Install a cable strap through the guide and around the lead bundle.




1. **Press latch**
2. **Press cap and latch**
3. **Remove cap**

**Figure A-42. Remove the Wire Lead Cap**

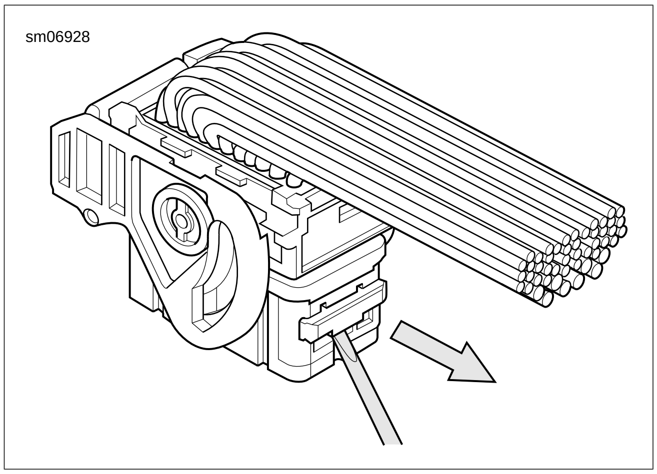



**Figure A-43. Molex CMC Sealed Connector Secondary Lock**

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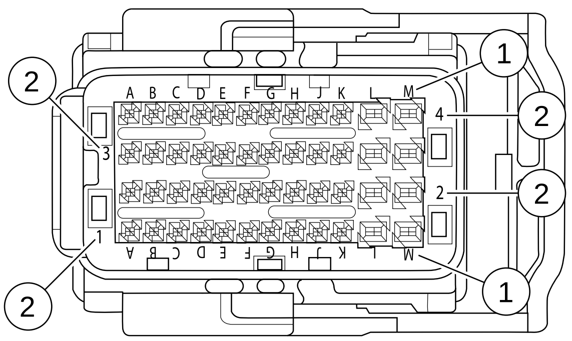


1. **Alpha**
2. **Numeric**

**Figure A-44. Alpha-Numeric Coordinates**

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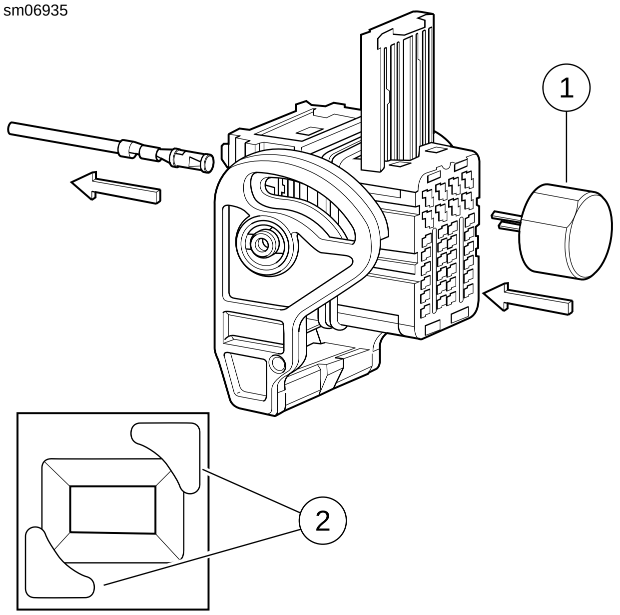



1. **Extractor tool**
2. **Access slots**

**Figure A-45. Terminal Removal**

## CRIMPING TERMINALS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50120 | UNIVERSAL CRIMPER SET |
| HD-50120-2 | HAND CRIMP FRAME |
| HD-50120-3 | JAE DIE |
| HD-50120-4 | JAE DIE |

1. Select the crimper die according to the terminal part number from the UNIVERSAL CRIMPER SET (Part No. HD-50120).
2. Strip the wire insulation to specification. Refer to Table A-5 or Table A-6.
3. Install the JAE DIE (Part No. HD-50120-3) or JAE DIE (Part No. HD-50120-4) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2).
4. Place the **new** terminal in the specified nest.
5. Insert the wire to the wire stop. Crimp the terminal.
6. Inspect the crimped terminal.

**Table A-5. Molex CMC Sealed Crimper Die (Part No. HD-50120-3)**

| PART NO. | TERMINAL: WIRE GAUGE | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| 72226-11 | Socket: 16 AWG | 0.177 | 4.5 | B |
| 72227-11 | Socket: 18 AWG | 0.177 | 4.5 | A |

**Table A-6. Molex CMC Sealed Crimper Die (Part No. HD-50120-4)**

| PART NO. | TERMINAL: WIRE GAUGE | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| 72222-11 | Socket: 18 AWG | 0.138 | 3.5 | B |
| 72222-11 | Socket: 20 AWG | 0.138 | 3.5 | A |

## MOLEX MX 150 SEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48114 | TERMINAL REMOVER |

### Separating Pin and Socket Housings

See Figure A-46. Press the latch while pulling the pin and socket housings apart.

### Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

### Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in (4.8 mm), until it stops.
   a. **Socket Housing:** See Figure A-47. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
   b. **Pin Housing:** See Figure A-48. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

*NOTE*

*Do not remove the secondary lock from the connector housing.*

2. See Figure A-49. Insert TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
   a. **Socket Housing:** The pin holes are inside the terminal openings.
   b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

### Installing Terminals

1. See Figure A-50. From the wiring diagram, match the wire color to its numbered terminal cavity.

*NOTE*

*Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. Determine the cavity number by counting the cavities up or down along the row from each stamped number.*

2. Orient the terminal that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

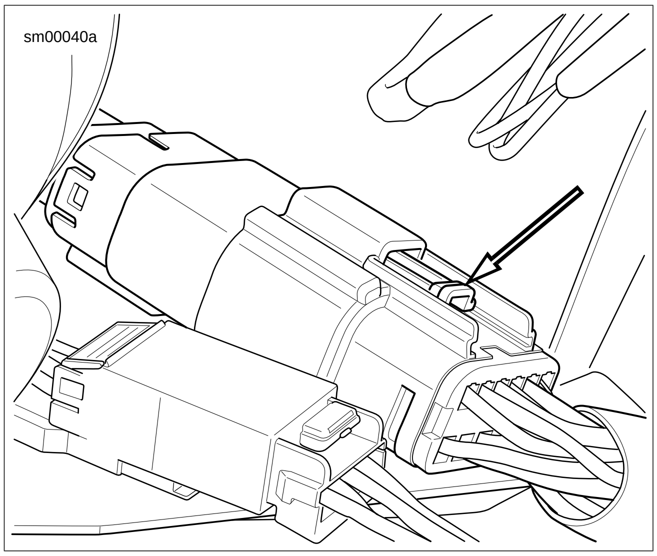



**Figure A-46. Molex MX 150 Sealed Connector: Latch**

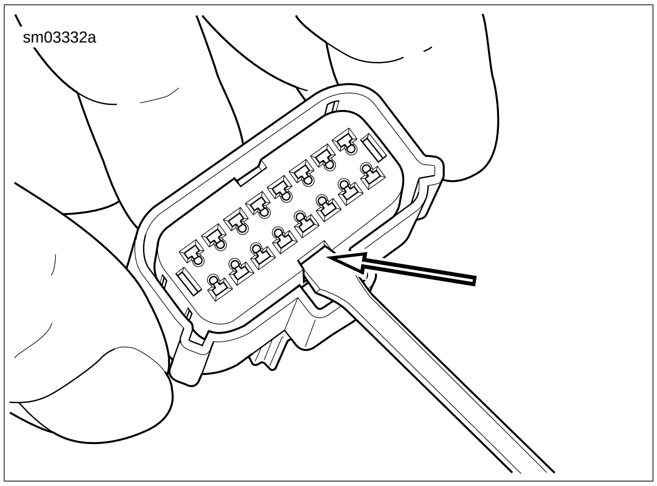



**Figure A-47. Secondary Lock Pry Slot (Socket Housing)**

HOME

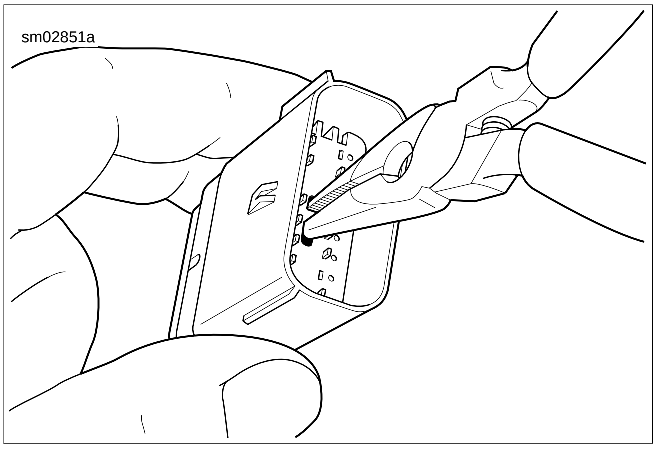



**Figure A-48. Pull Up Secondary Lock**

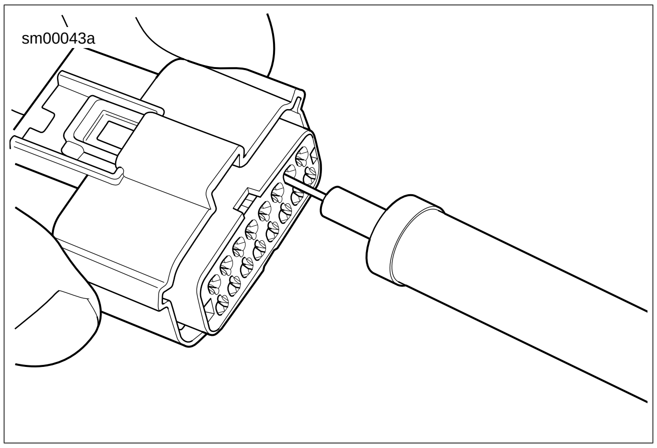
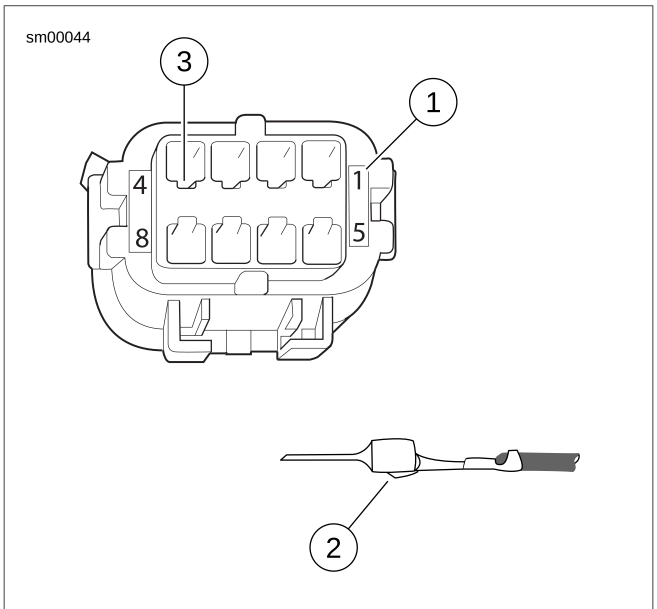



**Figure A-49. Molex MX 150 Sealed Connector: Terminal Remover (HD-48114)**




1. **Cavity number**
2. **Tang**
3. **Cavity slot**

**Figure A-50. Molex MX 150 Sealed Connector: Pin Cavities and Wire Terminal**

## CRIMP TERMINAL TO LEAD

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48119 | TERMINAL CRIMPER |

### Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.
2. Strip wire lead removing 3/16 in (4.70-5.60 mm) of insulation.

*NOTE*

*The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.*

### Prepare Tool

1. Identify the punch/die in the jaws of the TERMINAL CRIMPER (Part No. HD-48119) for the wire gauge. Refer to Table A-7.
2. Squeeze and release the handles to open the tool.

*NOTE*

*The crimp tool automatically opens when the handles are released.*

3. See Figure A-51. Hold fully open tool at approximately 45 degrees.

*NOTE*

*Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.*

**Table A-7. Crimp Tool Wire Gauge Punch/Die**

| AWG (WIRE GAUGE) | PUNCH/DIE |
|---|---|
| 22 | Left |
| 18-20 | Middle |
| 14-16* | Right |
| * Crimp 16 AWG **pin** terminals in the 18-20 middle die. | |

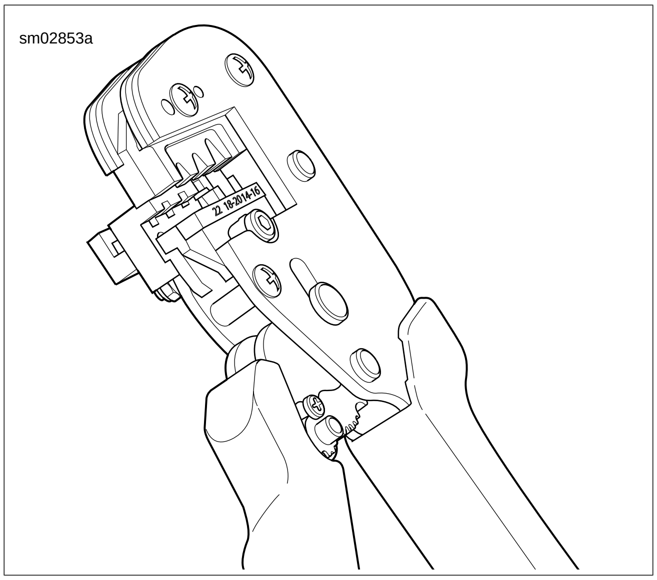
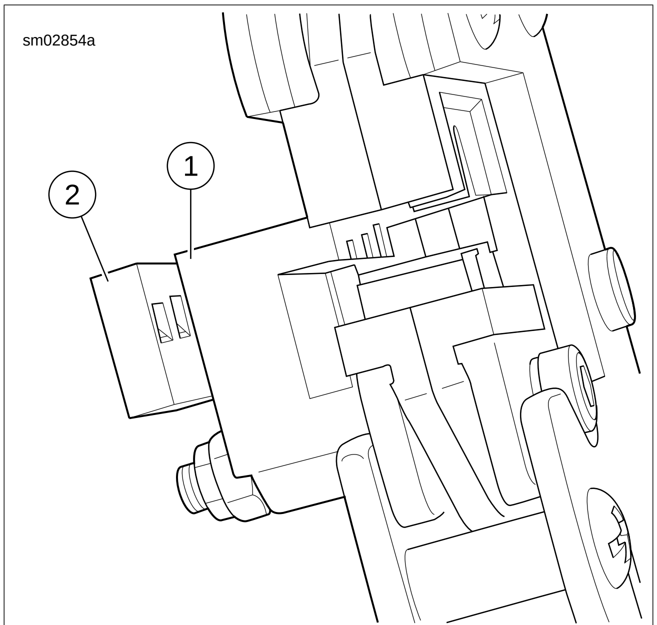



**Figure A-51. Open Terminal Crimper (HD-48119) at 45 Degrees**




1. **Socket locator bar**
2. **Pin locator bar**

**Figure A-52. Terminal Locator Bars**

## Position Terminal in the Punch/Die

1. See Figure A-53. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
   a. **Socket Terminal:** See Figure A-52. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-54. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-55. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

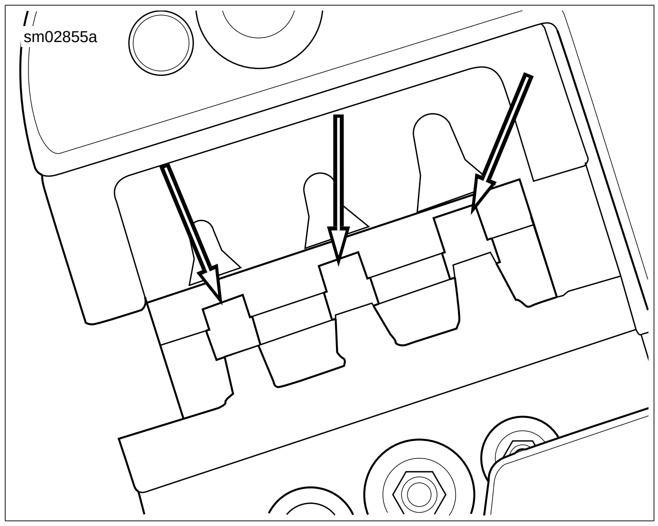



**Figure A-53. Square Openings in Socket Locator Bar**

## Insert Stripped Lead

See Figure A-56. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

*NOTES*

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

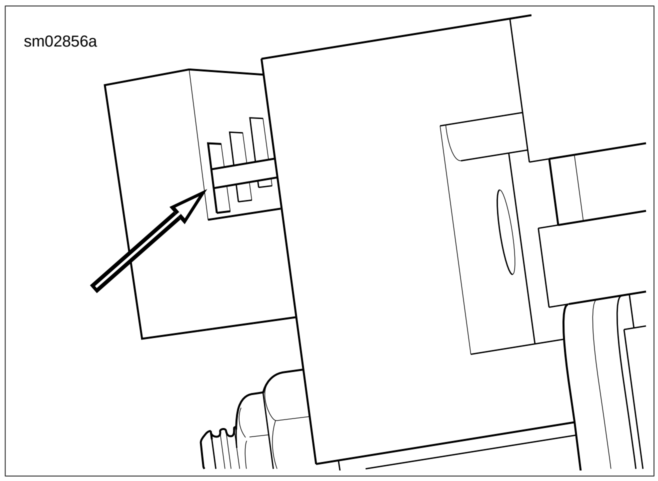



**Figure A-54. Pin Terminal against Pin Locator Bar**

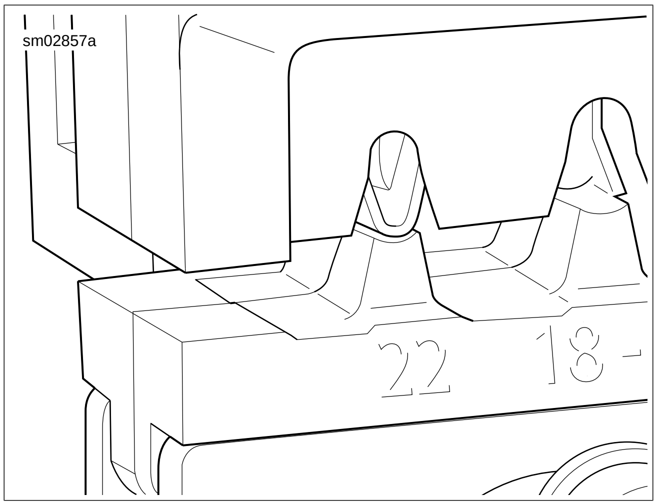



**Figure A-55. Crimp Tails in Vertical Alignment between Punch and Die**

## Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

*NOTE*

*Open a stuck or jammed tool by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.*

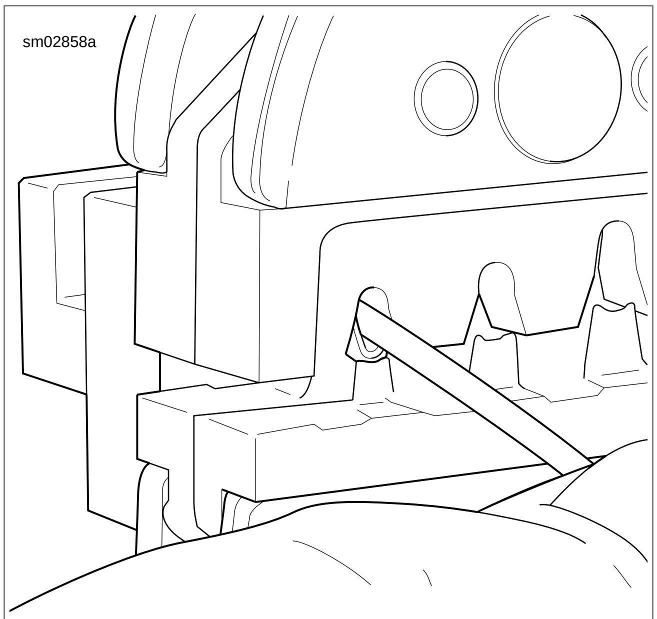
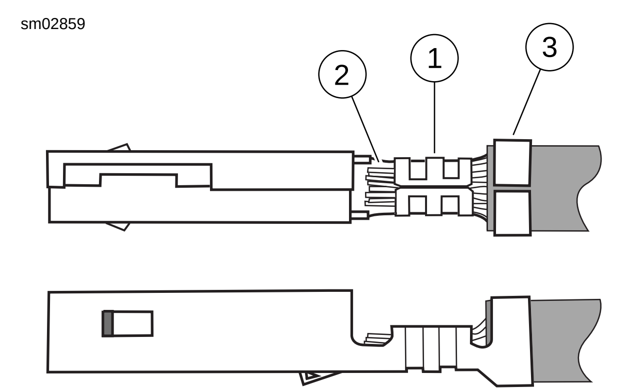



**Figure A-56. Stripped Lead at Up Angle**

## Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-57. The core tails should be creased into the wire strands at the core crimp (1).
   b. Strands (2) of wire should be visible beyond the core crimp but not forward into the terminal shell.
   c. The insulation tails should be folded into the insulation (3) without piercing or cutting the insulation.
   d. Distortion should be minimal.
2. **Test Crimp:** Hold the terminal. Pull the lead.




1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

**Figure A-57. Terminal Crimp**

# TYCO 070 MULTILOCK UNSEALED CONNECTOR A.20

## TYCO 070 MULTILOCK UNSEALED CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41609 | AMP MULTI-LOCK CRIMPER |
| SNAP-ON TT600-3 | SNAP-ON PICK |

### General

Tyco 070 Multilock Unsealed 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-58. 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*

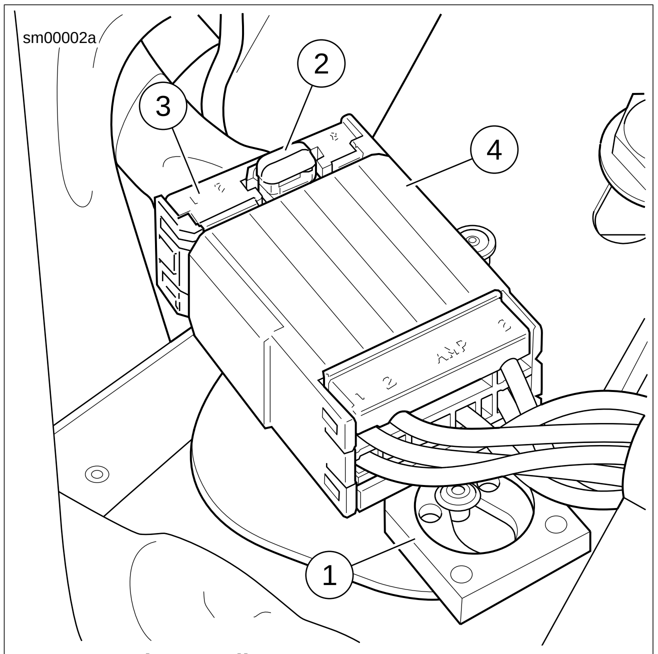
*For terminal crimping use the AMP MULTI-LOCK CRIMPER (Part No. HD-41609).*

### 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-58. Press 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 clicks 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.




1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

**Figure A-58. Tyco 070 Multilock Unsealed Connector**

### Removing Terminals from Housing

1. See Figure A-59. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

*NOTE*

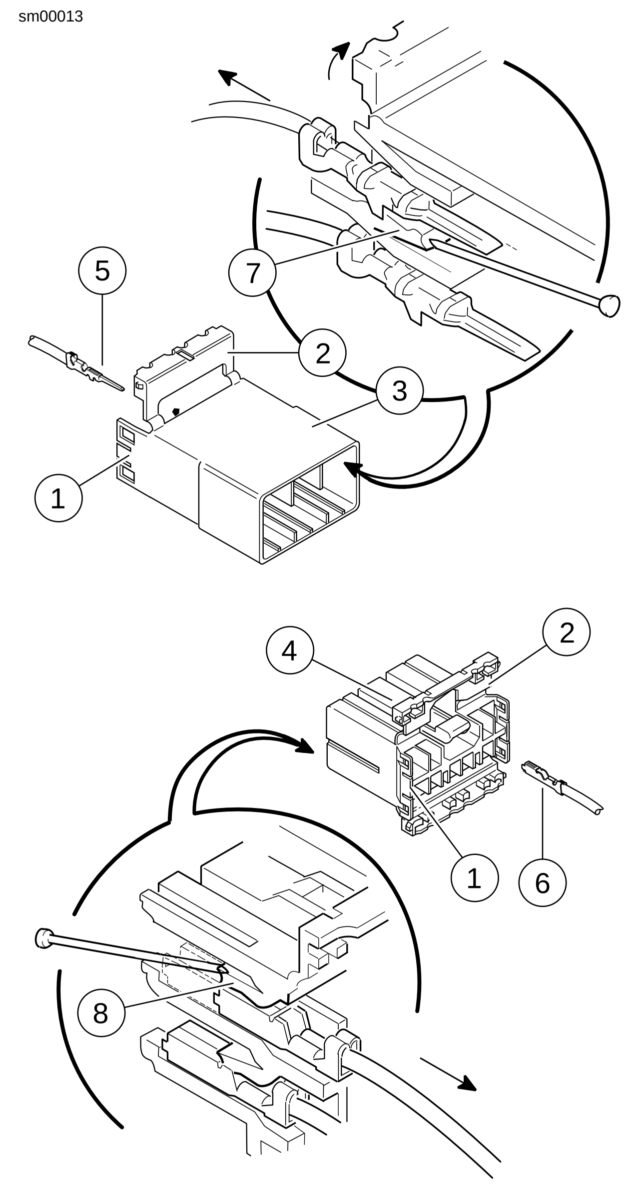
*If socket/pin terminal tool is not available, use a push pin/safety pin or a SNAP-ON PICK (Part No. SNAP-ON TT600-3).*

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

*NOTE*

*A click is heard if the tang is released.*

5. Gently tug on wire to pull wire and terminal from cavity.




1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

**Figure A-59. Tyco 070 Multilock Unsealed Connector: Socket and Pin Housings**

## Inserting Terminals into Housing

*NOTE*

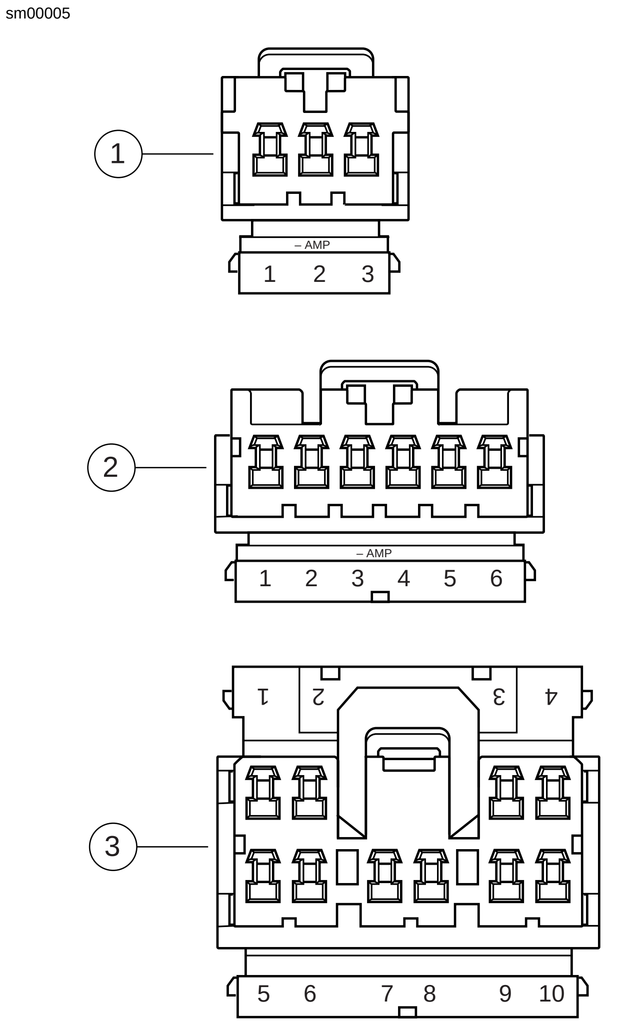
*See Figure A-60. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.*

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*

- *The release button is always on 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.




1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

**Figure A-60. Tyco 070 Multilock Unsealed Connector: Cavity Numbers on Secondary Locks (socket housings shown)**

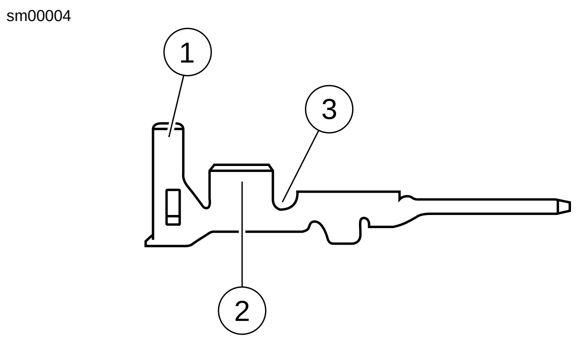
## Preparing Wire Leads for Crimping

1. Strip wire lead removing 5/32 in (4.0 mm) of insulation.

2. See Figure A-59 and Figure A-62. 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-8.

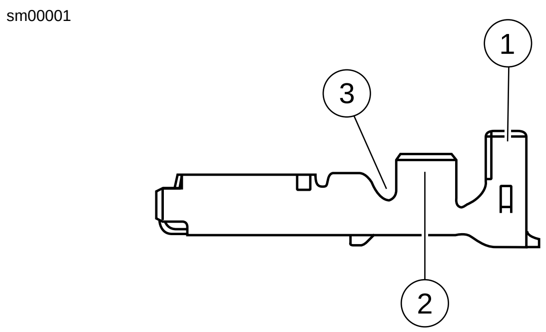
**Table A-8. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest**

| WIRE GAUGE | NEST |
|---|---|
| 20 | Front |
| 16 | Middle |
| 18 | Rear |




1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

**Figure A-61. Tyco 070 Multilock Unsealed Connector: Pin Terminal**




1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

**Figure A-62. Tyco 070 Multilock Unsealed Connector: Socket Terminal**

## Crimping Terminals to Leads

*NOTE*

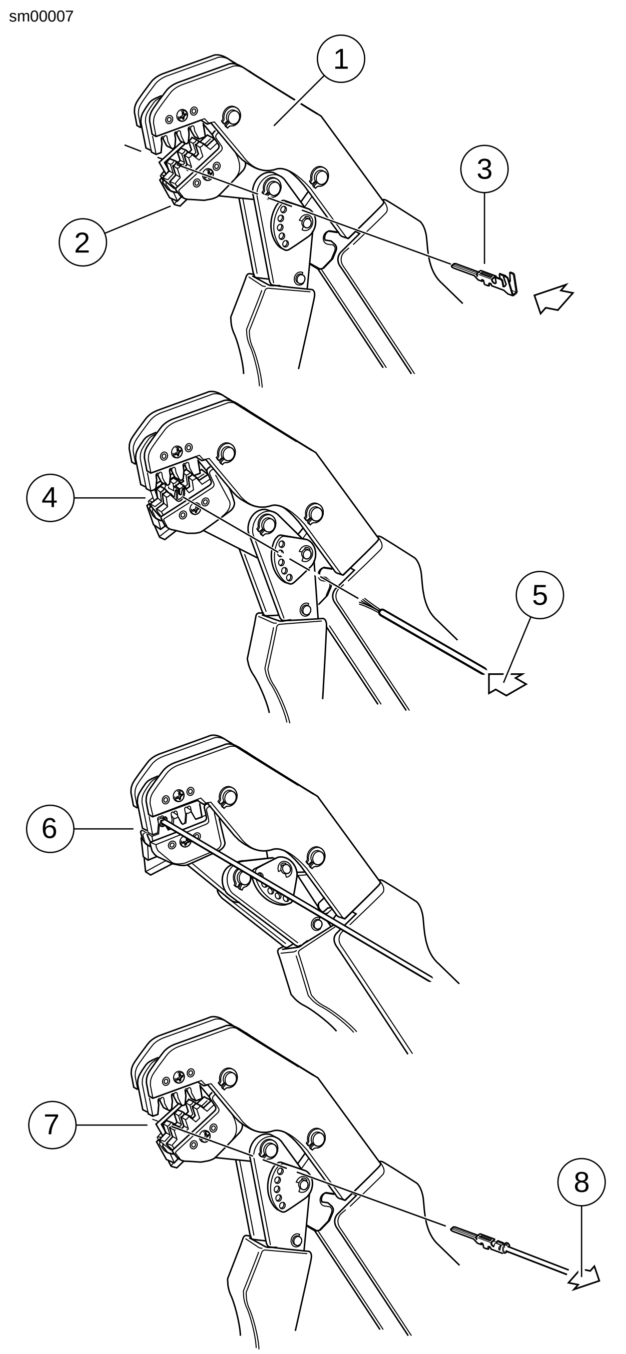
*Crimping with the AMP Multi-lock Crimper is a one step operation. One squeeze crimps both the wire core and the insulation tails.*

1. See Figure A-63. Squeeze the handles to cycle the AMP MULTI-LOCK 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-59 and Figure A-62. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and simultaneously crimp around the stripped lead and the insulation.*

3. See Figure A-63. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Position wire that the wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (7) to remove crimped terminal.

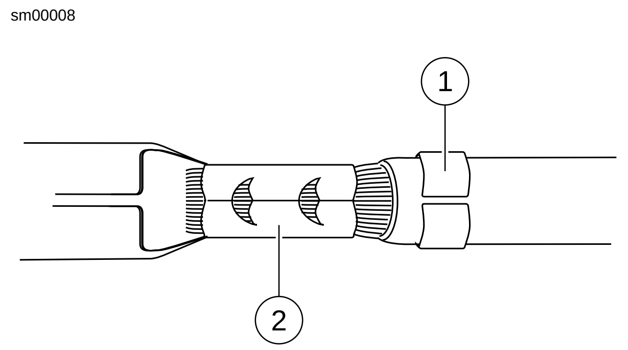



1. **Open position**
2. **Locking bar flange**
3. **Insert contact**
4. **Release locking bar**
5. **Insert lead**
6. **Squeeze**
7. **Raise locking bar**
8. **Remove crimped terminal**

**Figure A-63. Tyco 070 Multilock Unsealed Connector: Terminal Crimping Procedure**

## Inspecting Crimped Terminals

See Figure A-64. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.




1. **Insulation crimp**
2. **Wire core crimp**

**Figure A-64. Tydo 070 Multilock Unsealed Connector: Terminal Crimp**

# TYCO GET 64 SEALED CONNECTOR A.21

## TYCO GET 64 SEALED CONNECTOR

| PART NUMBER | TOOL NAME |
|---|---|
| B-50085 | TERMINAL EXTRACTOR |

### General

See Figure A-65. The Tyco GET 64 Sealed connector is found on the ECM of Dyna and Softail Models.

### Housings

**Separate:** Press on the latch. Pull the socket housings off of the ECM.

**Join:** Align the socket housing latch with the catch on the ECM. Press housing onto ECM.

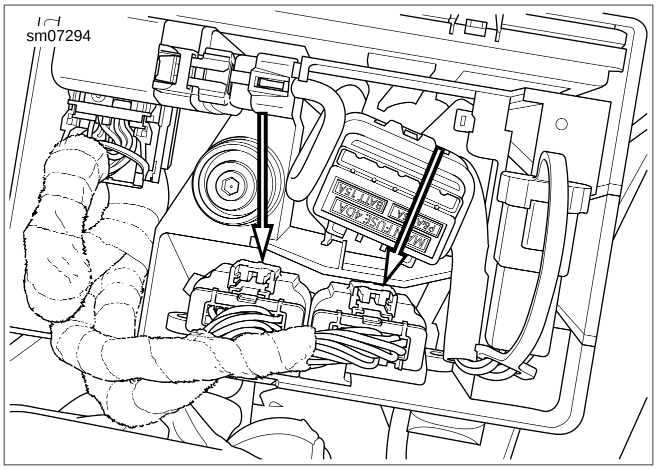



**Figure A-65. Tyco GET 64 Sealed Connector Latch**

### Removing Socket Terminals

1. Remove the black wrap to access the back of the connector.
2. See Figure A-66. Use needle nose pliers to pull the secondary lock out of the housing.
3. See Figure A-67. Orient the bevel of the TERMINAL EXTRACTOR (Part No. B-50085) (1) to the upper or lower terminal row. Insert the extractor into the slot adjacent to the terminal.
4. Rotate the extractor to release the retention beam and simultaneously pull on the wire lead to remove the terminal.

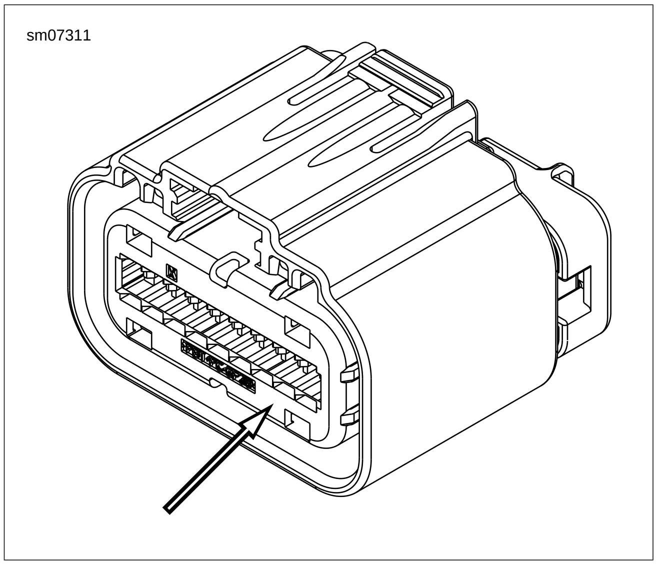
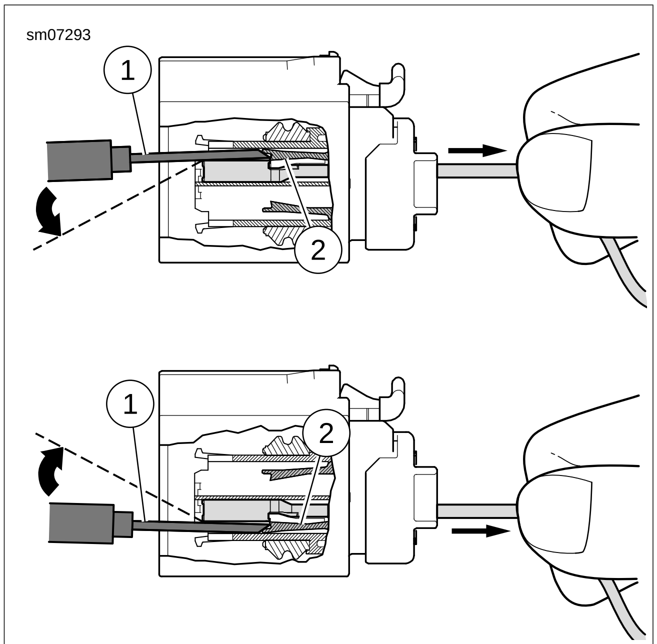



**Figure A-66. Tyco GET 64 Secondary Lock**




1. **Terminal extractor**
2. **Retention beam**

**Figure A-67. Removing Terminals: Tyco GET 64 Sealed Connector**

### Installing Socket Terminals

1. See Figure A-68. Locate the wire lead cavity by number.
2. See Figure A-69. Orient the open side of the crimp to the lower or the upper terminal row.
3. Press the terminal in through the rear cover and the seal until it clicks.
4. Press the secondary lock into the locked position.
5. Black wrap the wire lead bundle.

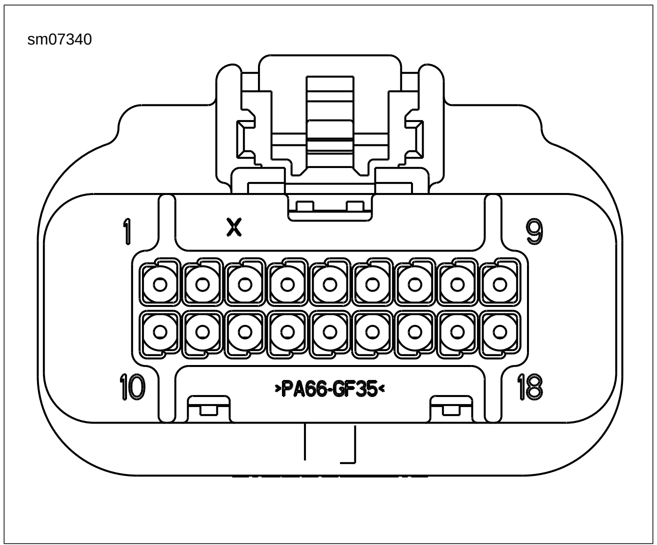



**Figure A-68. Cavity Numbers**

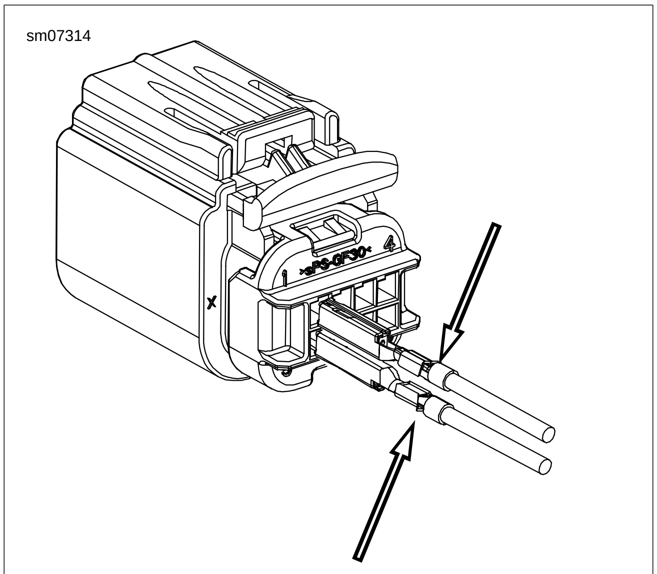



**Figure A-69. Socket Terminal Orientation: Crimp Open Side**

## CRIMPING TERMINALS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50120 | UNIVERSAL CRIMPER SET |
| HD-50120-2 | HAND CRIMP FRAME |
| HD-50120-7 | TYCO GET 64 DIE |

1. Strip the wire insulation. Refer to Table A-9.
2. Install the TYCO GET 64 DIE (Part No. HD-50120-7) in the HAND CRIMP FRAME (Part No. HD-50120-2) of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the **new** terminal in the specified nest. Refer to Table A-9.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal and wire lead.

**Table A-9. Tyco GET 64 Sealed Crimper Die (Part No. HD-50120-7)**

| TERMINAL | PART NO. | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| Socket: 18-20 AWG | 72666-12 | 0.170 | 4.4 | A |

## TYCO MCP SEALED CONNECTOR

| PART NUMBER | TOOL NAME |
|---|---|
| B-0085 | TERMINAL EXTRACTOR |
| GA500A | SNAP-ON TERMINAL PICK |

### General

The Tyco MCP sealed connector is used on certain ABS modules.

### Housing

**Separate:** See Figure A-70. Press and hold the lock tab. Pulling on both ends of the lever, open the lever.

**Join:** Gently mate the pins to the socket. Press and hold the lock tab. Pressing on both ends of the lever, close the lever.

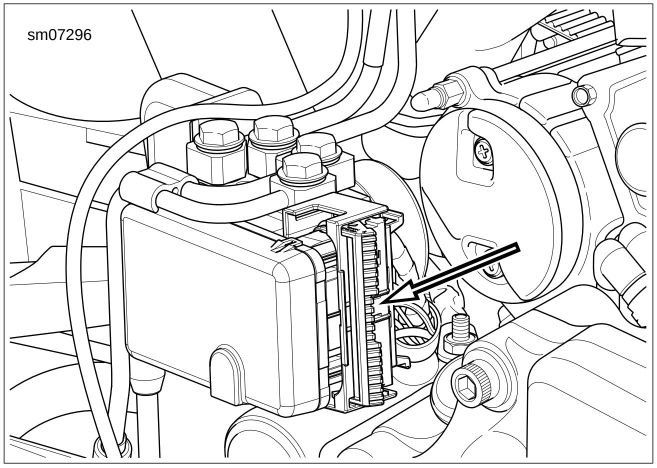



**Figure A-70. Tyco MCP Connector Release Bar**

### Removing the Large Terminals

1. Snap the wire harness cover off of the back of the connector

*NOTE*

*Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.*

2. See Figure A-71. Gently slide the secondary lock out of the connector with a screw driver.
3. See Figure A-72. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the socket to compress the tangs on each side of the terminal.
4. Gently pull on the wire to remove the terminal.

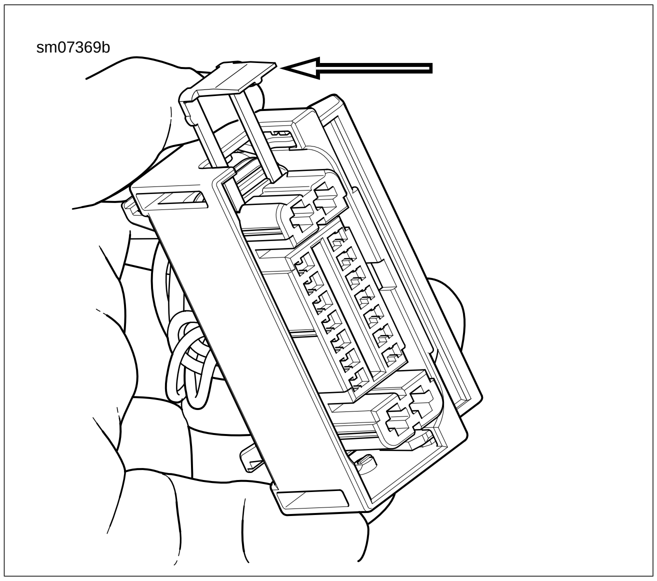



**Figure A-71. Tyco MCP Connector Secondary Lock**

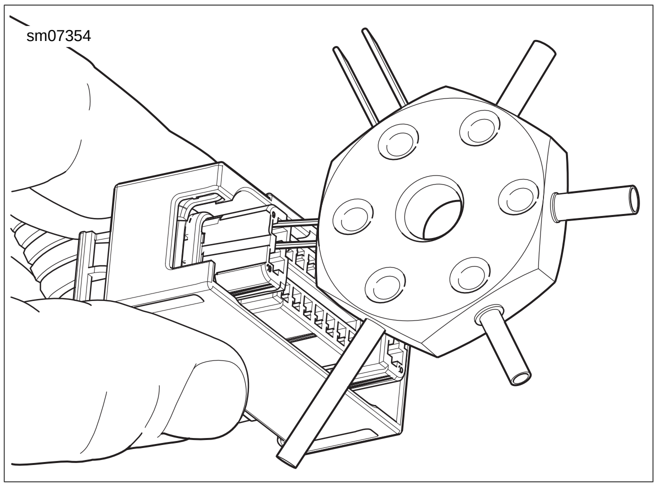



**Figure A-72. Removing Large Socket Terminals: Tyco MCP Connector**

### Removing the Small Terminals

1. Snap the wire harness cover off of the back of the connector

*NOTE*

*Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.*

2. See Figure A-71. Gently slide the secondary lock out of the connector with a screw driver.
3. See Figure A-73. Insert the TERMINAL EXTRACTOR (Part No. B-0085) into the cavity on the outside of the terminal.
4. Tilt the extractor to lift the molding latch and release the terminal.
5. Gently pull on the wire to remove the terminal.

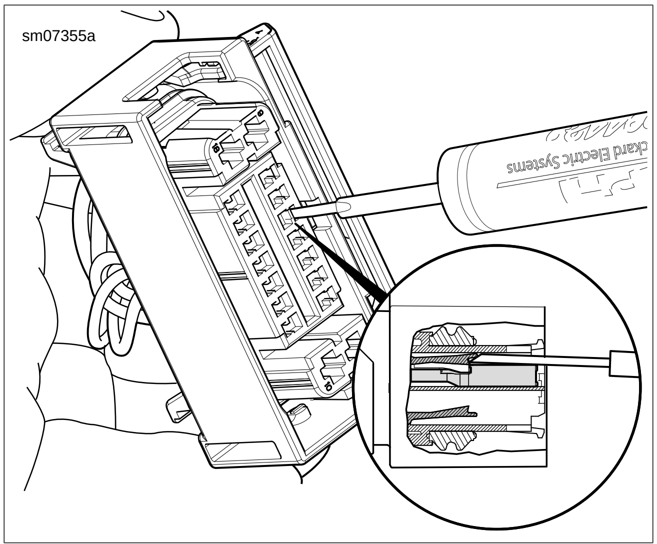



**Figure A-73. Removing Small Socket Terminal: Tyco MCP Connector**

## Installing Terminals

1. See Figure A-74. Locate the wire lead cavity by number.
2. Use a hobby knife to bend the tangs on each side of the terminal outward.
3. Align the socket.
4. Push the socket in until it clicks.
5. Press the secondary lock back into the connector.
6. Snap the wire cover in place.

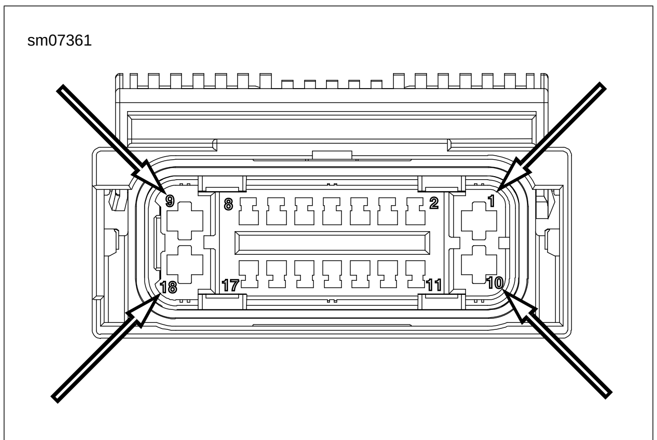



**Figure A-74. Tyco MCP Sealed Connector Cavity Numbers**

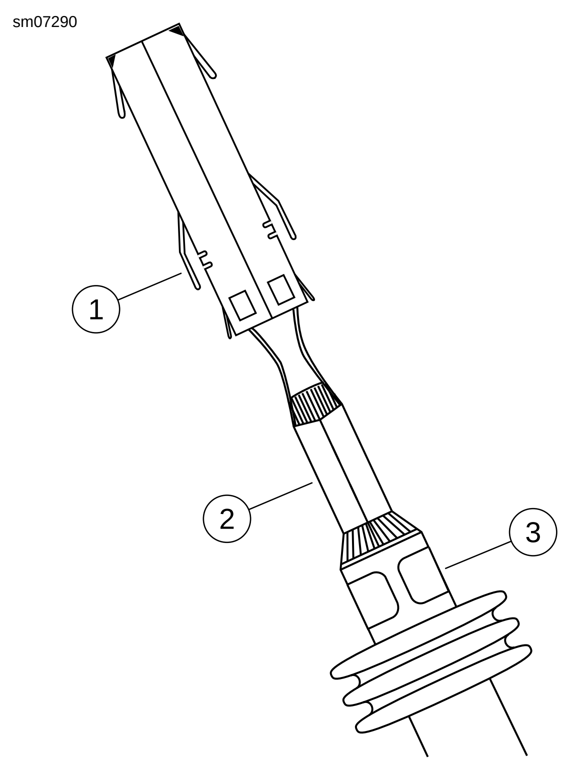
## CRIMPING TERMINALS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-50120 | UNIVERSAL CRIMPER SET |
| HD-50120-8 | TYCO MCP DIE |

1. Strip the wire insulation to specification. Refer to Table A-10.
2. Install the TYCO MCP DIE (Part No. HD-50120-8) in the handle of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the **new** terminal in the specified nest.
4. Insert the wire to the wire stop.
5. Crimp the terminal.
6. Inspect the crimped terminal.

**Table A-10. Tyco MCP Crimper Die (Part No. HD-50120-8)**

| TERMINAL | PART NO. | STRIP LENGTH | | NEST |
|---|---|---|---|---|
| | | in | mm | |
| Large socket: 14 AWG | 72579-12 | 0.165-0.189 | 4.2-4.8 | A |
| Large socket: 16 AWG | 72579-12 | 0.165-0.189 | 4.2-4.8 | B |
| Small socket: 20 AWG | 72580-12 | 0.130-0.153 | 3.3-3.9 | C |




1. **Locking tang**
2. **Lead crimp**
3. **Seal crimp**

**Figure A-75. Tyco MCP Socket Terminal Crimp**

# SEALED SPLICE CONNECTORS A.23

## SEALED SPLICE CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-25070 | HEAT GUN |
| HD-38125-8 | PACKARD CRIMPING TOOL |
| HD-39969 | ULTRA TORCH |
| HD-41183 | HEAT SHIELD ATTACHMENT |

### General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

### Preparing Wire Leads

*NOTE*

*When splicing adjacent wires, stagger the splices that the sealed splice connectors will not touch each other.*

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-11.
3. Strip insulation off the the wire lead. Refer to Table A-11.

**Table A-11. Sealed Splice Connectors**

| WIRE GAUGE | COLOR | PART NO. | STRIP LENGTH | |
|---|---|---|---|---|
| | | | in | mm |
| 18-20 (0.5-0.8 mm) | Red | 70585-93 | 3/8 | 9.5 |
| 14-16 (1.0-2.0 mm) | Blue | 70586-93 | 3/8 | 9.5 |
| 10-12 (3.0-5.0 mm) | Yellow | 70587-93 | 3/8 | 9.5 |

*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-77. The connector is crimped on one side and then the other.*

1. See Figure A-76. 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. Insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-77. 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. 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 electrical system component that is not being serviced.
- Always keep hands away from tool tip area and heat shrink attachment.

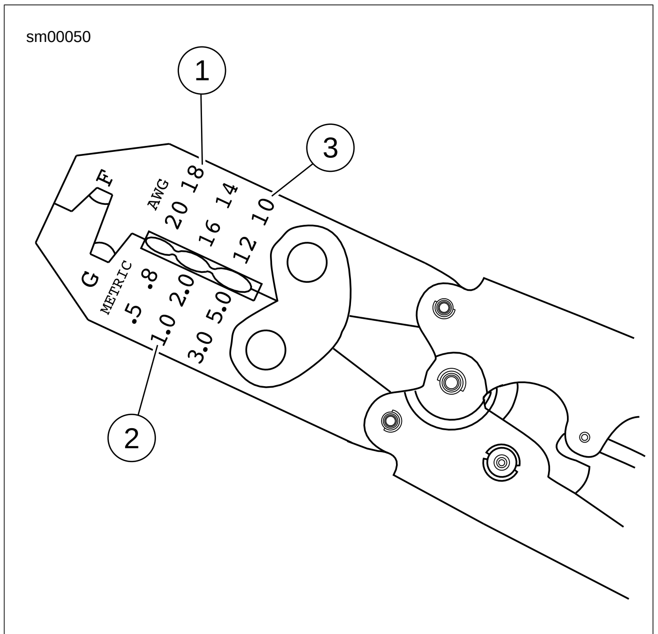
7. Use an ULTRA TORCH (Part No. HD-39969), or a HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

*NOTE*

*It is acceptable for the splice to rest against the heat shrink tool attachment.*

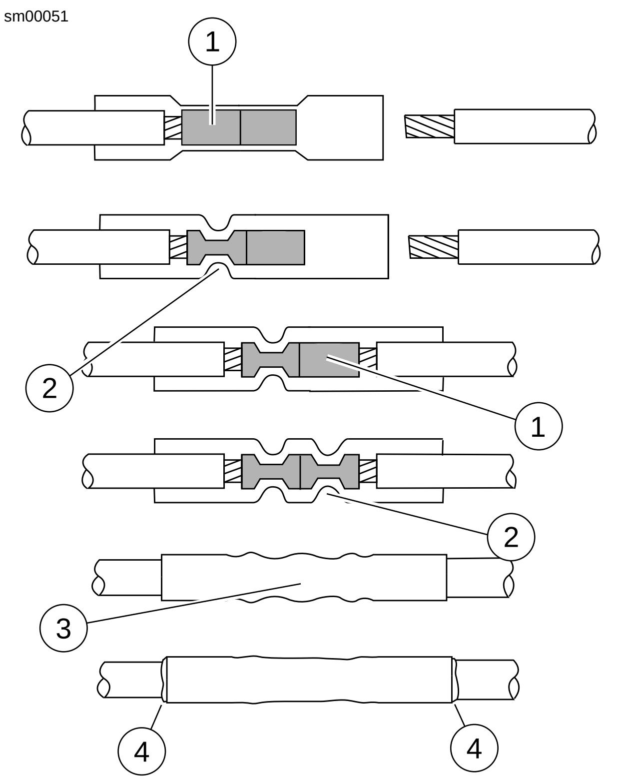
### Inspecting Seals

See Figure A-77. 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. **Red connector die**
2. **Blue connector die**
3. **Yellow connector die**

**Figure A-76. Packard Crimping Tool (HD-38125-8)**




1. **Wire lead in metal insert**
2. **Crimp metal insert**
3. **Center of crimp**
4. **Melted SEALANT**

**Figure A-77. Sealed Splice Connector**

TABLE OF CONTENTS

# NOTES

# CONNECTORS B.1

## CONNECTOR LOCATIONS

### Function/Location

All vehicle connectors are identified by their function and location. Refer to Table B-1.

### Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

### Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

### Repair Instructions

The repair instructions in Appendix A are by connector type. Refer to Table B-1.

**Table B-1. Sportster Connector Locations**

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|---|---|---|---|---|
| [5] | Main fuse | 2-place Delphi 800 Metripack Sealed (BK) | Red | Behind left side cover |
| [7] | Tail lamp harness to main harness | 6-place Tyco 070 Multilock Unsealed (BK) | Gray | Below seat |
| [18] | Right rear turn signal | 2-place Tyco 070 Multilock Unsealed (single stop lamp)<br>2-place Tyco 070 Multilock Unsealed (W) (LED)<br>4-place Tyco 070 Multilock Unsealed (BK) (dual stop lamp) | Gray | Inside tail lamp lens (single stop lamp)<br>Under the seat (LED and dual stop lamp) |
| [19] | Left rear turn signal | 2-place Tyco 070 Multilock Unsealed (BK) (single stop lamp)<br>2-place Tyco 070 Multilock Unsealed (BK) (LED)<br>4-place Tyco 070 Multilock Unsealed (BK) (dual stop lamp) | Gray | Inside tail lamp lens (single stop lamp)<br>Under the seat (LED and dual stop lamp) |
| [20] | Instruments | 12-place Molex MX 150 Sealed (BK) | Gray | Under fuel tank |
| [22] | Right hand controls | 6-place Molex MX 150 Sealed (BK) | Gray | Under fuel tank |
| [24] | Left hand controls | 8-place Molex MX 150 Sealed (GY) | Gray | Under fuel tank |
| [30] | TSM, TSSM or HFSM | 12-place Deutsch DT Sealed (GY) | Breakout Box | Under battery |
| [31] | Front turn signals | 6-place Tyco 070 Multilock Unsealed (BK) | Gray | Under fuel tank |
| [38] | Headlamp | 4-place Tyco 070 Multilock Unsealed (BK) | Gray | Under fuel tank |
| [39] | Speedometer (XL) | 12 Delphi Micro 64 Sealed (BK) | Breakout Box | Back of speedometer |
| [39] | Speedometer (XR) | 5-place Delphi 150.2 Sealed (BK) | Gray | Back of speedometer |
| [40] | License plate lamp | 2-place Tyco 070 Multilock Unsealed (BK)<br>3-place Tyco 070 Multilock Unsealed (BK) | Gray | Under seat |
| [47] | Voltage regulator to stator | 3-place Dekko (BK) | Green | Right side, under gear case cover |
| [61] | Fuse block | Tyco JR Power Timer Unsealed (BK) | Gray | Behind left side cover |

**Table B-1. Sportster Connector Locations**

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|---|---|---|---|---|
| [65] | VSS | 3-place Delphi 150.2 Sealed (BK) | Gray | Behind starter |
| [77] | Voltage regulator | 2-place Dekko (BK) | Green | Left side frame, in front of oil filter |
| [78] | ECM (XL) | 36-place Delphi 100W Sealed (GY) | Breakout Box | Behind rear cylinder |
| [78] | ECM (XR) | 36-place Delphi 100W Sealed (GY) | Breakout Box | Under seat |
| [79] | CKP sensor | 2-place Deutsch DTM Sealed (BK) | Brown | Left side frame under oil filter |
| [80] | TMAP sensor | 4-place Bosch 1.1M sealed (BK) | Purple | Top of intake manifold |
| [83] | Ignition coil | 4-place Delphi GT 150 Sealed (BK) | Gray | Under fuel tank |
| [84] | Front fuel injector | 2-place Molex BPT Sealed (BK) | Purple | Top of induction manifold |
| [85] | Rear fuel injector | 2-place Molex BPT Sealed (BK) | Purple | Top of induction manifold |
| [87] | IAC | 4-place Delphi 150.2 sealed (BK) | Gray | Top of induction manifold |
| [88] | TPS | 3-place Delphi 150.2 Sealed (BK) | Gray | Behind air cleaner mounting plate |
| [90] | ET sensor | 2-place Tyco Superseal 1.5 Sealed (BK) | Gray | On right side ECM caddy: XL models<br>On right side H-bracket: XR 1200X |
| [91] | DLC | 4-place Deutsch DT Sealed (GY) | Black | Under left side cover |
| [93] | Tail/stop lamp | 4-place Tyco 070 Multilock Unsealed (BK) | Gray | Inside tail lamp lens |
| [94] | Rear turn signal lamp | 6-place Tyco 070 Multilock Unsealed (BK) | Gray | Inside tail lamp lens |
| [108] | Tachometer (XR) | 12-place Delphi Micro 64 Sealed (GY) | Breakout Box | Back of tachometer |
| [120] | Oil pressure switch | Right Angle Push On terminal (BK) | | Under oil filter mount |
| [121] | Rear stop lamp switch | Tyco Insulated Spade terminals (BK) | Red | Left side under battery (XL)<br>Under rear fork (XR) |
| [122] | Horn | Flag terminals (BK) | Red | Between front frame tubes or on the left side of engine |
| [128] | Starter solenoid | 1-place Delphi 56 Spade terminal (W) | Gray | Right side bottom of starter |
| [131] | Neutral switch | Right Angle Push On Molded terminals (BK) | Black | Right side under sprocket cover behind transmission sprocket |
| [133] | JSS (HDI) | 3-place Molex MX 150 Sealed (BK) | Gray | Left side frame down tube |
| [136] | Neutral switch jumper | 1-place bullet (BK) | | Right side frame, beneath gearcase cover |
| [137] | Rear O2 sensor | 2-place Tyco 070 Multilock Unsealed (BK) | Gray | On left side ECM caddy: XL models<br>On left side H-bracket: XR 1200X |
| [138] | Front O2 sensor | 2-place Tyco 070 Multilock Unsealed (BK) | Gray | Left side frame in front of oil filter |

**Table B-1. Sportster Connector Locations**

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|---|---|---|---|---|
| [141] | Fuel pump and low fuel switch | 4-place Molex MX 150 Sealed (BK) | Gray | On left side of ECM caddy: XL models<br>On left side of H-bracket: XR 1200X |
| [142] | Security siren | 3-place Delphi 150.2 Sealed (BK) | Gray | Under frame |
| [145] | Engine sensor harness | 16-place Molex MX 150 Sealed (BK) | Gray | Under seat |
| [160] | P&A battery | 1-place Delphi 800 Metripack Sealed (GY) | Purple | Under seat |
| [178] | Active intake solenoid | 2-place Tyco Superseal 1.5 Sealed (BK) | Gray | Right side behind air box: XR 1200X |
| [200] | Fuel sender resistor assembly | 3-place Molex MX 150 Sealed (BK) | Gray | Under seat |
| [208] | HFSM antenna harness | 4-place Deutsch DT Sealed (GY) | Black | Under battery |
| [209] | HFSM antenna | 2-place Molex MX 64 Unsealed (BK) | Gray | Under seat |
| [210] | Fuel Tank Ground (XR) | 1-place molded (BK) | | Under fuel tank cover |
| [266] | Anti-theft tracking module | 4-place Delphi GT 150 Sealed (BK) | Gray | Under frame |
| [267] | Anti-theft harness to main harness | 3-place Deutsch DT Sealed (BK) | Black | Under battery |
| [Battery ground] | Battery ground | Ring terminal (BK) | | Top of transmission case |
| [GND 1] | Harness ground | Ring terminal (BK) | | Left side behind starter |

# WIRING DIAGRAMS B.2

## 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.

**For Striped Wires:** The code is written with a slash (/) between the solid color code and the stripe code. 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 [ ]. The letter inside the brackets identifies whether the housing is a socket or pin housing.

**A=Pin:** The letter A and the pin symbol after a connector number identifies the pin side of the terminal connectors.

**B=Socket:** The letter B and the socket symbol after a connector number identifies the socket side of the terminal connectors. Other symbols found on the wiring diagrams include the following:

**Diode:** The diode allows current flow in one direction only in a circuit.

**Wire break:** The wire breaks are used to show option variances or page breaks.

**No Connection:** Two wires crossing over each other in a wiring diagram that are shown with no splice indicating they are not connected together.

**Circuit to/from:** This symbol indicates a more complete circuit diagram on another page. The symbol is also identifying the direction of current flow.

**Splice:** Splices are where two or more wires are connected together along a wiring diagram. The indication of a splice only indicates that wires are spliced to that circuit. It is not the true location of the splice in the wiring harness.

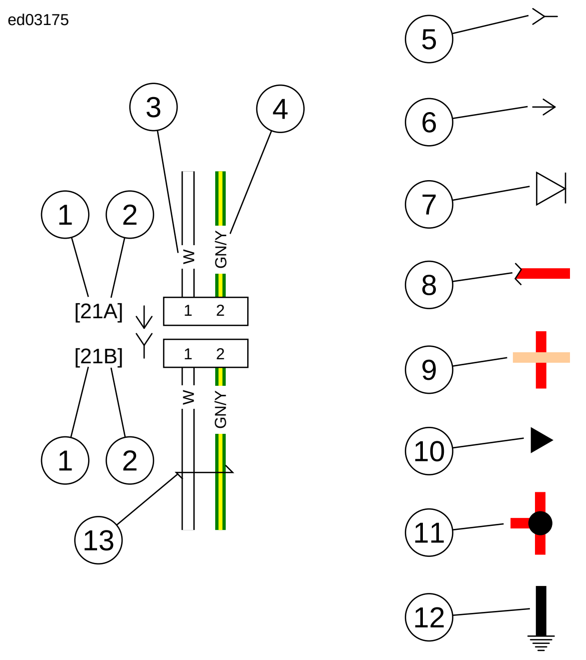
**Ground:** Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

*NOTE*

*Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.*

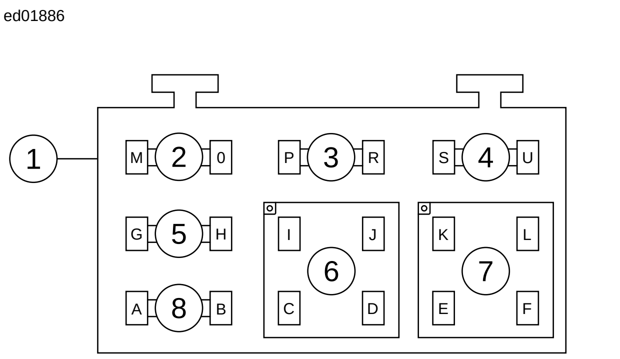
Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

**Twisted pair:** This symbol indicates the two wires are twisted together in the harness. This minimizes the circuit's electromagnetic interference from external sources. If repairs are necessary to these wires they should remain as twisted wires.




**1. Connector number**
**2. Terminal code (A=pin, B=socket)**
**3. Solid wire color**
**4. Striped wire color**
**5. Socket symbol**
**6. Pin symbol**
**7. Diode**
**8. Wire break**
**9. No connection**
**10. Circuit to/from**
**11. Splice**
**12. Ground**
**13. Twisted pair**

**Figure B-1. Connector/Wiring Diagram Symbols**




1. [61B] Fuse block top view (located under left side cover)
2. ACCY fuse
3. Battery fuse
4. ECM fuse
5. Lights fuse
6. Start relay
7. System relay
8. Ignition fuse

**Figure B-2. Fuse Block and Socket Terminals**

**Table B-2. Wire Color Codes**

| ALPHA CODE | WIRE COLOR |
|---|---|
| BE | Blue |
| BK | Black |
| BN | Brown |
| GN | Green |
| GY | Gray |
| LGN | Light Green |
| O | Orange |
| PK | Pink |
| R | Red |
| TN | Tan |
| V | Violet |
| W | White |
| Y | Yellow |

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## 2013 SPORTSTER WIRING DIAGRAMS

Refer to the table below for wiring diagram information.

# Wiring Diagram List

| DIAGRAM | LOCATION |
|---|---|
| Battery Power | Figure B-3 |
| Ignition Power | Figure B-4 |
| Accessory Power | Figure B-5 |
| Chassis Grounds | Figure B-6 |
| Main Harness: 2013 Sportster | Figure B-7 |
| Engine Management: 2013 Sportster | Figure B-8 |
| Starting and Charging Circuit: 2013 Sportster | Figure B-9 |
| Lighting (1 of 2): 2013 Sportster | Figure B-10 |
| Lighting (2 of 2): 2013 Sportster | Figure B-11 |
| Instrument, Indicators, and Hand Controls: 2013 Sportster | Figure B-12 |
| Security Circuit: 2013 Sportster | Figure B-13 |
| Security Circuit with Anti-Theft Tracking Module: 2013 Sportster | Figure B-14 |

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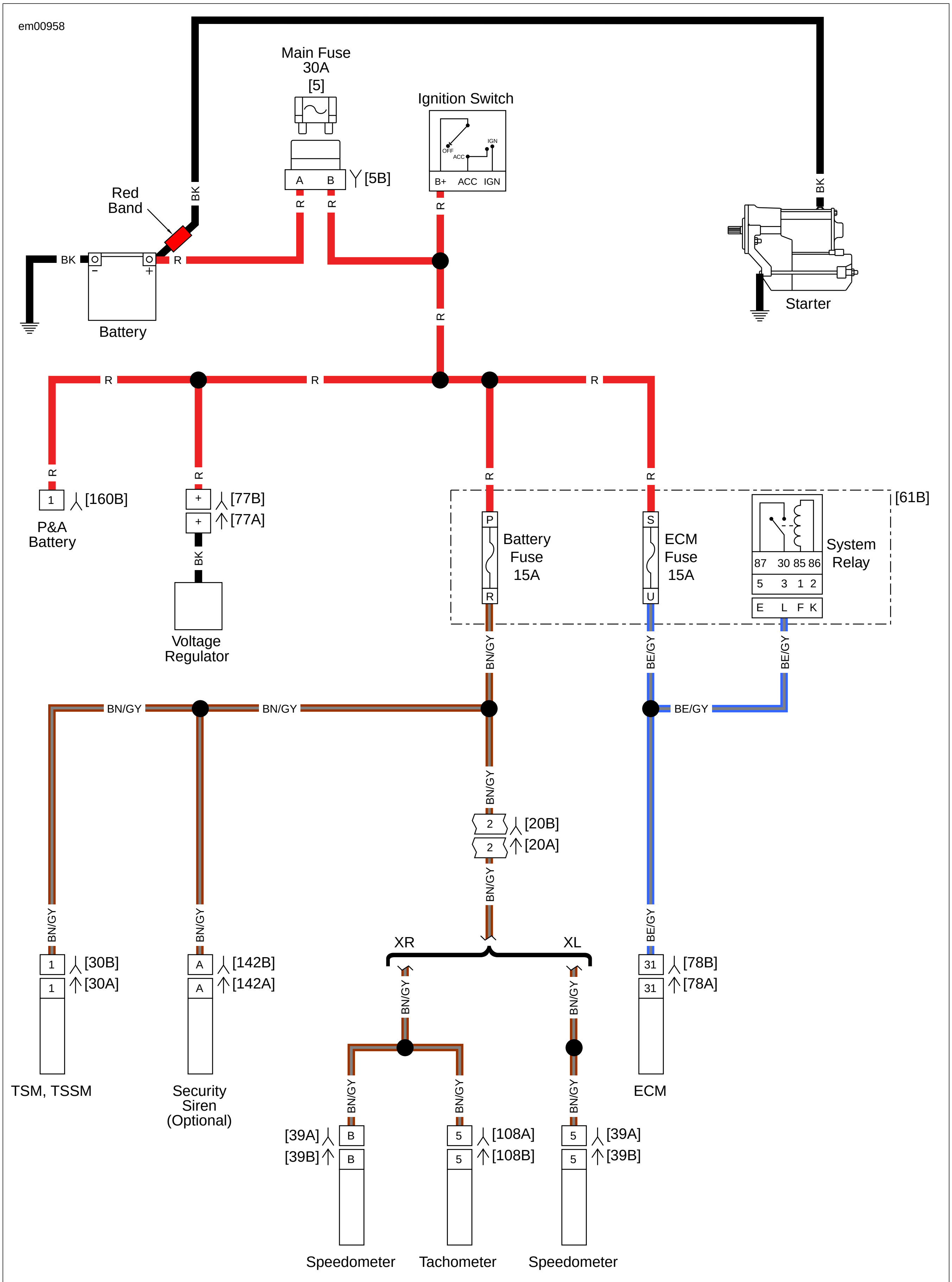


**Figure B-3. Battery Power**

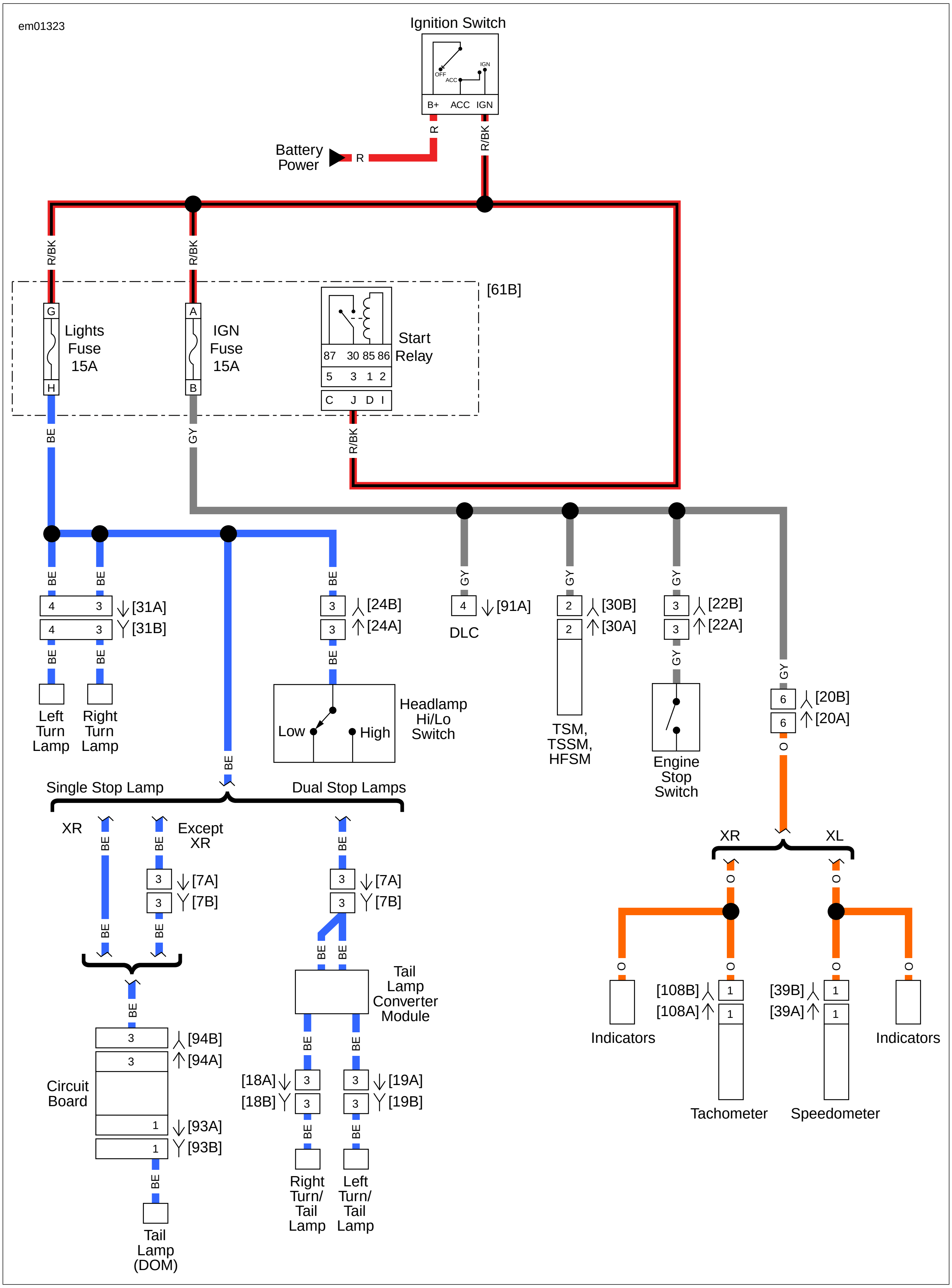


**Figure B-4. Ignition Power**

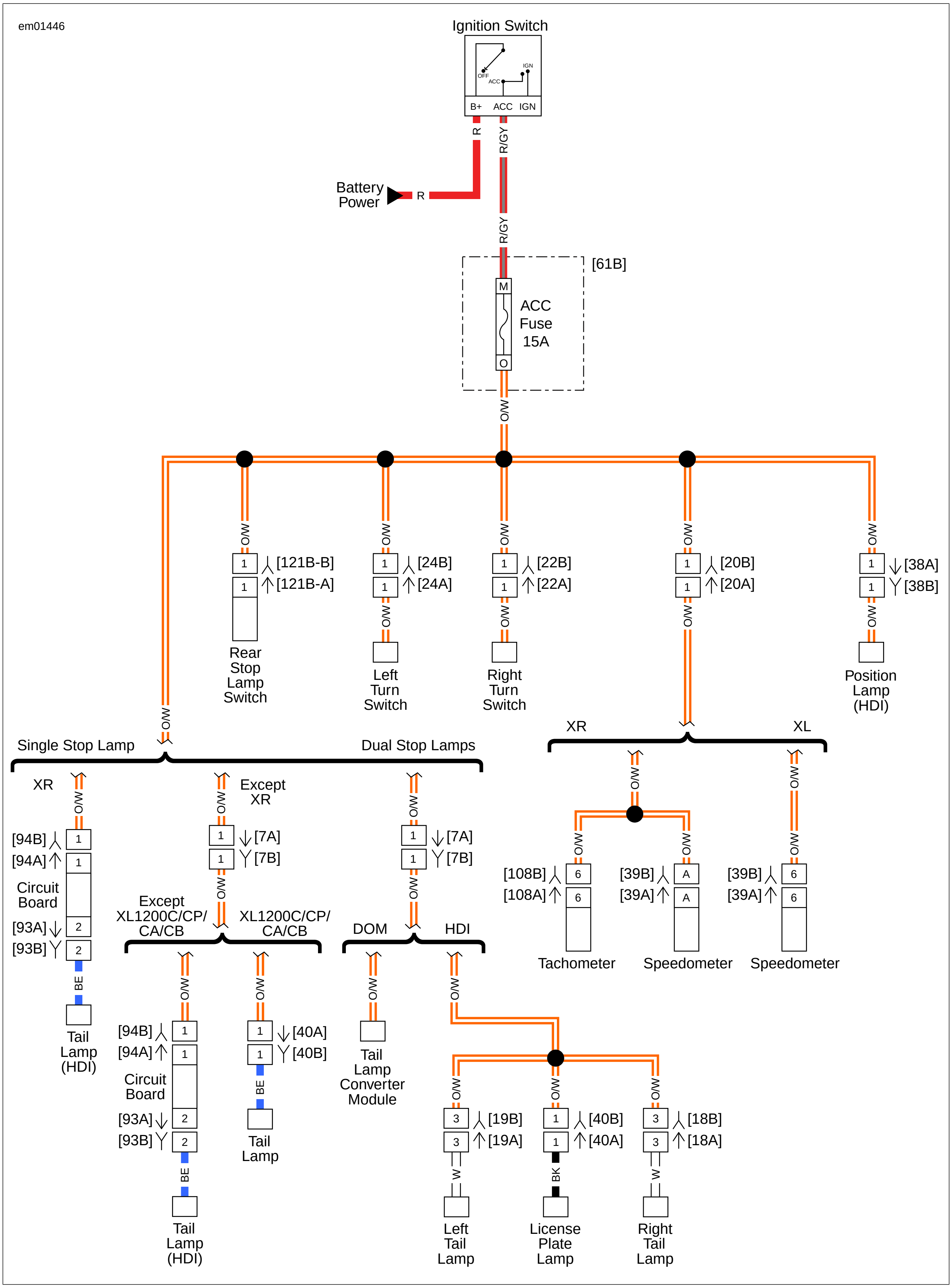


**Figure B-5. Accessory Power**

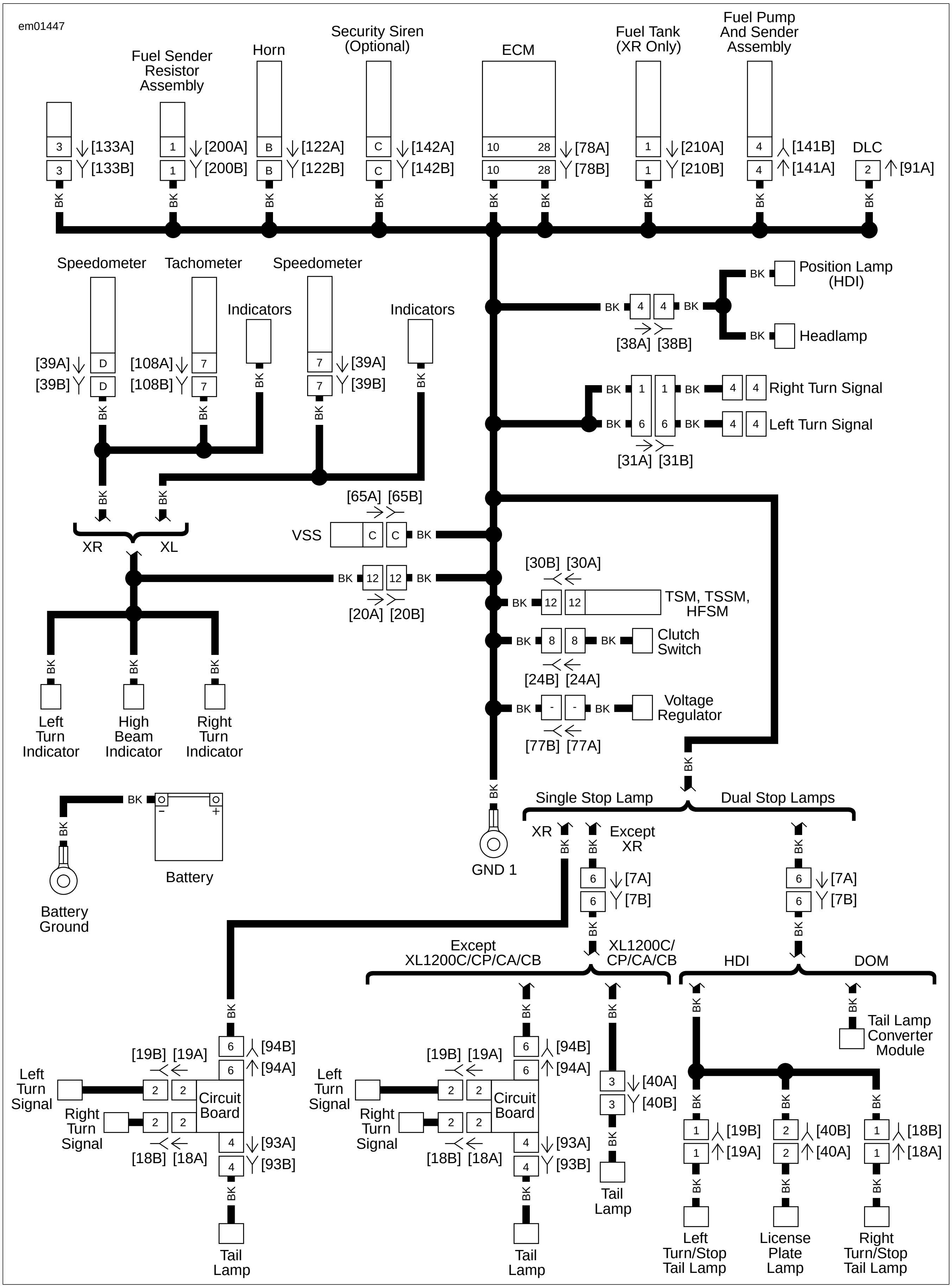


**Figure B-6. Chassis Grounds**

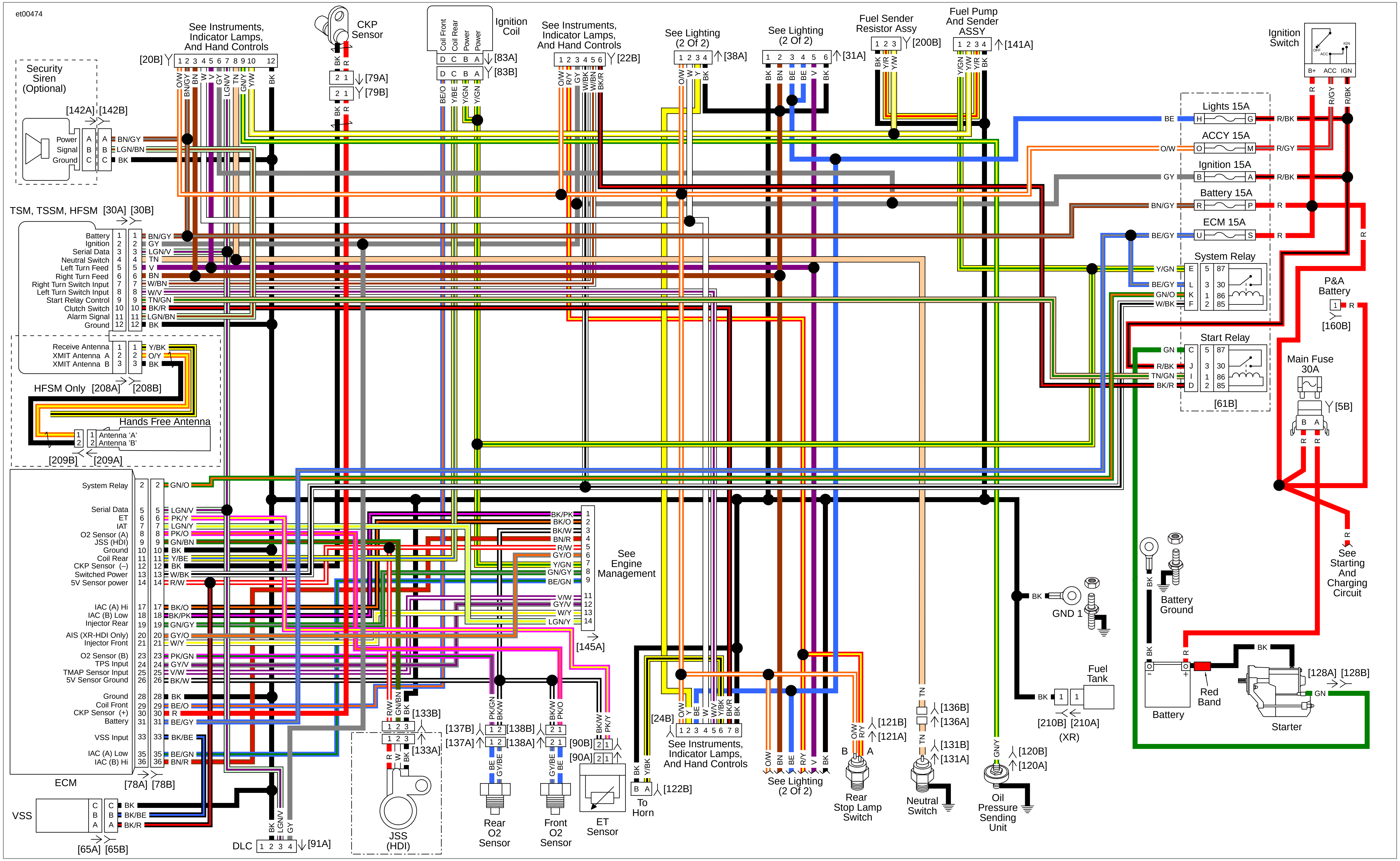


Figure B-7. Main Harness: 2013 Sportster

**Figure B-7.**
**Main Harness: 2013 Sportster**

**Figure B-7.**
**Main Harness: 2013 Sportster**

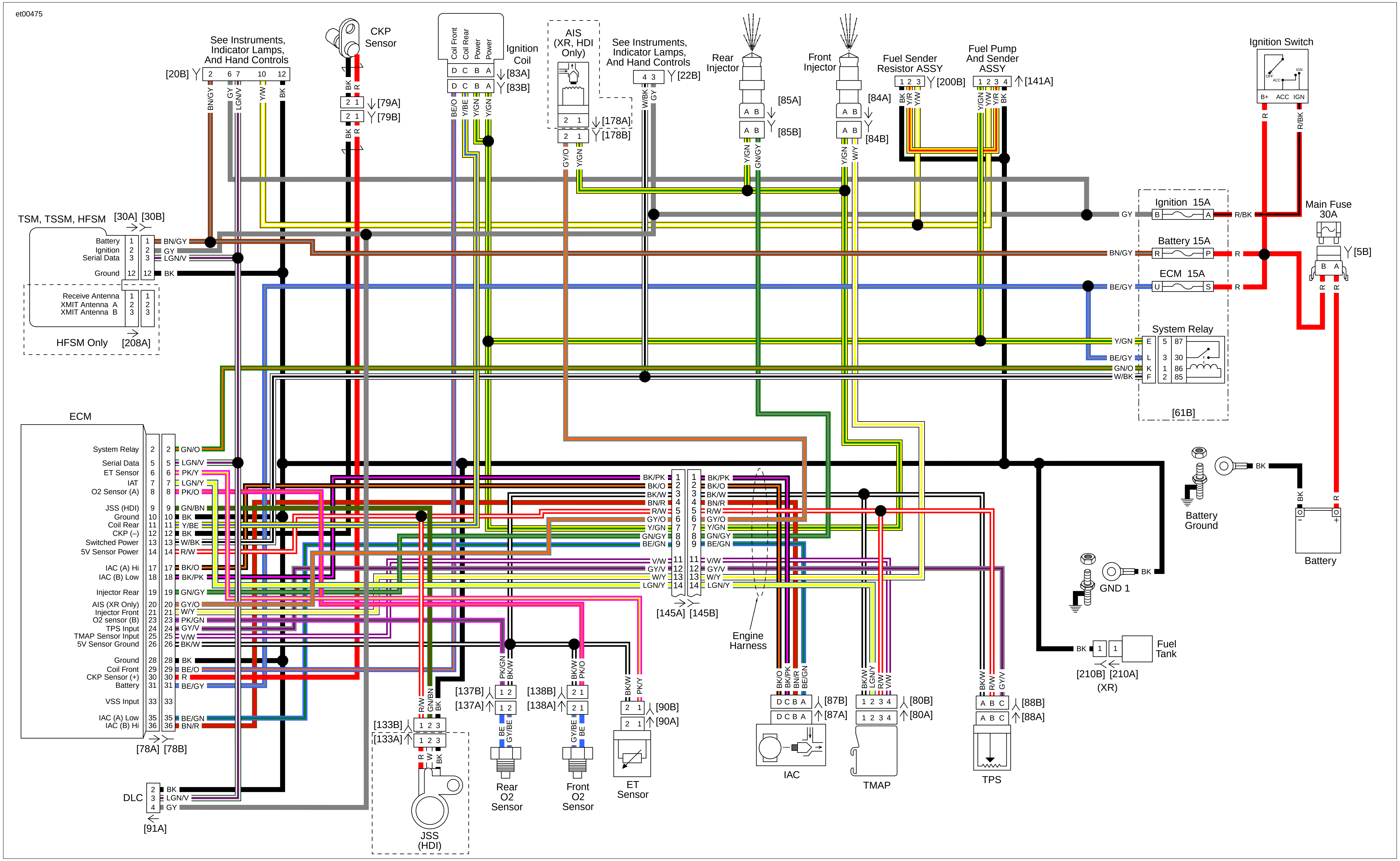


**Figure B-8. Engine Management: 2013 Sportster**

**Figure B-8.**
**Engine Management: 2013 Sportster**

**Figure B-8.**
**Engine Management: 2013 Sportster**

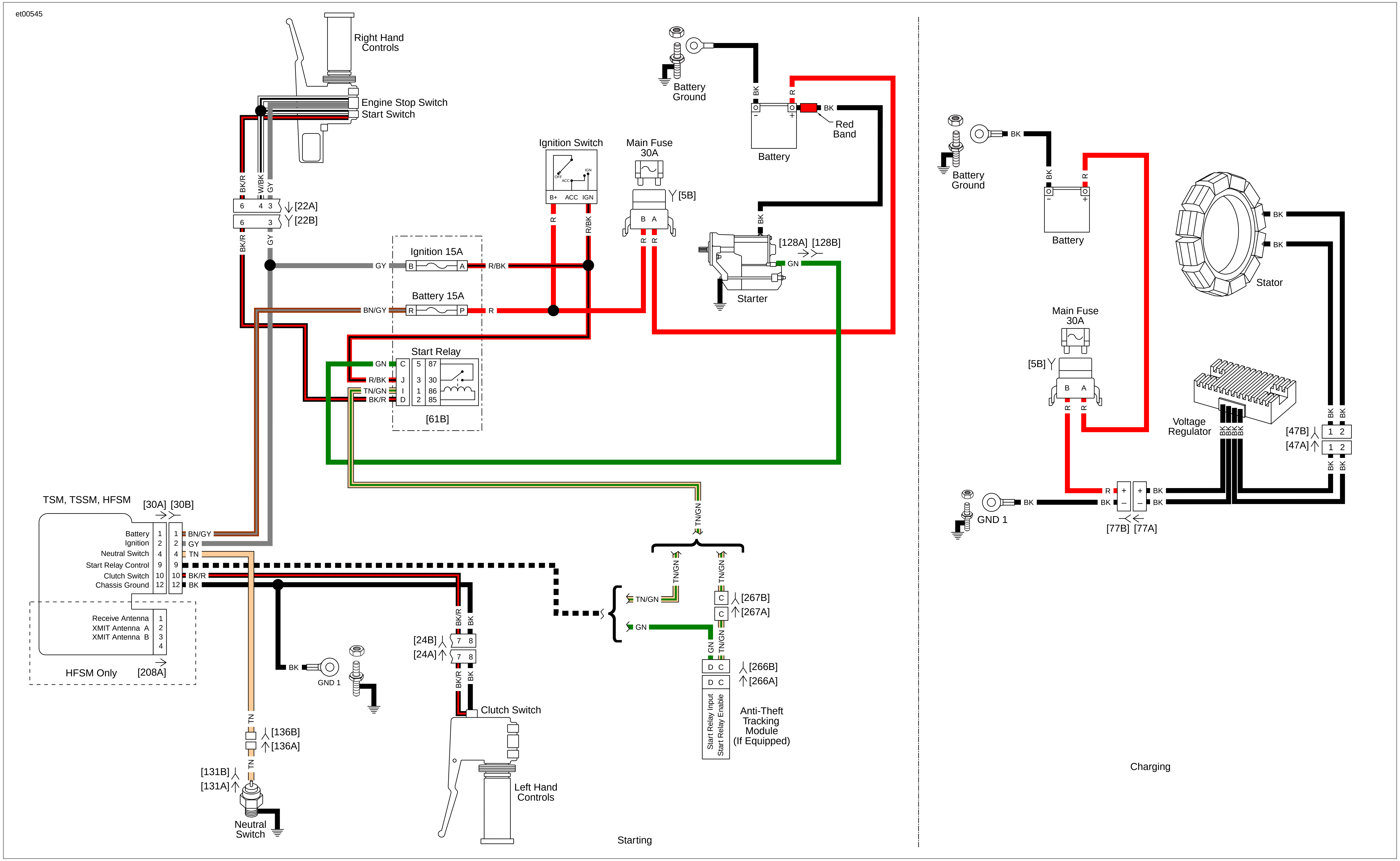


**Figure B-9. Starting and Charging Circuit: 2013 Sportster**

**Figure B-9.**
**Starting and Charging Circuit: 2013 Sportster**

**Figure B-9.**
**Starting and Charging Circuit: 2013 Sportster**

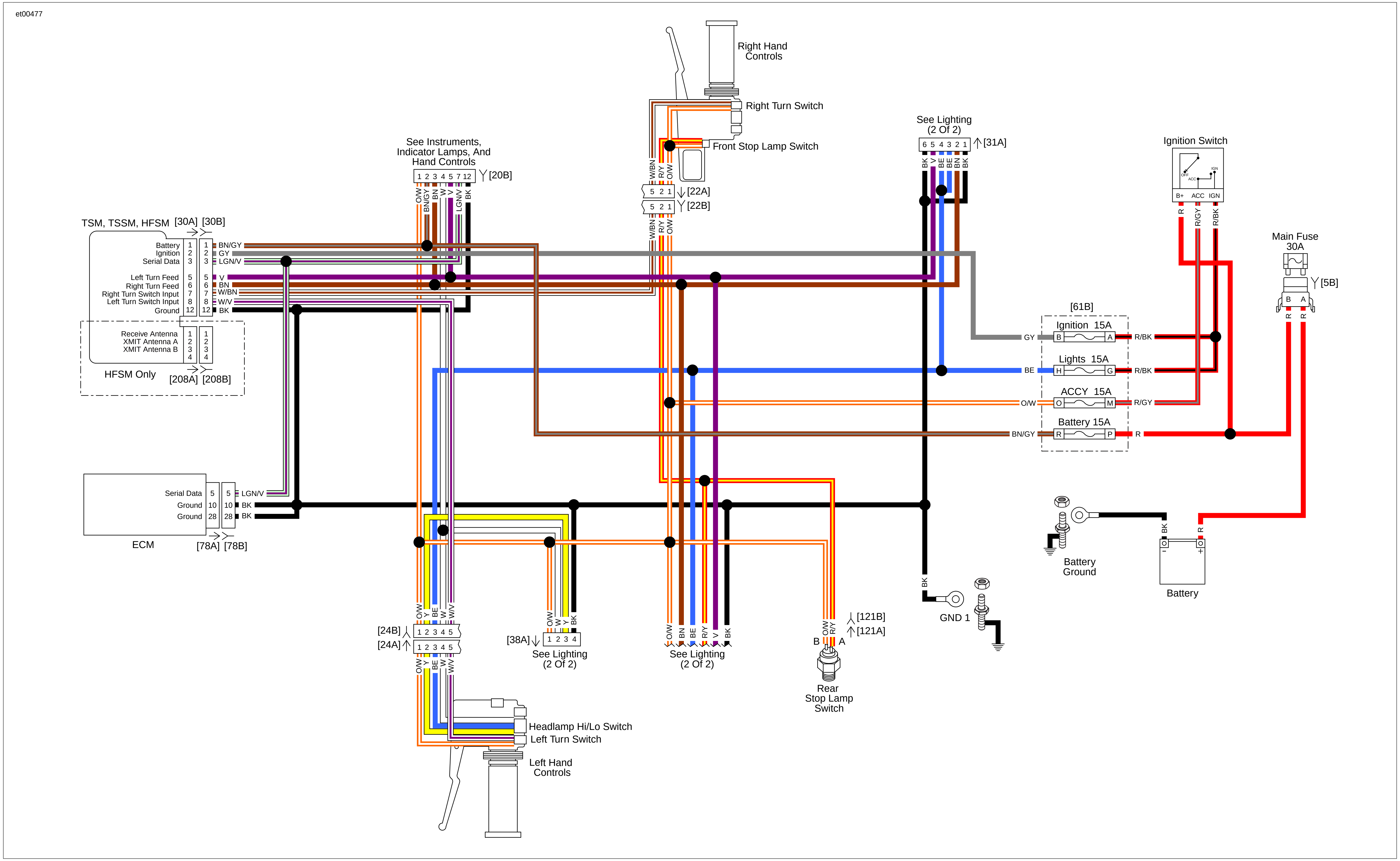


**Figure B-10. Lighting (1 of 2): 2013 Sportster**

**Figure B-10.**
**Lighting (1 of 2): 2013 Sportster**

**Figure B-10.**
**Lighting (1 of 2): 2013 Sportster**

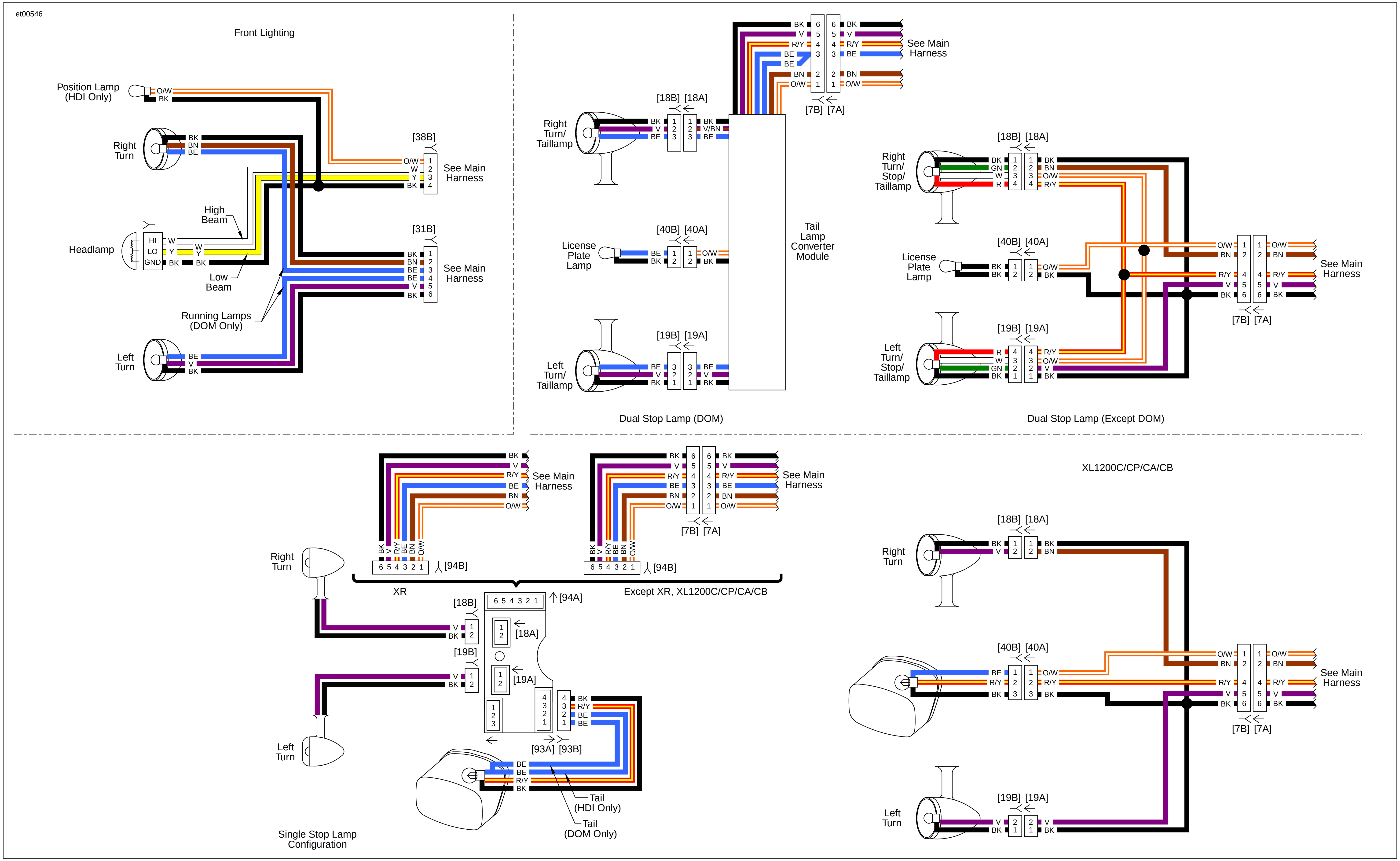


**Figure B-11. Lighting (2 of 2): 2013 Sportster**

**Figure B-11.**
**Lighting (2 of 2): 2013 Sportster**

**Figure B-11.**
**Lighting (2 of 2): 2013 Sportster**

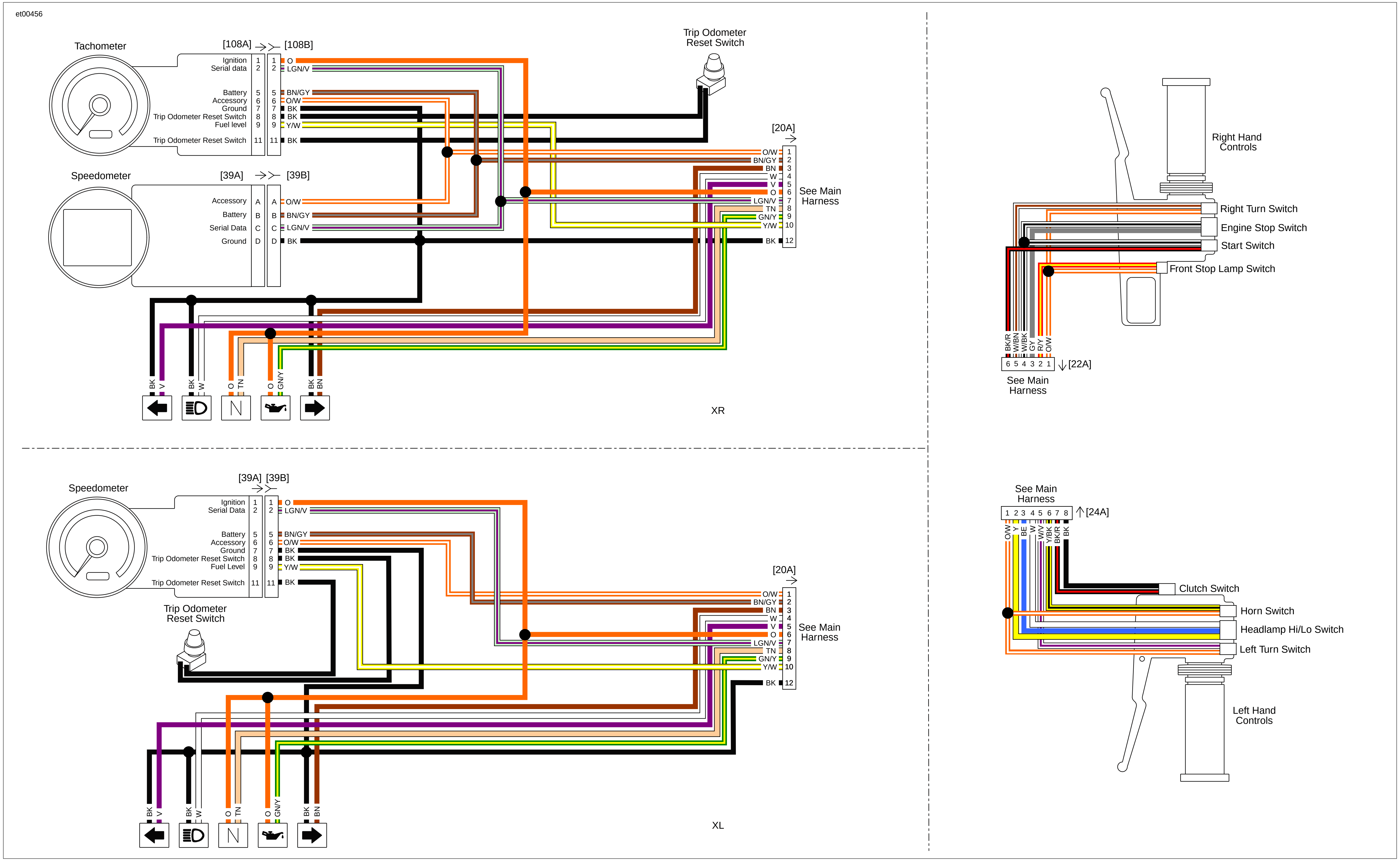


**Figure B-12. Instrument, Indicators, and Hand Controls: 2013 Sportster**

**Figure B-12.**
**Instrument, Indicators, and Hand Controls: 2013 Sportster**

**Figure B-12.**
**Instrument, Indicators, and Hand Controls: 2013 Sportster**

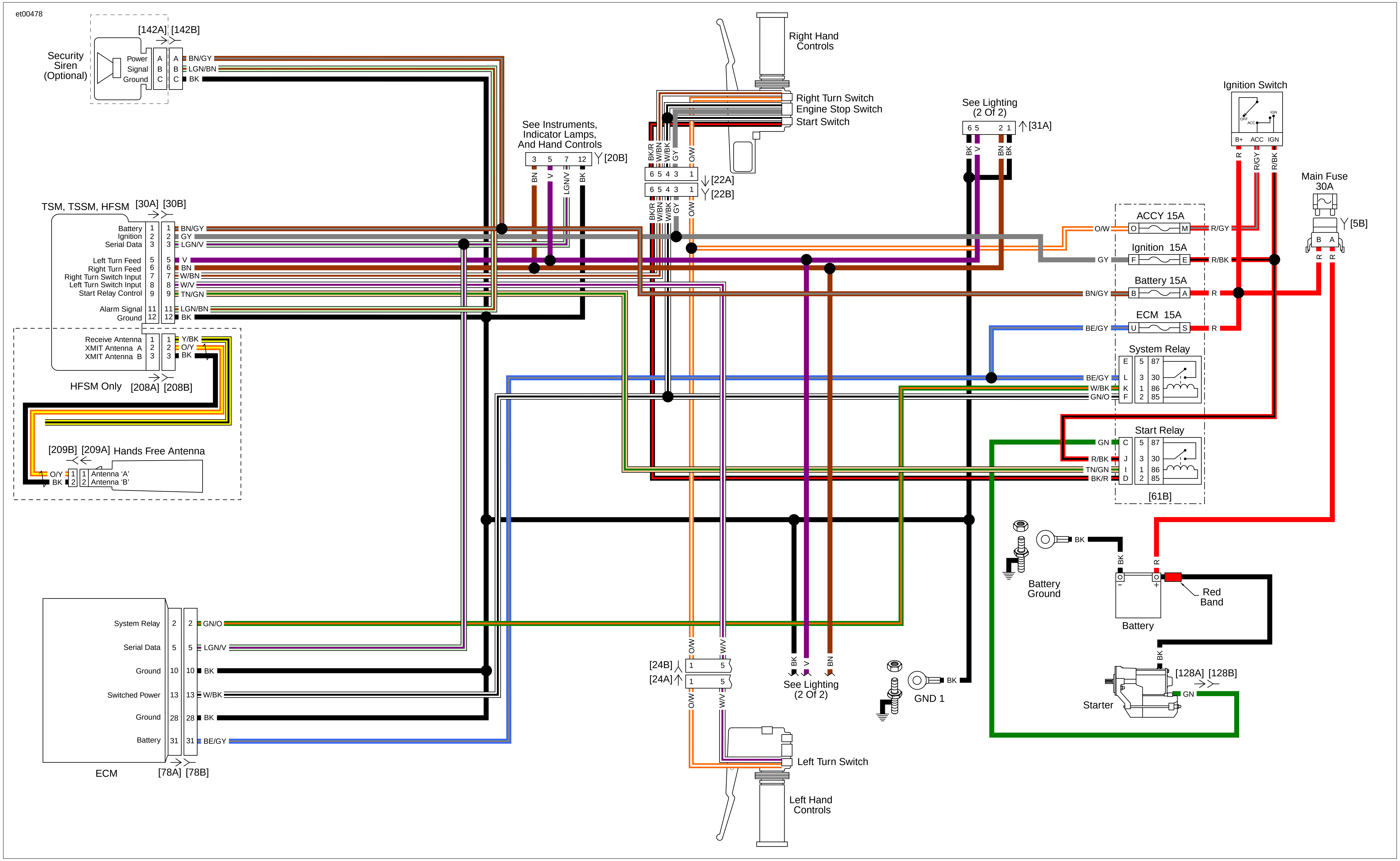


**Figure B-13. Security Circuit: 2013 Sportster**

**Figure B-13.**
**Security Circuit: 2013 Sportster**

**Figure B-13.**
**Security Circuit: 2013 Sportster**

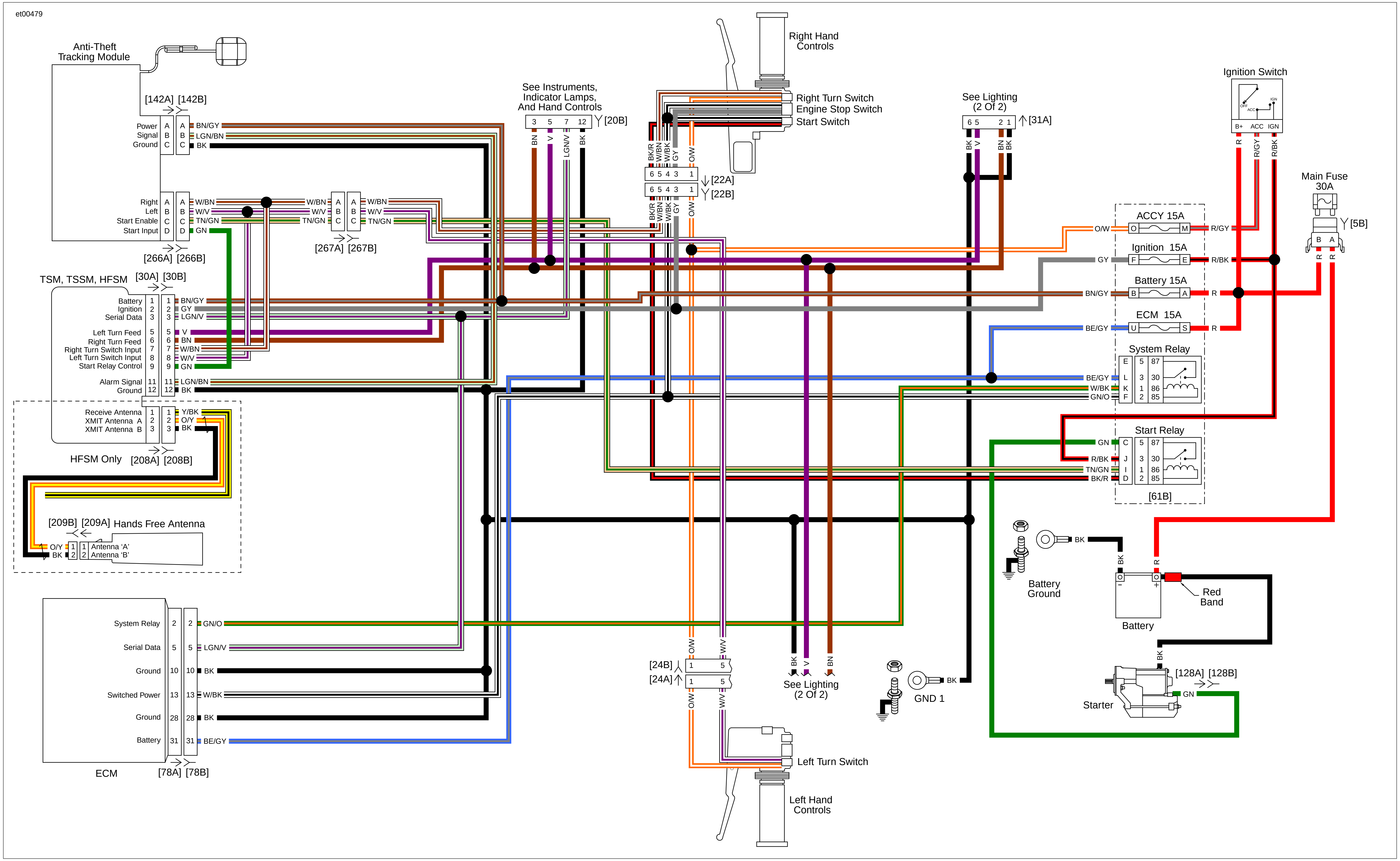


**Figure B-14. Security Circuit with Anti-Theft Tracking Module: 2013 Sportster**

**Figure B-14.**
**Security Circuit with Anti-Theft Tracking Module: 2013 Sportster**

**Figure B-14.**
**Security Circuit with Anti-Theft Tracking Module: 2013 Sportster**

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**SUBJECT** **PAGE NO.**

# NOTES

# 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 |

# FLUID CONVERSIONS C.2

## 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). To convert between U.S. units-of-measure and metric units-of-measure, 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. To convert between U.S. units and British Imperial units, 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 C.3

## UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

## METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

# NOTES

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# NOTES

# GLOSSARY D.1

## ACRONYMS AND ABBREVIATIONS

**Table D-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| A | Amperes |
| AAT | Ambient air temperature |
| ABS | Anti-lock braking system |
| AC | Alternating current |
| ACC | Accessory position on ignition switch |
| ACR | Automatic compression release |
| AGM | Absorbed glass mat (battery) |
| Ah | Ampere-hour |
| AIS | Active Intake Solenoid |
| AWG | American wire gauge |
| B+ | Battery voltage |
| bar | Bar |
| BAS | Bank angle sensor |
| BCM | Body control module |
| BOB | Breakout box |
| BTDC | Before top dead center |
| °C | Celsius (Centigrade) |
| CA | California |
| CAL | Calibration |
| CAN | Controller area network |
| cc | Cubic centimeters |
| CCA | Cold cranking amps |
| CCW | Counterclockwise |
| CKP | Crankshaft position |
| cm | Centimeters |
| $cm^3$ | Cubic centimeters |
| CW | Clockwise |
| DC | Direct current |
| DLC | Data link connector |
| DOM | Domestic |
| DOT | Department of Transportation |
| DTC | Diagnostic trouble code |
| DVOM | Digital volt ohm meter |
| ECM | Electronic control module |
| ECT | Engine coolant temperature |
| ECU | Electronic Control Unit |
| EEPROM | Electrically erasable programmable read only memory |
| EFI | Electronic fuel injection |
| EHCU | Electro Hydraulic Control Unit |
| ET | Engine temperature |

**Table D-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| EVAP | Evaporative emissions control system |
| °F | Fahrenheit |
| FPS | Fuel pressure sensor |
| ft | Feet |
| ft-lbs | Foot pounds |
| fl oz | Fluid ounce |
| g | Gram |
| gal | Gallon |
| GAWR | Gross axle weight rating |
| GND | Ground (electrical) |
| GPS | Global positioning system |
| GVWR | Gross vehicle weight rating |
| HCU | Hydraulic control unit |
| HDI | Harley-Davidson International |
| H-DSSS | Harley-Davidson smart security system |
| HFSM | Hands-free security module |
| Hg | Mercury |
| H02S | Heated oxygen sensor |
| hp | Horsepower |
| hr | Hour |
| IAC | Idle air control |
| IAT | Intake air temperature |
| IC | Instrument cluster |
| ID | Inside diameter |
| IGN | Ignition light/key switch position |
| in | inch |
| $in^3$ | Cubic inch |
| INJ PW | Injector pulse width |
| **in-lbs** | Inch pounds |
| JSS | Jiffy stand sensor |
| kg | Kilogram |
| km | Kilometer |
| km/h | Kilometers per hour |
| kPa | Kilopascal |
| kW | Kilowatt |
| L | Liter |
| lb | Pounds |
| LCD | Liquid crystal display |
| LED | Light emitting diode |
| LH | Left hand |
| LHCM | Left hand control module |
| LP | License plate |
| LT | Left |

**Table D-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| mA | Milliampere |
| MAP | Manifold absolute pressure |
| max | Maximum |
| mi | Mile |
| min | Minimum |
| mL | Milliliter |
| mm | Millimeter |
| mph | Miles per hour |
| ms | Millisecond |
| Nm | Newton-meter |
| NIM | Navigation interface module |
| NiMH | Nickel metal hydride |
| N/A | Not applicable |
| O2 | Oxygen |
| OD | Outside diameter |
| OEM | Original equipment manufacturer |
| oz | Ounce |
| P&A | Parts and Accessories |
| Part No. | Part number |
| PIN | Personal identification number |
| psi | Pounds per square inch |
| PWM signal | Pulse width modulated signal |
| qt | Quart |
| RCM | Reverse control module |
| RES | Reserve mark on fuel supply valve |
| RH | Right hand |
| RHCM | Right hand control module |
| rpm | Revolutions per minute |
| RT | Right |
| s | Seconds |
| SCFH | Cubic feet per hour at standard conditions |
| SDARS | Satellite digital audio radio service |
| SPDO | Speedometer |
| SPKR | Speaker |
| STT | Stop/tail/turn |
| TCA | Throttle control actuator |
| TDC | Top dead center |
| TGS | Twist grip sensor |
| TPS | Throttle position sensor |
| TSM | Turn signal module |
| TSSM | Turn signal/security module |
| V | Volt |
| VAC | Volts of alternating current |

**Table D-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| VDC | Volts of direct current |
| VIN | Vehicle identification number |
| VR | Voice recognition |
| VSS | Vehicle speed sensor |
| W | Watt |
| WSS | Wheel speed sensor |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| 99861-02 | ELECTRICAL CONTACT LUBRICANT | 5.3 TURN SIGNALS, Flash at Double Normal Rate, No DTCs |
| B-0085 | TERMINAL EXTRACTOR | A.22 TYCO MCP SEALED CONNECTOR, Tyco MCP Sealed Connector |
| B-50085 | TERMINAL EXTRACTOR | A.17 JAE MX19 SEALED CONNECTORS, JAE MX19 Sealed Connectors |
| B-50085 | TERMINAL EXTRACTOR | A.21 TYCO GET 64 SEALED CONNECTOR, Tyco GET 64 Sealed Connector |
| GA500A | SNAP-ON TERMINAL PICK | A.1 AUTOFUSE UNSEALED ELECTRICAL CON-NECTORS, Autofuse Unsealed Connector Repair |
| GA500A | SNAP-ON TERMINAL PICK | A.22 TYCO MCP SEALED CONNECTOR, Tyco MCP Sealed Connector |
| GRX-3110 HD | BATTERY DIAGNOSTIC STATION | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| GRX-3110 HD | BATTERY DIAGNOSTIC STATION | 3.1 BATTERY TESTING, Battery Diagnostic Test |
| HD-23738 | VACUUM PUMP | 6.4 DTC P0107, P0108, Description and Operation |
| HD-25070 | HEAT GUN | A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-26792 | SPARK TESTER | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-26792 | SPARK TESTER | 6.20 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start |
| HD-26792 | SPARK TESTER | 6.23 HESITATION, LOSS OF POWER, Hesitation, Loss of Power Test |
| HD-26792 | SPARK TESTER | 6.24 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 5.3 TURN SIGNALS, One Turn Signal Lamp Inoperative, No DTCs |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0261 |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0263 |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1351 |
| HD-34730-2E | FUEL INJECTOR TEST LIGHT | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1354 |
| HD-38125-6 | PACKARD TERMINAL CRIMP TOOL | A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps |
| HD-38125-7 | PACKARD TERMINAL CRIMPER | A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps |
| HD-38125-7 | PACKARD TERMINAL CRIMPER | A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR, Deutsch DTM Sealed Mini Terminal Crimps |
| HD-38125-8 | PACKARD CRIMPING TOOL | A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps |
| HD-38125-8 | PACKARD CRIMPING TOOL | A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-39965-A | DEUTSCH TERMINAL CRIMP TOOL | A.14 DEUTSCH DT SEALED TERMINAL REPAIR, Deutsch DT Sealed Terminal Crimps |
| HD-39969 | ULTRA TORCH | A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-39978 | DIGITAL MULTIMETER (FLUKE 78) | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-39978 | DIGITAL MULTIMETER (FLUKE 78) | 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test |
| HD-41183 | HEAT SHIELD ATTACHMENT | A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-41199-3 | IAC TEST LIGHT | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-41199-3 | IAC TEST LIGHT | 6.12 DTC P0505, DTC P0505 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 2.4 DTC U1300, U1301 OR BUS ER, DTC U1301 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 3.2 STARTING SYSTEM, Starter Testing |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 3.2 STARTING SYSTEM, Start Relay Clicks |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 3.6 DTC B0563, P0562, P0563, DTC P0562 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 4.2 DTC B1004, B1005, DTC B1005 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.3 TURN SIGNALS, Both Turn Signal Lamps on One Side Inoperative, No DTCs |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.3 TURN SIGNALS, Both Turn Signal Lamps on One Side Inoperative, No DTCs |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.3 TURN SIGNALS, One Turn Signal Lamp Inoperative, No DTCs |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1121: TSM or TSSM |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1122: TSM or TSSM |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1123 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1124 |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1125 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1126 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.8 DTC B1135, B1136, B1141, B1142, DTC B1141 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.13 FAILS TO DISARM, Fails to Disarm: HFSM |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.14 DTC B1131, B1132, DTC B1131 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.14 DTC B1131, B1132, DTC B1131 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.14 DTC B1131, B1132, DTC B1132 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.15 DTC B1134, DTC B1134 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.17 DTC B1154, B1155, DTC B1154 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 5.17 DTC B1154, B1155, DTC B1155 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.4 DTC P0107, P0108, DTC P0107 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.5 DTC P0112, P0113, DTC P0112 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.5 DTC P0112, P0113, DTC P0113 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.6 DTC P0117, P0118, DTC P0117 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.6 DTC P0117, P0118, DTC P0118 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.6 DTC P0117, P0118, DTC P0118 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.7 DTC P0122, P0123, DTC P0123 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0131 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0134 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0261 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0262 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0263 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0264 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.11 DTC P0501, P0502, DTC P0501 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.11 DTC P0501, P0502, DTC P0502 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.14 DTC P0661, P0662, DTC P0661, P0662 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.16 DTC P1001, P1002, P1003, P1004, DTC P1002 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1351 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1352 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1355 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.18 DTC P1501, P1502, DTC P1501 |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.20 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.21 NO ECM POWER, No ECM Power |
| HD-41404 | HARNESS CONNECTOR TEST KIT | 6.24 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load |
| HD-41475 | DEUTSCH TERMINAL REPAIR KIT | A.13 DEUTSCH DT SEALED CONNECTORS, Deutsch DT Sealed Connector Repair |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-41475-100 | FLAT BLADE L-HOOK | A.13 DEUTSCH DT SEALED CONNECTORS, Deutsch DT Sealed Connector Repair |
| HD-41609 | AMP MULTI-LOCK CRIMPER | A.20 TYCO 070 MULTILOCK UNSEALED CON-NECTOR, Tyco 070 Multilock Unsealed Connector Repair |
| HD-41609 | AMP MULTI-LOCK CRIMPER | A.20 TYCO 070 MULTILOCK UNSEALED CON-NECTOR, Tyco 070 Multilock Unsealed Connector Repair |
| HD-42682 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-42682 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-42682 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-42682 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-42682 | BREAKOUT BOX | 2.4 DTC U1300, U1301 OR BUS ER, DTC U1300 |
| HD-42682 | BREAKOUT BOX | 2.4 DTC U1300, U1301 OR BUS ER, DTC U1301 |
| HD-42682 | BREAKOUT BOX | 3.2 STARTING SYSTEM, Nothing Clicks |
| HD-42682 | BREAKOUT BOX | 4.2 DTC B1004, B1005, DTC B1004 |
| HD-42682 | BREAKOUT BOX | 4.2 DTC B1004, B1005, DTC B1005 |
| HD-42682 | BREAKOUT BOX | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-42682 | BREAKOUT BOX | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-42682 | BREAKOUT BOX | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-42682 | BREAKOUT BOX | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-42682 | BREAKOUT BOX | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-42682 | BREAKOUT BOX | 4.5 INDICATOR LAMPS, Low Fuel Lamp Inoperative |
| HD-42682 | BREAKOUT BOX | 5.3 TURN SIGNALS, Both Turn Signal Lamps on One Side Inoperative, No DTCs |
| HD-42682 | BREAKOUT BOX | 5.3 TURN SIGNALS, Both Turn Signal Lamps on One Side Inoperative, No DTCs |
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1121: HFSM |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1121: TSM or TSSM |
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1122: TSM or TSSM |
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1124 |
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1125 |
| HD-42682 | BREAKOUT BOX | 5.7 DTC B1121, B1122, B1123, B1124, B1125, B1126, DTC B1126 |
| HD-42682 | BREAKOUT BOX | 5.8 DTC B1135, B1136, B1141, B1142, DTC B1141 |
| HD-42682 | BREAKOUT BOX | 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: HFSM |
| HD-42682 | BREAKOUT BOX | 5.14 DTC B1131, B1132, DTC B1131 |
| HD-42682 | BREAKOUT BOX | 5.14 DTC B1131, B1132, DTC B1131 |
| HD-42682 | BREAKOUT BOX | 5.14 DTC B1131, B1132, DTC B1132 |
| HD-42682 | BREAKOUT BOX | 5.14 DTC B1131, B1132, DTC B1132 |
| HD-42682 | BREAKOUT BOX | 5.17 DTC B1154, B1155, DTC B1154 |
| HD-42682 | BREAKOUT BOX | 5.17 DTC B1154, B1155, DTC B1155 |
| HD-42879 | ELECTRICAL CRIMPER TOOL | A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR, Deutsch DTM Sealed Solid Barrel Terminal Crimps |
| HD-43876 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-43876 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-43876 | BREAKOUT BOX | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-43876 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-43876 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-43876 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-43876 | BREAKOUT BOX | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-43876 | BREAKOUT BOX | 3.6 DTC B0563, P0562, P0563, DTC P0562 |
| HD-43876 | BREAKOUT BOX | 6.4 DTC P0107, P0108, DTC P0107 |
| HD-43876 | BREAKOUT BOX | 6.5 DTC P0112, P0113, DTC P0112 |
| HD-43876 | BREAKOUT BOX | 6.5 DTC P0112, P0113, DTC P0113 |
| HD-43876 | BREAKOUT BOX | 6.6 DTC P0117, P0118, DTC P0117 |
| HD-43876 | BREAKOUT BOX | 6.6 DTC P0117, P0118, DTC P0118 |
| HD-43876 | BREAKOUT BOX | 6.7 DTC P0122, P0123, DTC P0122 |
| HD-43876 | BREAKOUT BOX | 6.7 DTC P0122, P0123, DTC P0123 |
| HD-43876 | BREAKOUT BOX | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0131 |
| HD-43876 | BREAKOUT BOX | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0134 |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-43876 | BREAKOUT BOX | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151 |
| HD-43876 | BREAKOUT BOX | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0261 |
| HD-43876 | BREAKOUT BOX | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0261 |
| HD-43876 | BREAKOUT BOX | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0263 |
| HD-43876 | BREAKOUT BOX | 6.9 DTC P0261, P0262, P0263, P0264, DTC P0263 |
| HD-43876 | BREAKOUT BOX | 6.10 DTC P0373, P0374, DTC P0374 |
| HD-43876 | BREAKOUT BOX | 6.11 DTC P0501, P0502, DTC P0501 |
| HD-43876 | BREAKOUT BOX | 6.11 DTC P0501, P0502, DTC P0502 |
| HD-43876 | BREAKOUT BOX | 6.12 DTC P0505, DTC P0505 |
| HD-43876 | BREAKOUT BOX | 6.16 DTC P1001, P1002, P1003, P1004, DTC P1001 |
| HD-43876 | BREAKOUT BOX | 6.16 DTC P1001, P1002, P1003, P1004, DTC P1004 |
| HD-43876 | BREAKOUT BOX | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1351 |
| HD-43876 | BREAKOUT BOX | 6.17 DTC P1351, P1352, P1354, P1355, DTC P1354 |
| HD-43876 | BREAKOUT BOX | 6.18 DTC P1501, P1502, DTC P1501 |
| HD-43876 | BREAKOUT BOX | 6.21 NO ECM POWER, No ECM Power |
| HD-43876 | BREAKOUT BOX | 6.24 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load |
| HD-44687 | IGNITION COIL CIRCUIT TEST ADAPTER | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-44687 | IGNITION COIL CIRCUIT TEST ADAPTER | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-45928 | TERMINAL REMOVER | 4.3 DTC B1008, DTC B1008 |
| HD-45928 | TERMINAL REMOVER | A.10 DELPHI MICRO 64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair |
| HD-45929 | TERMINAL CRIMPER | A.10 DELPHI MICRO 64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair |
| HD-46601 | BREAKOUT BOX ADAPTERS | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-46601 | BREAKOUT BOX ADAPTERS | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1016 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1064, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1097, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.3 DTC U1016, U1064, U1097, U1098, U1255, DTC U1098, U1255 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.4 DTC U1300, U1301 OR BUS ER, DTC U1300 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 2.4 DTC U1300, U1301 OR BUS ER, DTC U1301 |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.2 DTC B1004, B1005, DTC B1004 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.2 DTC B1004, B1005, DTC B1005 |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.4 NO INSTRUMENT POWER, Speedometer (XL) or Tachometer (XR) Inoperative |
| HD-46601 | BREAKOUT BOX ADAPTERS | 4.5 INDICATOR LAMPS, Low Fuel Lamp Inoperative |
| HD-48114 | TERMINAL REMOVER | A.19 MOLEX MX 150 SEALED CONNECTORS, Molex MX 150 Sealed Connector Repair |
| HD-48119 | TERMINAL CRIMPER | A.19 MOLEX MX 150 SEALED CONNECTORS, Crimp Terminal to Lead |
| HD-48637 | BREAKOUT BOX | 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test |
| HD-48650 | DIGITAL TECHNICIAN II | 1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools |
| HD-48650 | DIGITAL TECHNICIAN II | 1.3 DIAGNOSTICS AND TROUBLESHOOTING, Job/Time Codes Values |
| HD-48650 | DIGITAL TECHNICIAN II | 5.9 SECURITY SYSTEM, TSSM or HFSM Features |
| HD-48650 | DIGITAL TECHNICIAN II | 5.13 FAILS TO DISARM, Description and Operation |
| HD-48650 | DIGITAL TECHNICIAN II | 6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154, Description and Operation |
| HD-48650 | DIGITAL TECHNICIAN II | 6.12 DTC P0505, Description and Operation |
| HD-50120 | UNIVERSAL CRIMPER SET | A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals |
| HD-50120 | UNIVERSAL CRIMPER SET | A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals |
| HD-50120 | UNIVERSAL CRIMPER SET | A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals |
| HD-50120 | UNIVERSAL CRIMPER SET | A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals |
| HD-50120 | UNIVERSAL CRIMPER SET | A.22 TYCO MCP SEALED CONNECTOR, Crimping Terminals |
| HD-50120-2 | HAND CRIMP FRAME | A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals |
| HD-50120-2 | HAND CRIMP FRAME | A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals |
| HD-50120-2 | HAND CRIMP FRAME | A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals |
| HD-50120-2 | HAND CRIMP FRAME | A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals |
| HD-50120-3 | JAE DIE | A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-50120-4 | JAE DIE | A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals |
| HD-50120-6 | JAE DIE | A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals |
| HD-50120-7 | DELPHI 100W MICRO-PACK SEALED DIE | A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals |
| HD-50120-7 | TYCO GET 64 DIE | A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals |
| HD-50120-8 | TYCO MCP DIE | A.22 TYCO MCP SEALED CONNECTOR, Crimping Terminals |
| HD-50423 | 0.6 MM TERMINAL EXTRACTOR TOOL | A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors |
| HD-50424 | 1.5 MM TERMINAL EXTRACTOR TOOL | A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors |
| SNAP-ON TT600-3 | SNAP-ON PICK | A.7 DELPHI 630 METRI-PACK UNSEALED CONNECTORS, Delphi 630 Metri-Pack Unsealed Connector Repair |
| SNAP-ON TT600-3 | SNAP-ON PICK | A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR, Tyco 070 Multilock Unsealed Connector Repair |
| YA840 | SNAP-ON IN-LINE SPARK TESTER | 6.24 MISFIRE AT IDLE OR UNDER LOAD, In-line Spark Tester |

# 2013 Harley-Davidson Sportster Models Electrical Diagnostic Manual

| FASTENER | TORQUE VALUE | NOTES |
|---|---|---|
| No torque values were found in this manual. | | |

# NOTES

## A



## B



## C



## D

## N



## O



## P



## R



## S



## T

## V



## W