

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.

NO.	CHAPTER
1	General Information
2	Initial Diagnostics and Serial Data
3	Starting and Charging
4	Instruments
5	Accessories, Horn, Lighting and Security
6	Engine Management
7	ABS
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D Glossary

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), first disarm the system. 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, Multilock, 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.

H-D MICHIGAN, INC. TRADEMARK INFORMATION

Bar & Shield, Cross Bones, Digital Tech, Digital Technician, Digital Technician II, Dyna, Electra Glide, Evolution, Fat Bob, Fat Boy, Forty-Eight, Glaze, Gloss, H-D, H-Dnet.com, Harley, Harley-Davidson, HD, Heritage Softail, Iron 883, Low Rider, Night Rod, Nightster, Night Train, Profile, Revolution, Road Glide, Road King, Road Tech, Rocker, Screamin' Eagle, Seventy-Two, Softail, Sportster, Street Glide, Street Rod, Sun Ray, Sunwash, Super Glide, SuperLow, Switchback, SYN3, TechLink, TechLink II, Tour-Pak, Twin Cam 88, Twin Cam 88B, Twin Cam 96, Twin Cam 96B, Twin Cam 103, Twin Cam 103B, Twin Cam 110, Twin Cam 110B, Ultra Classic, V-Rod, VRSC and Harley-Davidson Genuine Motor Parts and Genuine Motor Accessories are among the trademarks of H-D Michigan, Inc.

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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.

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SPECIFICATIONS AND COMPONENT LOCATIONS

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SPECIFICATIONS

Table 1-1. Fuel System Specifications

FUEL SYSTEM	TYPE
Intake	Side draft
Recommended fuel	91 Octane

Table 1-2. Idle Speed Specifications

ADJUSTMENT	RPM
Normal idle speed	950-1050 Nominal, non-adjustable

Table 1-3. Battery Specifications

BATTERY	SPECIFICATIONS
Size	12V/19 AH/315CCA
Type	Sealed, AGM

Table 1-4. Spark Plug Specifications

SPARK PLUG	SPECIFICATIONS	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque with anti-seize applied to threads	12-18 ft-lbs	16.3-24.4 Nm
Type	Harley-Davidson No. 6R12	

Table 1-5. Spark Plug Cable Specifications

SPECIFICATION	FRONT	REAR
Length in. (except FXS/B)	18.75-19.50	6.50-6.75
Length mm (except FXS/B)	476.3-495.3	165.1-171.5
Resistance-ohms (except FXS/B)	4688-13,007	1625-4502
Length in. (FXS/B)	7.25-7.75	7.25-7.75
Length mm (FXS/B)	184.2-196.9	184.2-196.9
Resistance-ohms (FXS/B)	1813-5170	1813-5170

Table 1-6. Ignition Coil Specifications

WINDING	RESISTANCE
Ignition coil primary resistance at room temperature	0.3-1.5 Ohm
Ignition coil secondary resistance at room temperature (except FXS/B)	5500-7500 Ohms
Ignition coil secondary resistance at room temperature (FXS/B)	2500-3500 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	16-23 VAC per 1000 rpm
Stator coil resistance	0.1-0.2 Ohm

Table 1-10. Regulator Specifications

MEASUREMENT	VALUE
Amperes @ 3600 rpm	35-50A
Voltage @ 3600 rpm	14.3-14.7V @ 75 °F (24 °C)

Table 1-11. Fuse Specifications

ITEM	RATING (AMPERES)
Battery fuse	15
Main fuse	40
P&A fuse	15

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.

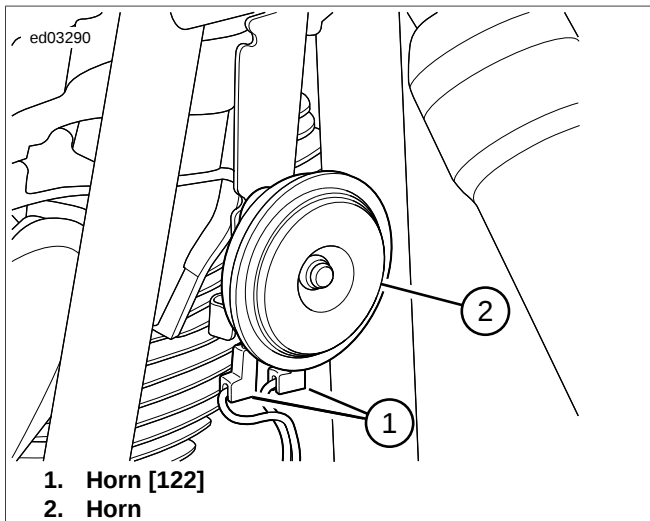


Figure 1-1. Horn: FXS/B

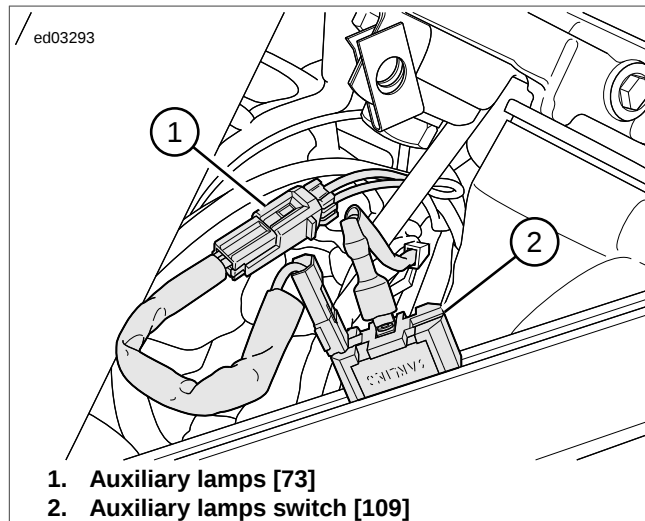


Figure 1-4. Auxiliary Lamps: FLSTC, FLSTN

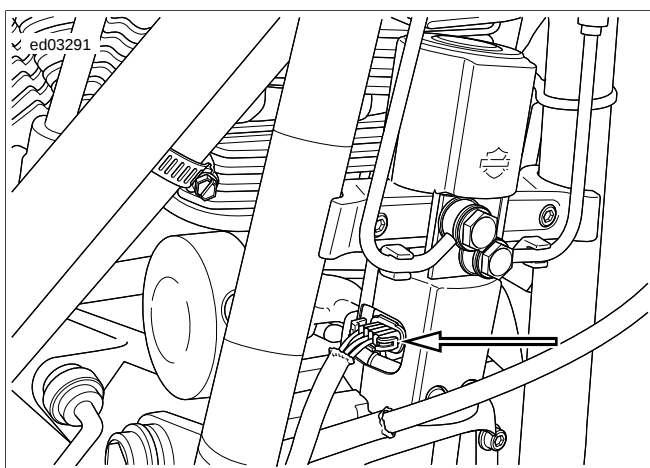


Figure 1-2. Front HCU [254]

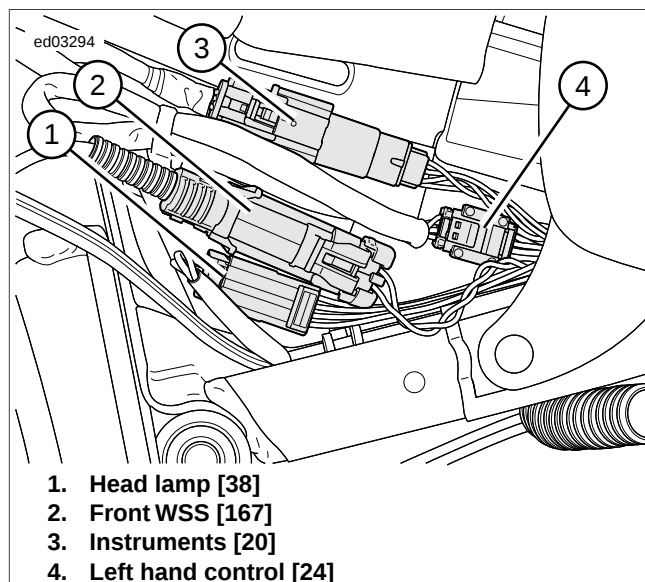


Figure 1-5. Under Fuel Tank Left Side

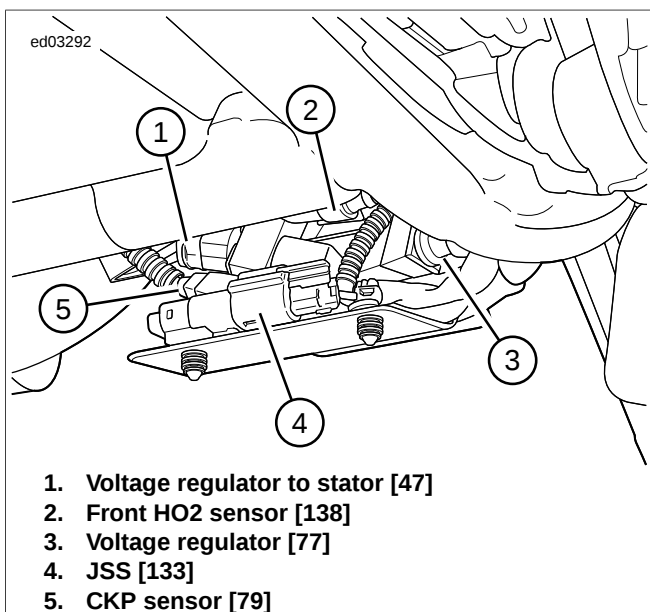


Figure 1-3. Under Voltage Regulator

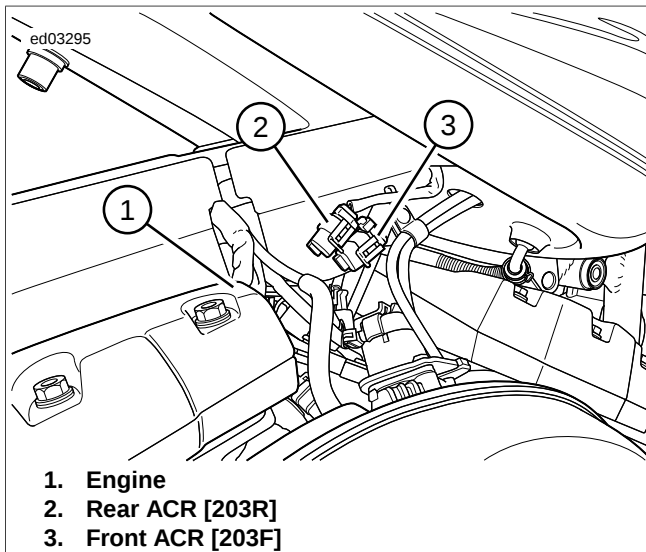


Figure 1-6. Under Fuel Tank Right Side

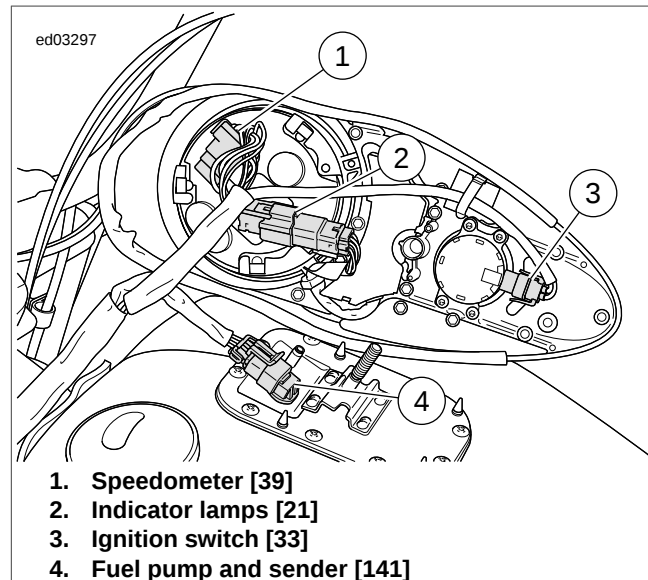


Figure 1-8. Under Console: Except FXS/B

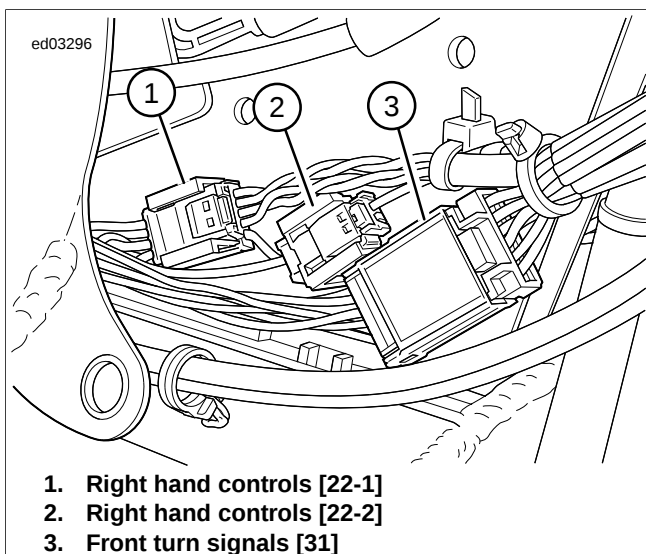


Figure 1-7. Under Fuel Tank Right Side

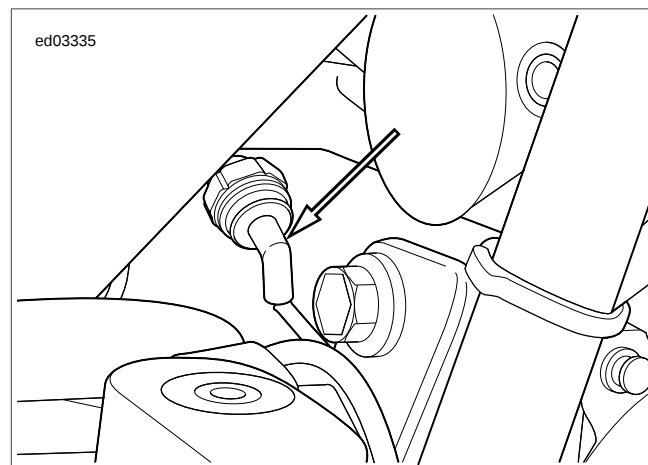


Figure 1-9. Oil Pressure Switch [120]

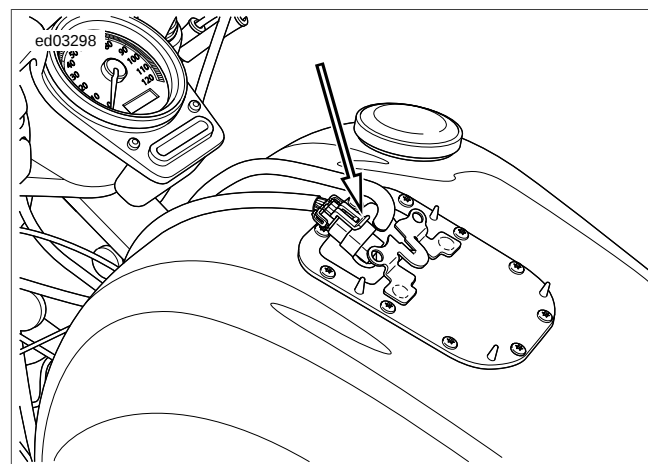


Figure 1-10. Under Console [141]: FXS/B Typical

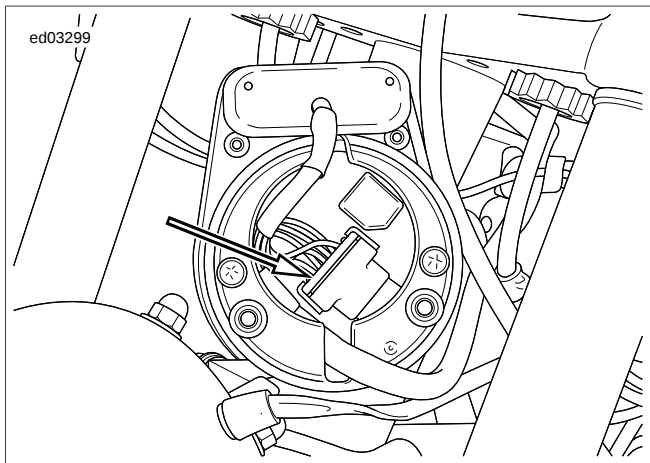


Figure 1-11. Speedometer [39]: FXS/B Typical

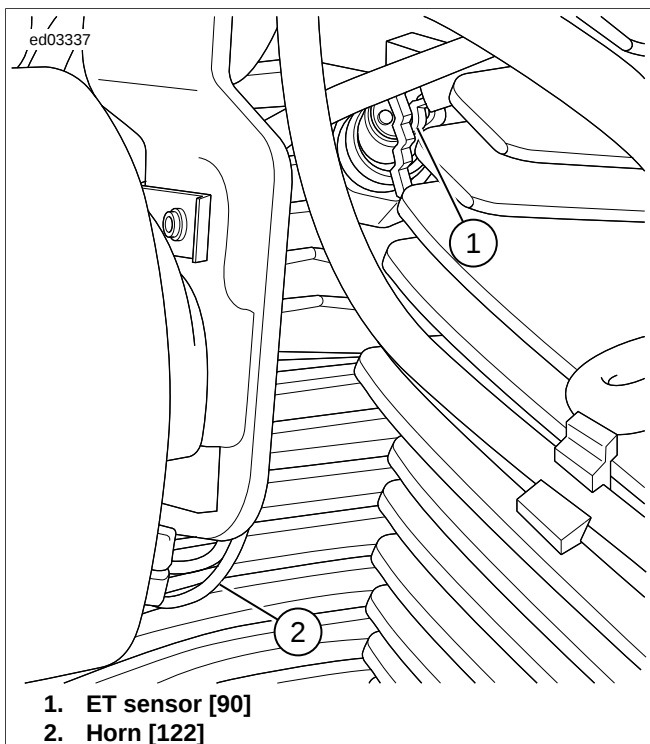


Figure 1-12. Horn and ET Sensor: Except FXS/B

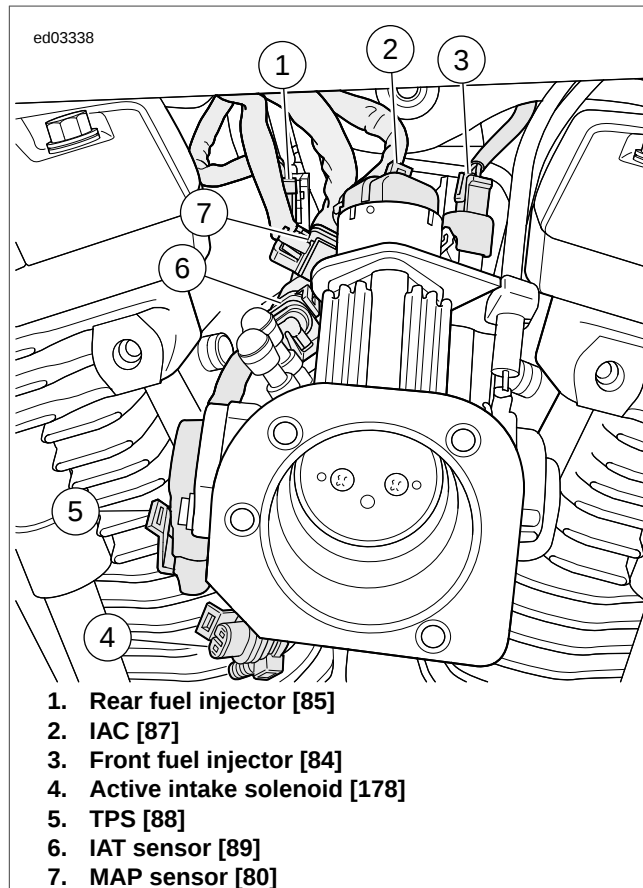


Figure 1-13. Between Cylinders Right Side

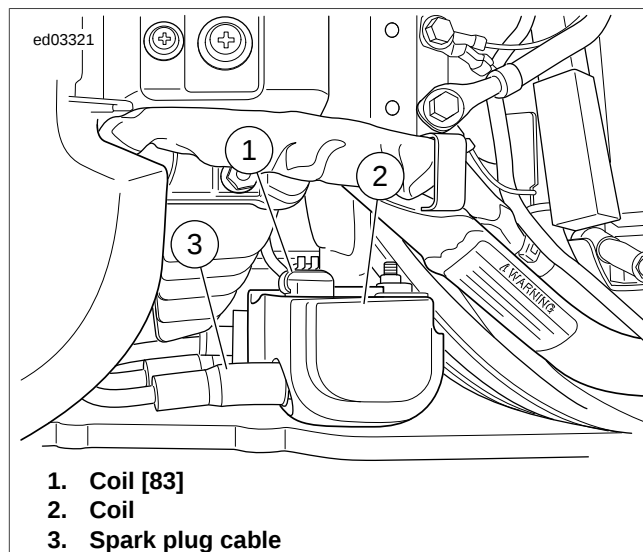


Figure 1-14. Coil: Except FXS/B

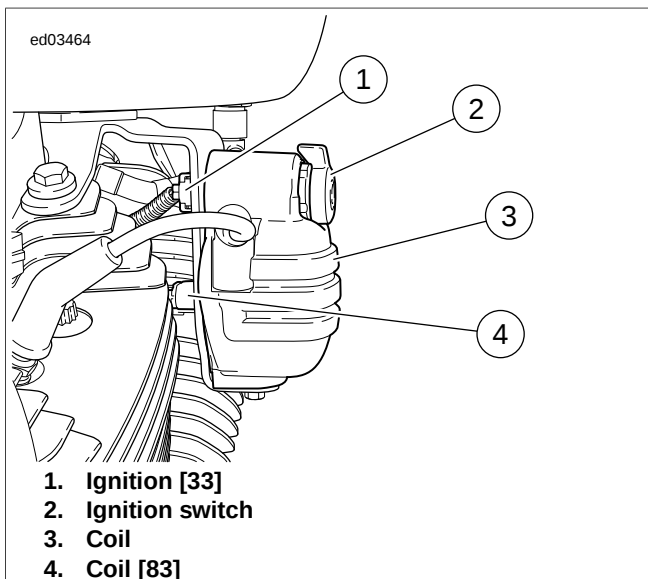


Figure 1-15. Ignition and Coil: FXS/B

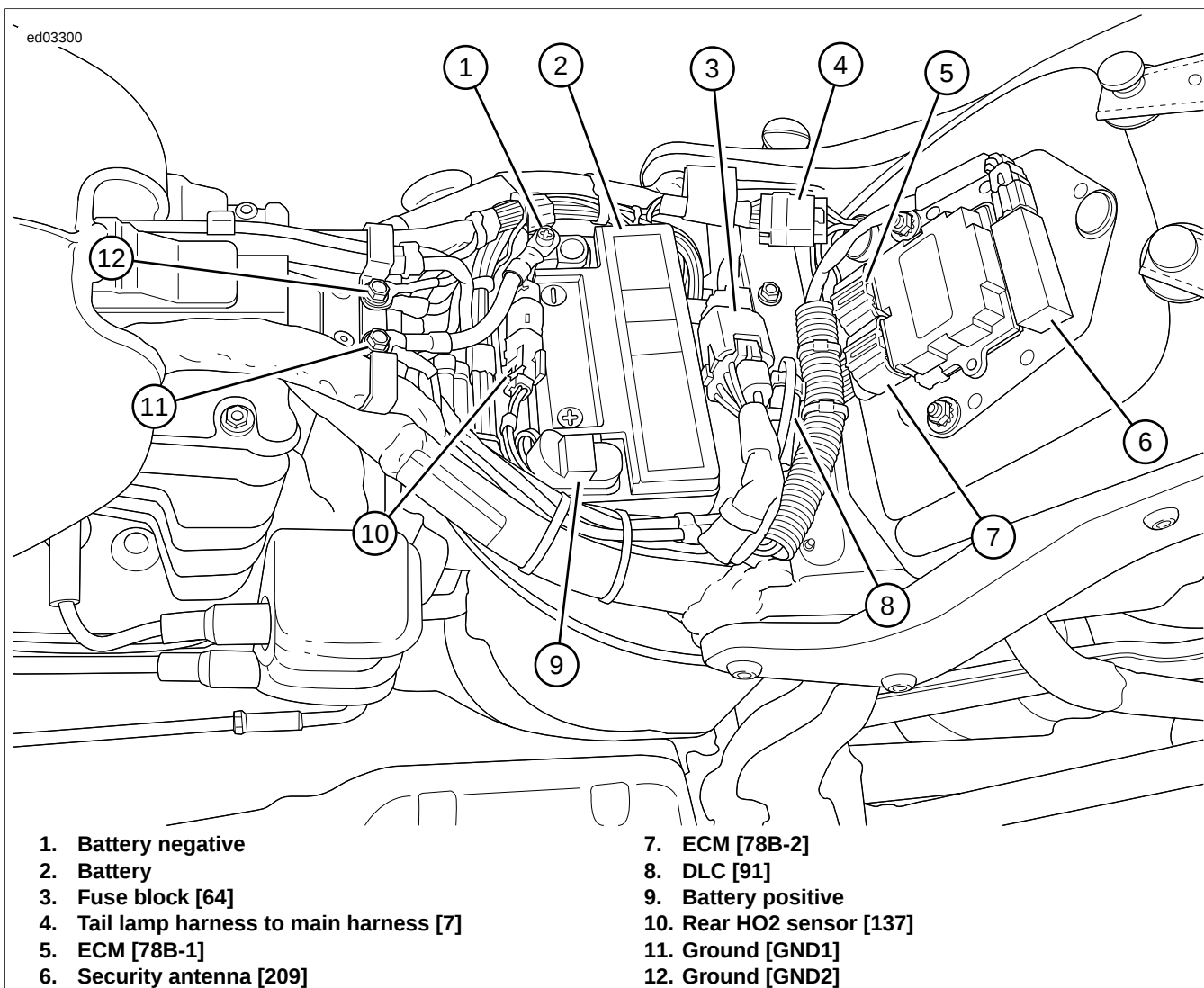


Figure 1-16. Under Seat: Except FXS/B and FLS

ed03468

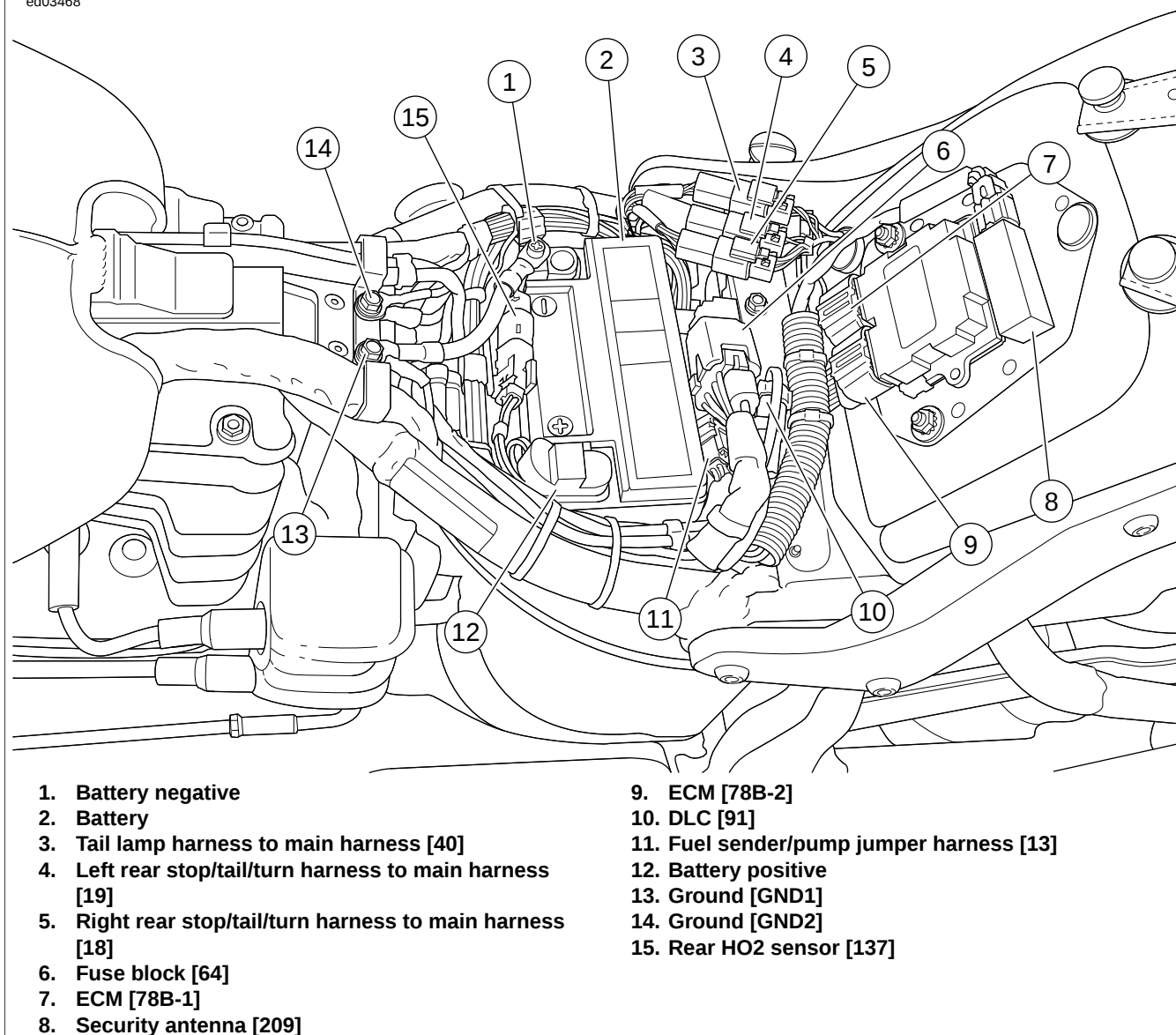


Figure 1-17. Under Seat: FXS and FLS

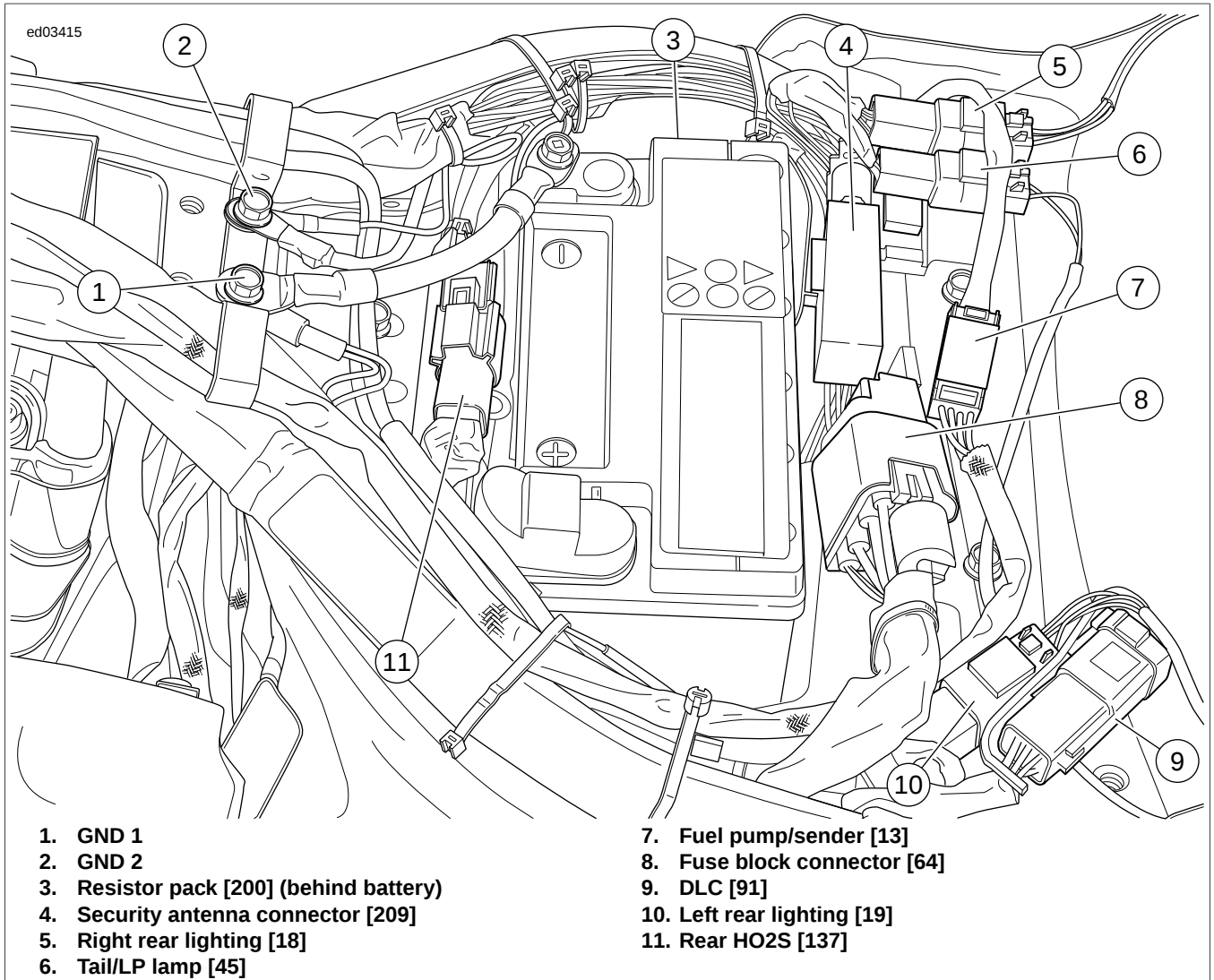


Figure 1-18. Under Seat: FXSB

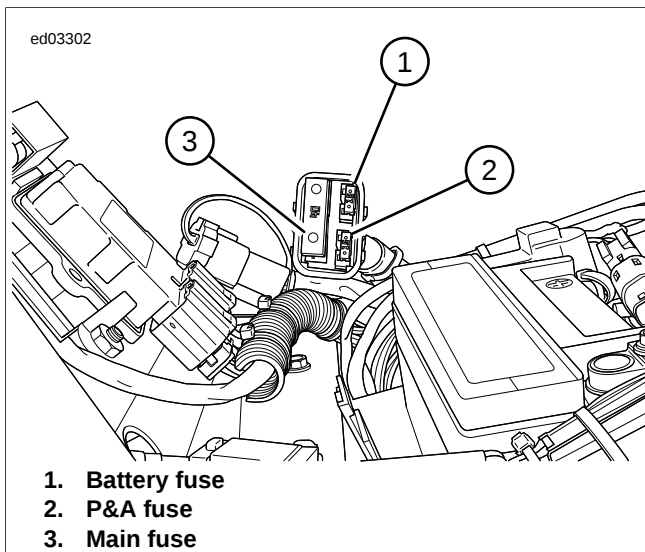


Figure 1-19. Fuse Locations

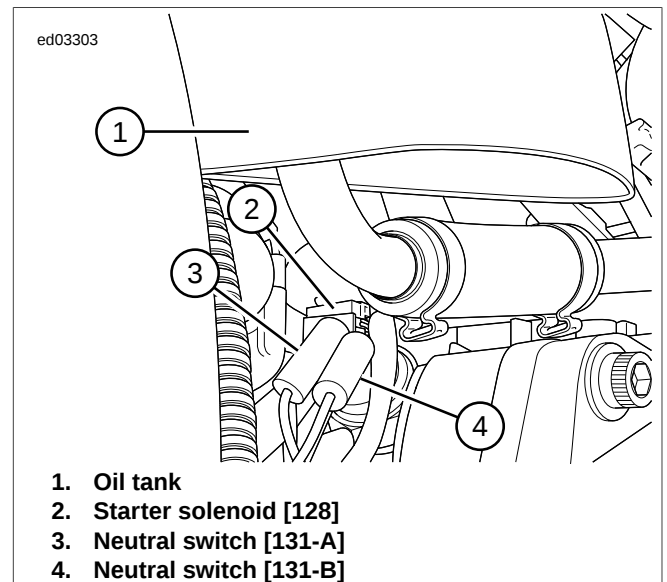


Figure 1-20. Under Oil Tank Right Side

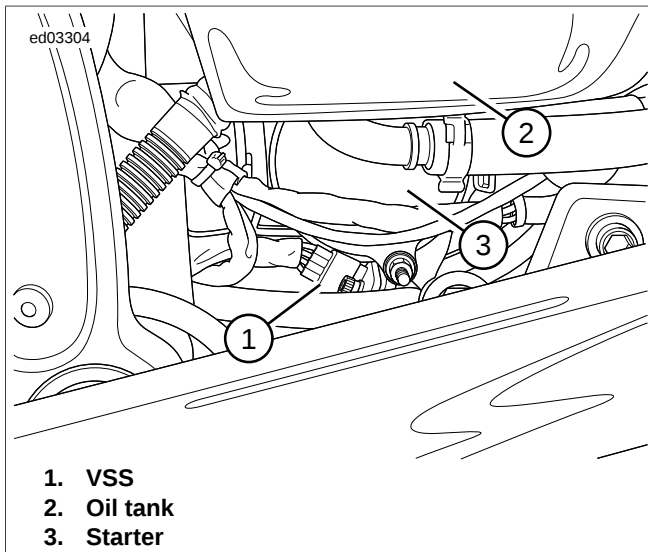


Figure 1-21. VSS

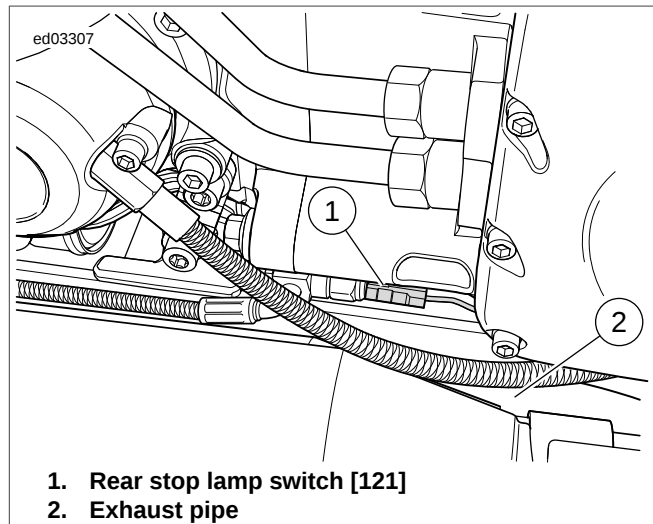


Figure 1-24. Rear Stop Lamp Switch [121]

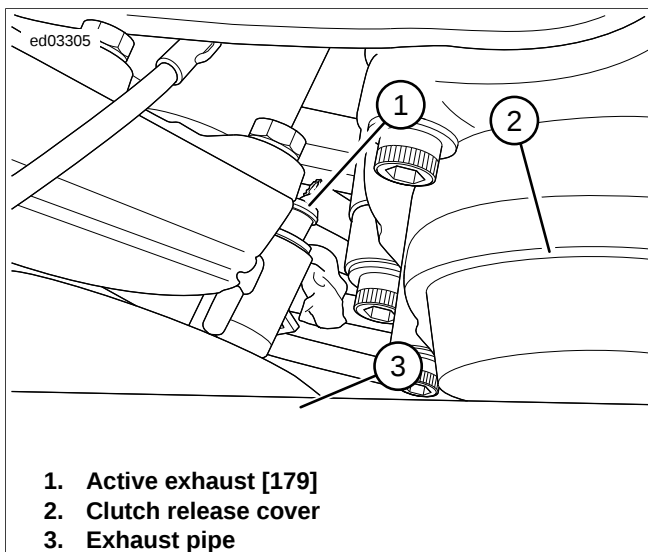


Figure 1-22. Active Exhaust [179]

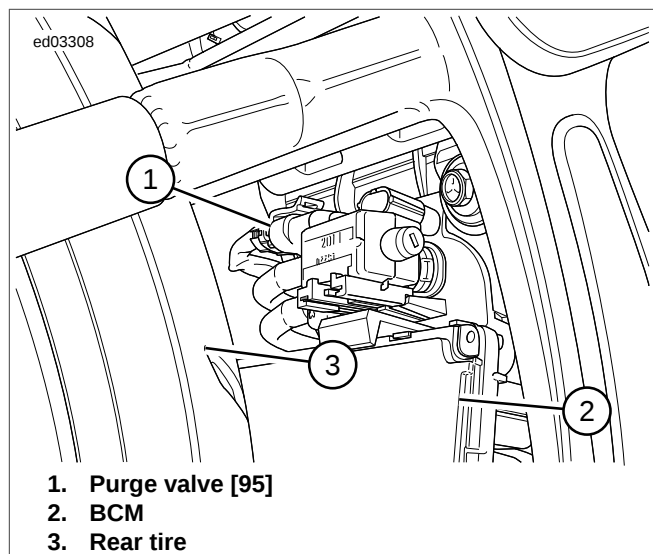


Figure 1-25. Purge Valve [95]: Except FXSB

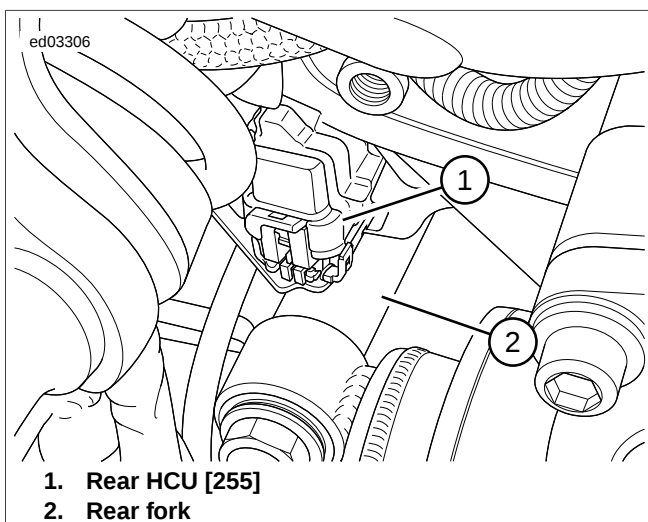


Figure 1-23. Rear HCU [255]

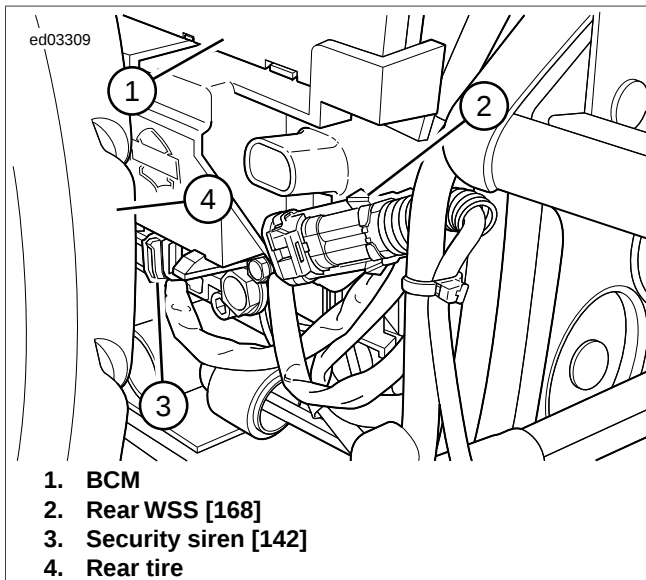


Figure 1-26. BCM: Except FXSB

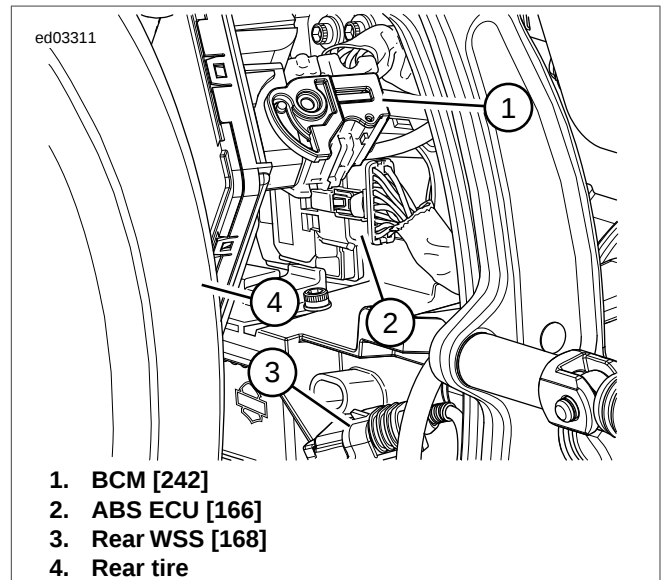


Figure 1-28. ABS [166]: Except FXSB

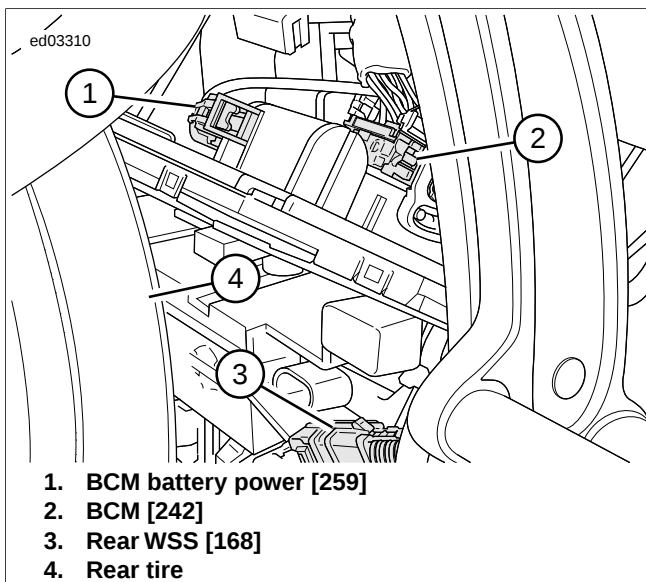


Figure 1-27. BCM [242]: Except FXSB

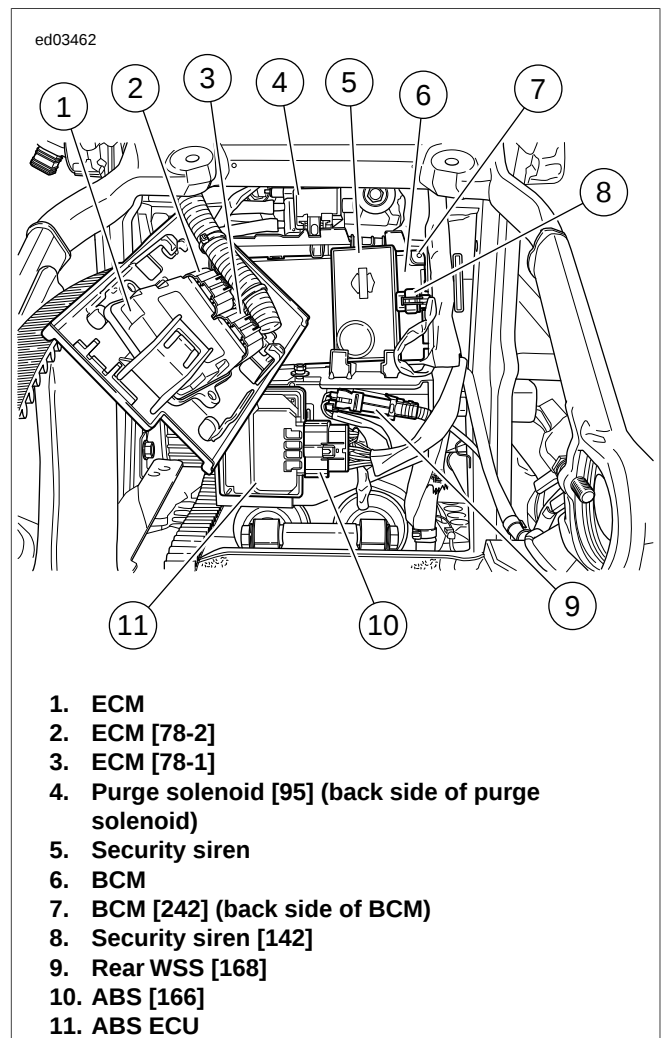


Figure 1-29. Electrical Panel: FXSB

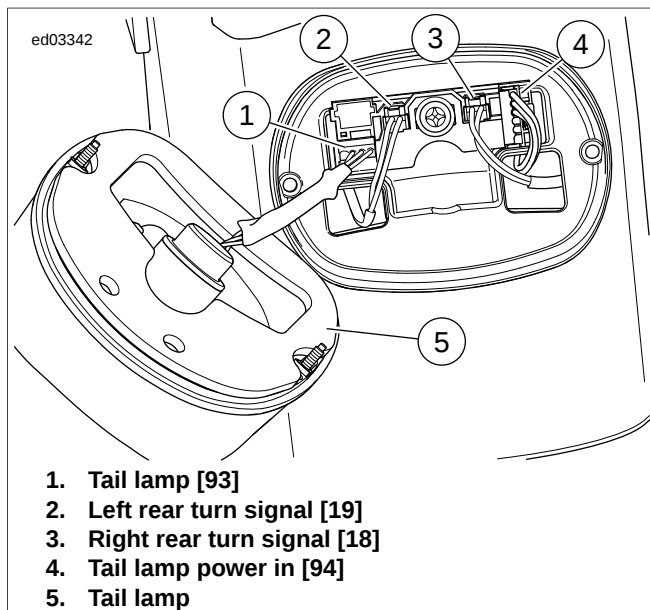


Figure 1-30. Tail Lamp: With Circuit Board: Typical

DIAGNOSTIC TOOLS

1.2

HOW TO USE DIAGNOSTIC TOOLS

PART NUMBER	TOOL NAME
GRX-3110 HD	BATTERY DIAGNOSTIC STATION
HD-26792	SPARK TESTER
HD-39617	FLUKE AC/DC CURRENT PROBE
HD-39978	DIGITAL MULTIMETER (FLUKE 78)
HD-41199-3	IAC TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-48642	ABS BREAKOUT BOX
HD-48650	DIGITAL TECHNICIAN II
HD-50341	WHEEL SPEED SENSOR TEST LEAD
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

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.

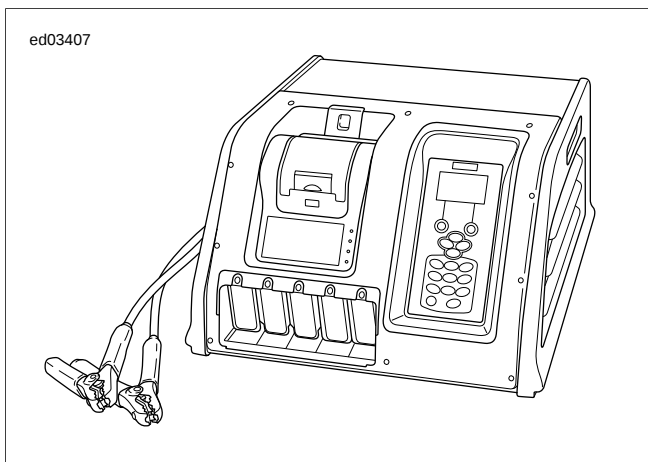


Figure 1-31. Advanced Battery Conductance and Electrical System Analyzer Kit

HD-26792 Spark Tester

See [Figure 1-32](#). The SPARK TESTER (Part No. HD-26792) is used to verify adequate spark at the spark plug. Attach the tester to the coil top plug and to ground. While cranking the engine, a spark should jump across the gap on the tester leads.

NOTE

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

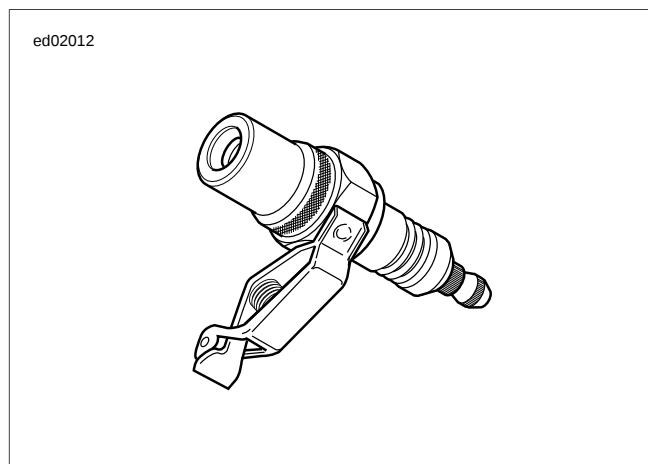


Figure 1-32. Spark Tester

HD-39978 Digital Multimeter (Fluke 78)

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

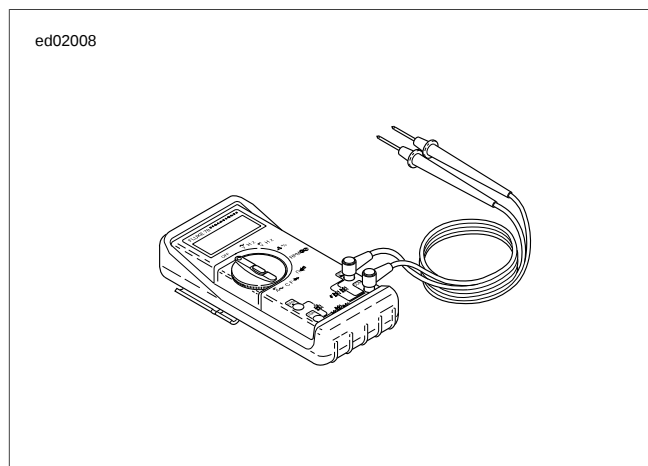


Figure 1-33. Digital Multimeter (Fluke 78)

HD-39617 Fluke AC/DC Current Probe

The FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) is used to measure current draw. Used in conjunction with DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978). Connect the current probe to positive (+) and negative (-) input terminals on the multimeter. Position the rotary switch to mV dc (millivolt direct current). Push the ON/OFF button and the ON indicator will illuminate. With the inductive jaws empty, turn the zero adjust so that the multimeter reads 0.000 mV. Clamp the inductive jaws around the conductor that is being tested. With the circuit activated read the multimeter display, 1 mV = 1 A.

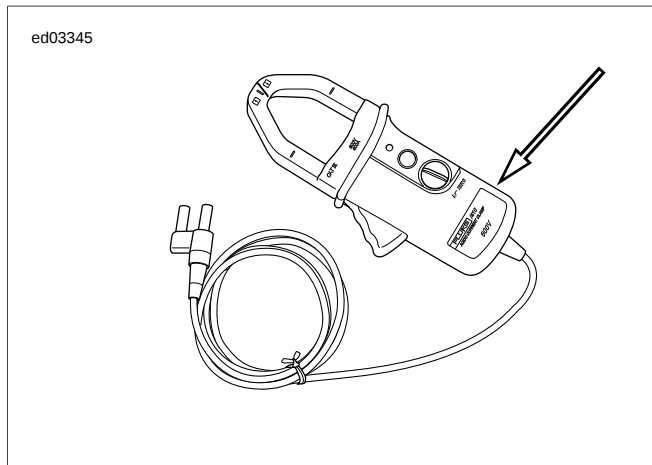


Figure 1-34. Fluke AC/DC Current Probe

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 1-35](#). 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].

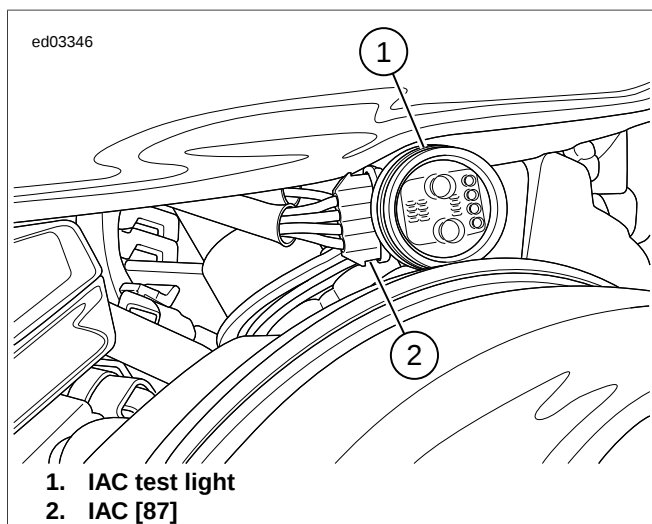


Figure 1-35. IAC Test Light

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-50341 Wheel Speed Sensor Test Lead

The WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) is a stackable banana jack patch cord with a built in resistor to test the wheels speed sensor circuit. Used in conjunction with HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect the test lead in place of the WSS when required during diagnostics.

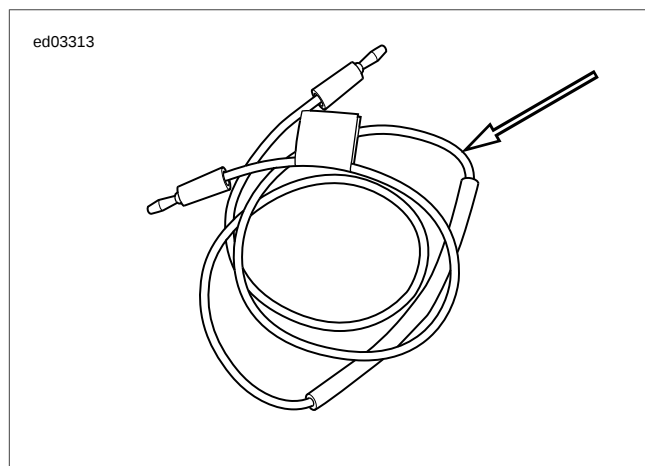


Figure 1-36. Wheel Speed Sensor Test Lead

HD-42682 Breakout Box (Instruments)

The BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the speedometer [39]. 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].
2. See [Figure 1-37](#). Press latch and disconnect [39B].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39A] and [39B].
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.

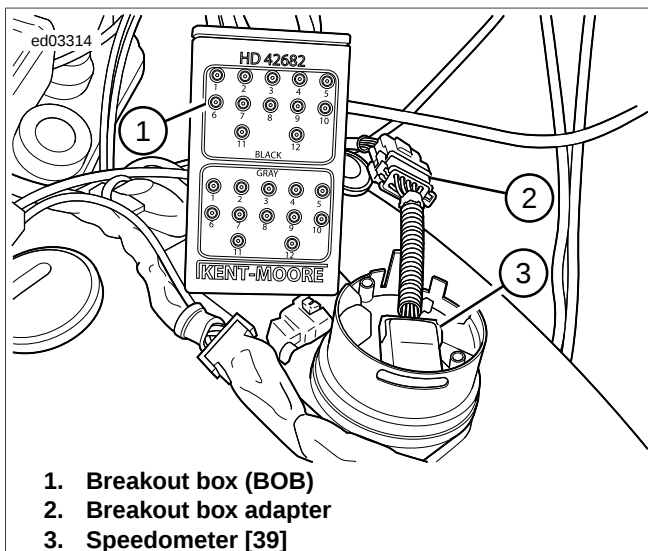


Figure 1-37. Breakout Box Connection

HD-50390-1 Breakout Box (ECM)

The BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) splice 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 the passenger seat.

1. Access the ECM.
2. Press latch and disconnect ECM connectors [78B-1] and [78B-2].
3. See [Figure 1-38](#). Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to connectors.
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on breakout box.
5. When testing is completed, remove the breakout box and restore connections.

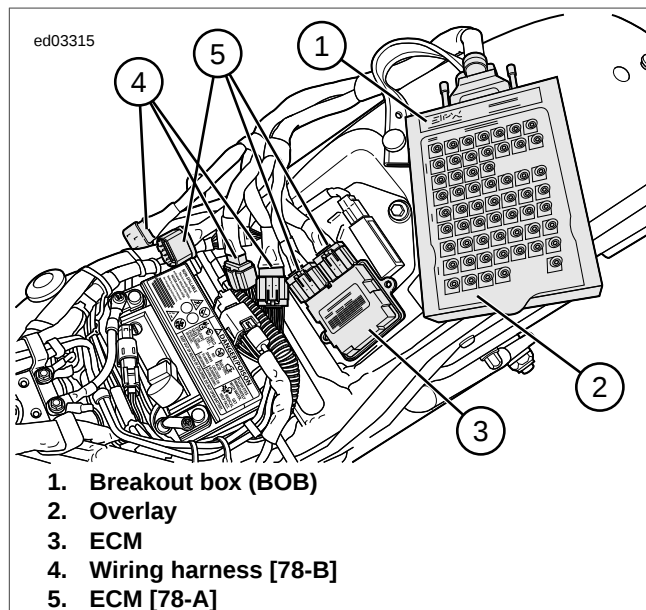


Figure 1-38. ECM Breakout Box Connection: Except FXSB

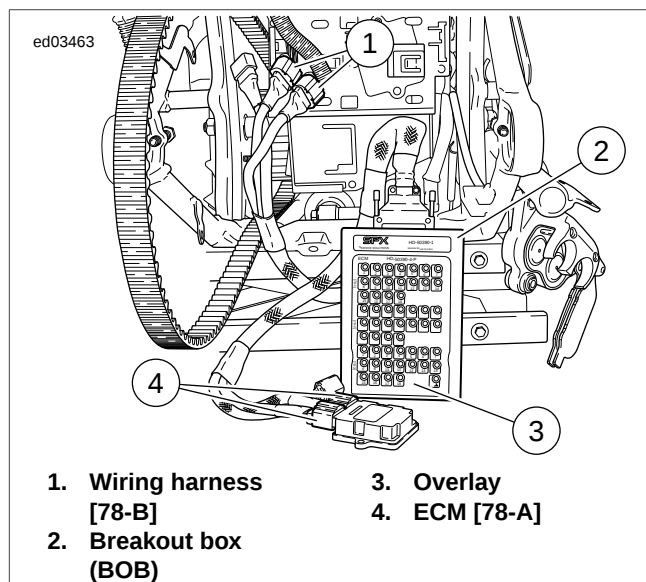


Figure 1-39. ECM Breakout Box Connection: FXSB

HD-50390-1 Breakout Box (BCM)

The BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) splice 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 BCM terminal functions. BCM is located in front of the rear tire.

1. Access the BCM.
2. Press latch and disconnect BCM [242B].
3. See [Figure 1-40](#). Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to connectors.

NOTE

On some models, the BCM connector will have to be accessed from the other side of the vehicle.

4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on breakout box.
5. When testing is completed, remove the breakout box and restore connections.

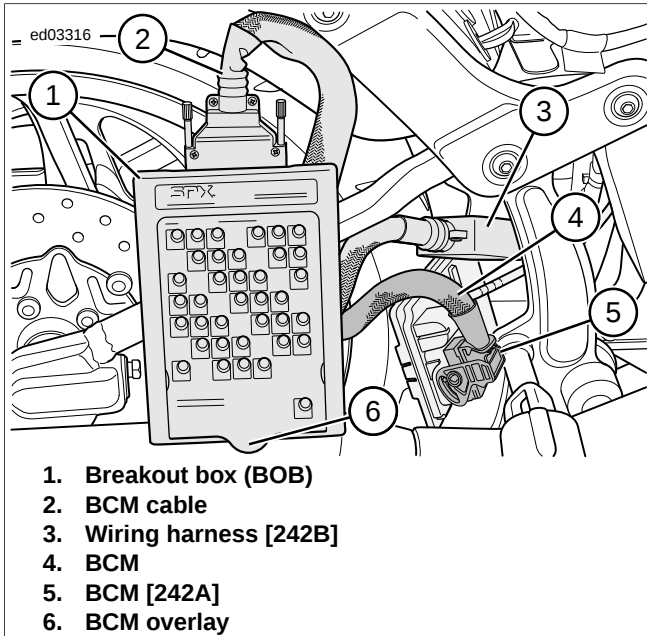


Figure 1-40. BCM Breakout Box Connection: Except FXSB

without having to probe with sharp objects. Install breakout box in series as follows:

1. Remove the splash guard and position the BCM aside.
2. Press latch and disconnect ABS module [166B].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to connectors.
4. In some cases it is necessary to leave the ABS module disconnected.
5. When testing is completed remove the breakout box and restore connections.
6. Position the BCM and install the splash guard.

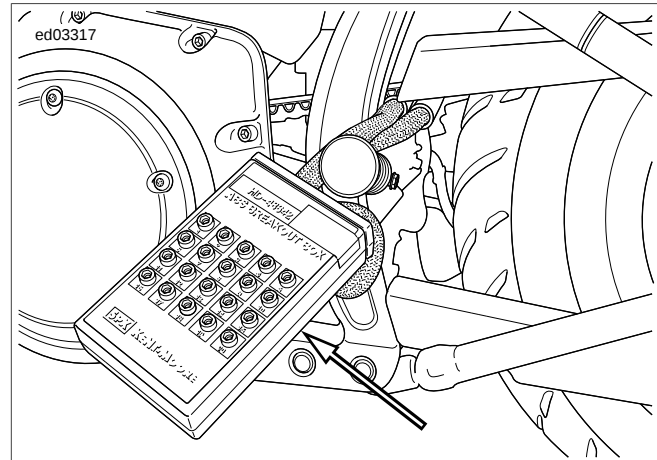


Figure 1-42. ABS Breakout Box Connection: Except FXSB

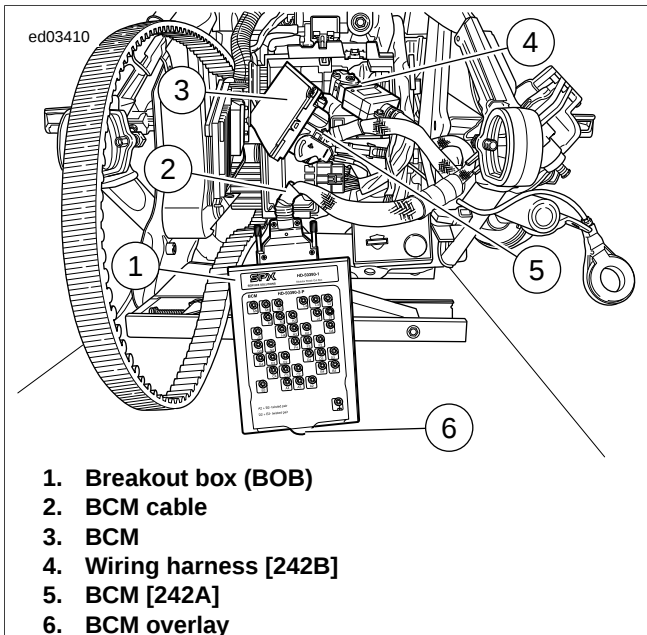


Figure 1-41. BCM Breakout Box Connection: FXSB

HD-48642 Breakout Box (ABS)

The ABS BREAKOUT BOX (Part No. HD-48642) connects to the ABS module [166]. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections

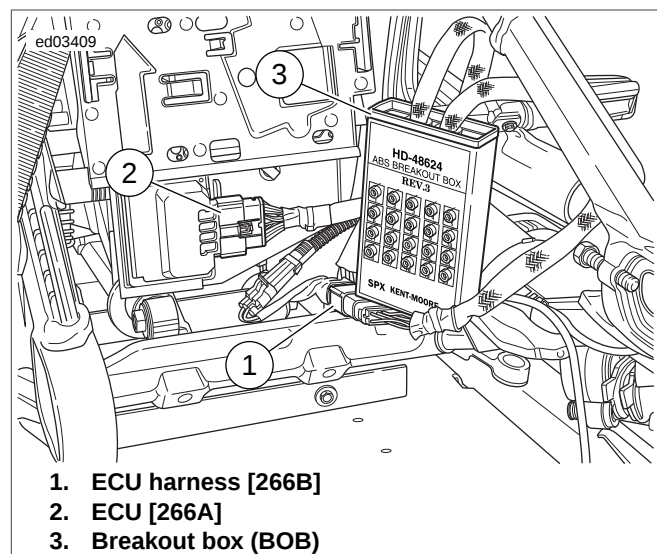


Figure 1-43. ABS Breakout Box Connection: FXSB

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.

DIAGNOSTICS AND TROUBLESHOOTING

1.3

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.

Components such as wires, switches and connectors are designed to have very little resistance and therefore very little voltage drop. A voltage drop greater than 1.0V across these components indicates a high resistance and possible fault.

The benefits of doing it this way are:

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

When testing a 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 CKP [79] to prevent the engine from starting.
 - a. See [Figure 1-44](#). Connect the red meter lead to the positive battery post.
 - b. See [Figure 1-44](#). Connect the black meter lead to the starter side post for the starter solenoid and observe the meter reading.
 - c. Crank the starter and observe the meter reading. The difference in the voltage is the voltage drop.

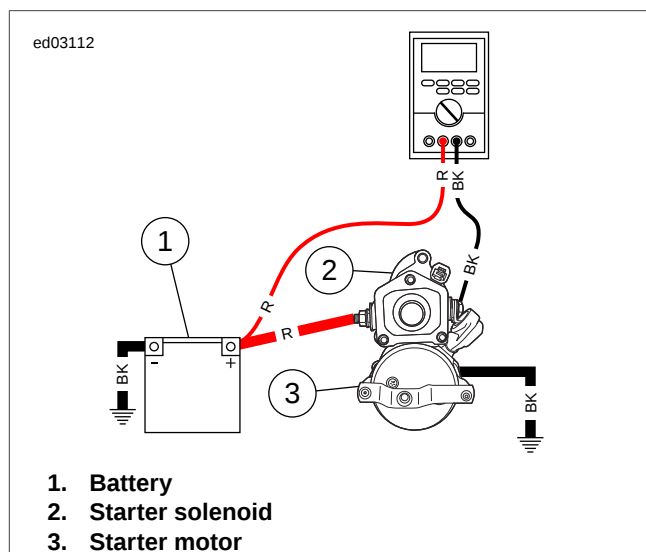


Figure 1-44. To Starter Solenoid Starter Terminal

2. See [Figure 1-45](#). Move the black meter lead to the battery side post on the starter solenoid. Crank the starter.

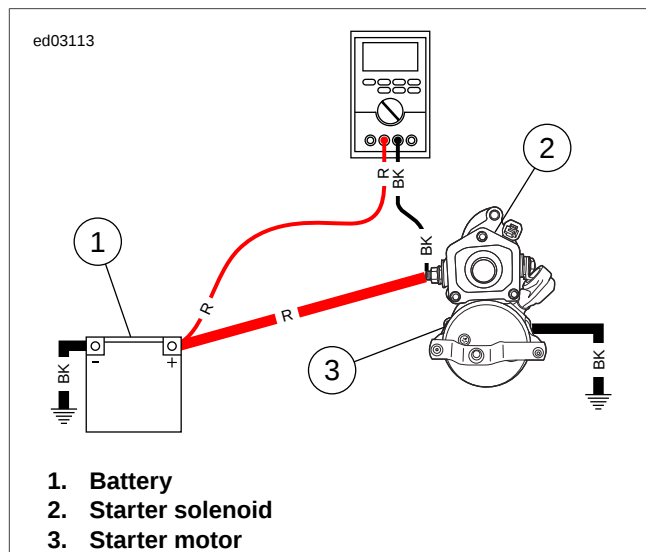


Figure 1-45. To Starter Solenoid Battery Terminal

3. See [Figure 1-46](#). Finally move the black meter lead to the negative battery post and the red meter lead to the starter case. Crank the starter.

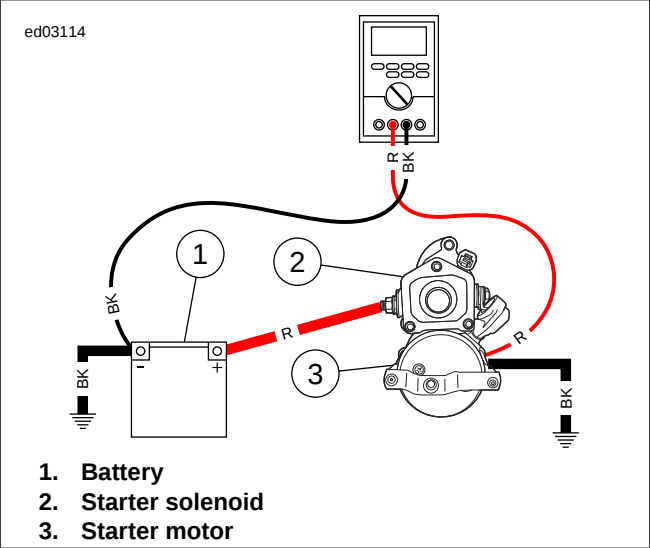


Figure 1-46. Starter Ground Circuit

WIGGLE TEST

PART NUMBER	TOOL NAME
HD-39978	DIGITAL MULTIMETER (FLUKE 78)
HD-48650	DIGITAL TECHNICIAN II
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

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 1-47](#). 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-50390-1), ECM

CABLE (Part No. HD-50390-4) and ECM OVERLAY (Part No. HD-50390-4-P) 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.

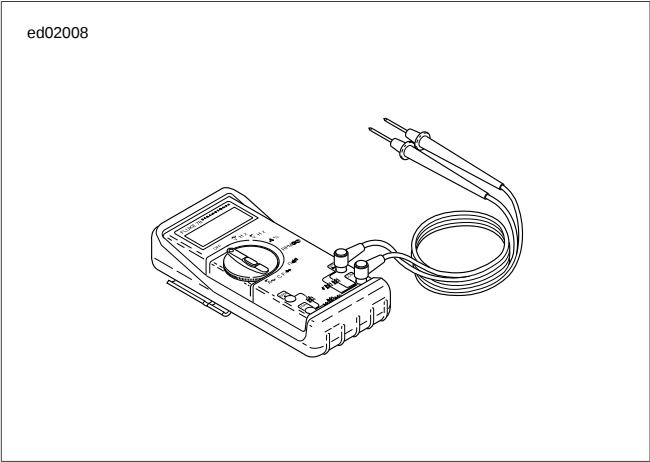


Figure 1-47. Digital Multimeter (Fluke 78)

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.

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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, BCM, ECM and ABS (if equipped) DTCs can be accessed and cleared.

ODOMETER SELF-DIAGNOSTICS

Diagnostic Mode

- To enter diagnostic mode, press and hold the trip odometer reset switch located on the left handlebar controls, while turning the IGN ON.

NOTE

The trip odometer reset switch is located in the left hand control module. The switch signal is sent to the speedometer over the CAN bus. Any CAN bus issues may interrupt odometer self-diagnostics.

- Release the trip odometer reset switch. "diag" will appear on the odometer display.
- Press and release the trip odometer reset switch. ECM will appear on the odometer display. It will have either a "Y" or an "N" after it, depending if there are any ECM codes or not.
- Quickly press and release the trip odometer reset switch to cycle through the modules. The modules include the BCM, SPDO and ABS.
- Once the desired module is displayed, press and hold the trip odometer reset switch.

- If any DTCs are stored in the module, the odometer will display the DTC. Quickly pressing and releasing the trip odometer reset switch will cycle through the stored DTCs.
- When all the DTCs have been cycled the odometer will display "end".
- To clear all the DTCs in that module press and hold the trip odometer reset switch, while a DTC is displayed. 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.
- Press and release the trip odometer reset switch again to continue to the next module.
- Make note of all DTCs. Clear all the DTCs and operate the vehicle to verify DTCs set and are current. Historic DTCs are not to be diagnosed unless the condition is reoccurring and intermittent.
- Turn the IGN OFF to exit diagnostic mode. If IGN is not turned off, vehicle will exit diagnostics mode when vehicle starts moving.

INITIAL DIAGNOSTICS

1. Fuse Test

- Verify all fuses are good.
- Are all fuses good?
 - Yes.** [Go to Test 2.](#)
 - No.** Replace fuse.

2. Current DTC Test

- Check for current DTCs. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).

NOTE

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

- Are current DTCs present?
 - Yes.** Refer to [Table 2-1](#).
 - No.** [Go to Test 3.](#)

3. Odometer Function Test

- Enter odometer self-diagnostics.
- Did odometer self-diagnostics mode function properly?
 - Yes.** Refer to [Table 2-2](#).
 - No.** [Go to Test 4.](#)

4. Odometer Inoperative Test

- Turn IGN ON.
- Does the odometer display illuminate?
 - Yes.** [Go to Test 7.](#)
 - No.** [Go to Test 5.](#)

5. Battery Power Test

1. Turn IGN/engine stop switch ON.
2. Does the headlamp and/or tail lamp illuminate?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Verify battery condition and connections. If all are good, see [2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140.](#)

6. Starter Test

1. Attempt to start vehicle. Does the starter crank?
 - a. **Yes.** See [4.1 INSTRUMENTS.](#)
 - b. **No.** See [2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274.](#)

7. LHCM Test

1. With IGN ON, operate all left hand control functions.

2. Do any left hand controls function properly?
 - a. **Yes.** All controls are operational except the trip switch. See [4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255.](#)
 - b. **No.** All left hand control functions are inoperative. See [2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Left Hand Controls Inoperative: DTC U0141.](#)

DIAGNOSTICS

Diagnostic Tips

- For a quick check of instrument function, perform a "WOW" test by entering odometer self-diagnostics. Background lighting will illuminate, gauge needles will sweep their full range of motion and indicator lamps controlled by the CAN circuit (battery, security and check engine) will illuminate.
- If the instrument fails "WOW" test, check for battery power and ground to the instrument. If any feature in the speedometer is non-functional, see [4.1 INSTRUMENTS.](#)

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B1101	141	LHCM turn signal bulb out	5.4 DTC B1101, B1151
B1103	25	LHCM internal fault	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B1151	142	RHCM turn signal bulb out	5.4 DTC B1101, B1151
B1153	24	RHCM internal fault	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B1200	15	Instrument internal fault	4.4 NO INSTRUMENT POWER, DTC B1200
B1210	99	Fuel sender shorted low/fuel gauge circuit open	4.2 DTC B1210, B1211
B1211	100	Fuel sender shorted high/open	4.2 DTC B1210, B1211
B2102	26	System power output shorted high	6.4 DTC B2102, B2103, B2104
B2103	27	System power output shorted low	6.4 DTC B2102, B2103, B2104
B2104	28	System power output overloaded	6.4 DTC B2102, B2103, B2104
B2107	155	Front position/running power output shorted high	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2108	156	Front position/running power output shorted low	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2109	157	Front position/running power output overloaded	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2112	67	Accessory output shorted high	5.1 ACCESSORIES: DTC B2112, B2113, B2114
B2113	68	Accessory output shorted low	5.1 ACCESSORIES: DTC B2112, B2113, B2114
B2114	69	Accessory output overloaded	5.1 ACCESSORIES: DTC B2112, B2113, B2114
B2116	50	Fuel pump output open	6.5 DTC B2116, B2117, B2118, B2119
B2117	51	Fuel pump output shorted high	6.5 DTC B2116, B2117, B2118, B2119
B2118	52	Fuel pump output shorted low	6.5 DTC B2116, B2117, B2118, B2119

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B2119	53	Fuel pump output overloaded	6.5 DTC B2116, B2117, B2118, B2119
B2121	36	Starter output open	3.3 DTC B2121, B2122, B2123, B2124
B2122	37	Starter output shorted high	3.3 DTC B2121, B2122, B2123, B2124
B2123	38	Starter output shorted low	3.3 DTC B2121, B2122, B2123, B2124
B2124	39	Starter output overloaded	3.3 DTC B2121, B2122, B2123, B2124
B2126	174	Horn output open	5.2 HORN: DTC B2126, B2127, B2128, B2129
B2127	175	Horn output shorted high	5.2 HORN: DTC B2126, B2127, B2128, B2129
B2128	176	Horn output shorted low	5.2 HORN: DTC B2126, B2127, B2128, B2129
B2129	177	Horn output overloaded	5.2 HORN: DTC B2126, B2127, B2128, B2129
B2131	164	High beam output open	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2132	165	High beam output shorted high	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2133	166	High beam output shorted low	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2134	167	High beam output overloaded	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2136	160	Low beam output open	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2137	161	Low beam output shorted high	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2138	162	Low beam output shorted low	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2139	163	Low beam output overloaded	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139
B2141	143	Left front turn signal output open	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2143	144	Left front turn signal output shorted low	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2144	145	Left front turn signal output overloaded	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2146	146	Right front turn signal output open	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2148	147	Right front turn signal output shorted low	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2149	148	Right front turn signal output overloaded	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149
B2151	149	Left rear turn signal output open	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159
B2153	150	Left rear turn signal output shorted low	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159
B2154	151	Left rear turn signal output overloaded	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159
B2156	152	Right rear turn signal output open	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159
B2158	153	Right rear turn signal output shorted low	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B2159	154	Right rear turn signal output overloaded	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159
B2161	135	Brake lamp output open	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223
B2163	136	Brake lamp output shorted low	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223
B2164	137	Brake lamp output overloaded	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223
B2166	96	Running lights output open	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2168	97	Running lights output shorted low	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2169	98	Running lights output over-loaded	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
B2172	168	Security siren output shorted high	5.15 DTC B2172, B2173
B2173	169	Security siren output shorted low	5.15 DTC B2172, B2173
B2176	170	Security antenna output open	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178
B2177	171	Security antenna output shorted high	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178
B2178	172	Security antenna output shorted low	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178
B2183	180	High side drive output #1 shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2188	181	High side drive output #2 shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2193	182	High side drive output #3 shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2198	183	High side drive output #4 shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2203	30	Ignition switch input shorted low	3.9 DTC B2203
B2206	31	Engine stop switch input open/shorted high	3.10 DTC B2206, B2208
B2208	32	Engine stop switch input shorted low	3.10 DTC B2206, B2208
B2210	33	Run and stop inputs both open	3.10 DTC B2206, B2208
B2212	34	Run and stop inputs both closed	3.10 DTC B2206, B2208
B2218	66	Neutral switch shorted low	5.18 DTC B2218
B2223	134	Rear brake switch shorted low	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223
B2226	184	BAS input open	BCM not configured properly.
B2228	185	BAS input shorted low	BCM not configured properly.
B2250	65	Clutch switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2251	173	Horn switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2252	159	High beam switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B2253	158	Low beam switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2254	139	Left turn switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2255	178	Trip switch stuck	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
B2260	35	Start switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2261	140	Right turn switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2262	133	Front brake switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2263	138	Hazard switch stuck	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2270	10	BCM internal fault	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
B2271	9	BCM voltage low	3.11 DTC B2271, B2272
B2272	14	BCM or speedometer voltage high	3.11 DTC B2271, B2272
B2274	29	Constant battery line fault	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274
C0562	18	ABS voltage low	3.7 DTC C0562, C0563, C1222, C1223
C0563	19	ABS voltage high	3.7 DTC C0562, C0563, C1222, C1223
C1018	107	Front actuator circuit low/open	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1021	127	Front wheel speed sensor always equals 0	7.3 DTC C1021, C1023
C1023	128	Rear wheel speed sensor always equals 0	7.3 DTC C1021, C1023
C1025	131	Front wheel speed signal intermittent	7.4 DTC C1025, C1032, C1206
C1027	132	Rear wheel speed signal intermittent	7.5 DTC C1027, C1034, C1208
C1032	125	Front wheel speed sensor circuit open or shorted	7.4 DTC C1025, C1032, C1206
C1034	126	Rear wheel speed sensor circuit open or shorted	7.5 DTC C1027, C1034, C1208
C1041	108	Rear actuator circuit low/open	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1042	103	Front actuator circuit open	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1044	104	Rear actuator circuit open	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1052	110	Rear actuator circuit high	7.6 DTC C1052, C1102
C1055	20	ABS ECU internal fault	7.7 DTC C1055
C1094	121	Brake switch always on	7.8 DTC C1094
C1102	102	Rear actuator motor stalled	7.6 DTC C1052, C1102
C1151	123	Front wheel release too long	7.9 DTC C1151, C1153
C1153	124	Rear wheel release too long	7.9 DTC C1151, C1153
C1158	21	Calibration not programmed	7.10 DTC C1158, C1178, C1184
C1178	22	No VIN received from ECM	7.10 DTC C1158, C1178, C1184

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
C1184	23	VIN does not match ABS ECU calibration	7.10 DTC C1158, C1178, C1184
C1192	109	Front actuator circuit high	7.11 DTC C1192, C1193
C1193	101	Front actuator motor stalled	7.11 DTC C1192, C1193
C1206	129	Front wheel speed sensor frequency out of range	7.4 DTC C1025, C1032, C1206
C1208	130	Rear wheel speed sensor frequency out of range	7.5 DTC C1027, C1034, C1208
C1212	122	Front or rear brake not applied on decel	7.12 DTC C1212
C1222	16	ABS voltage low - terminal 11	3.7 DTC C0562, C0563, C1222, C1223
C1223	17	ABS voltage low - terminal 20	3.7 DTC C0562, C0563, C1222, C1223
C1224	105	Front actuator power shorted high	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1225	106	Rear actuator power shorted high	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225
C1561	111	Front apply solenoid circuit open or high resistance	7.13 DTC C1561, C1562, C1563, C1564, C1565
C1562	113	Front apply solenoid circuit shorted low	7.13 DTC C1561, C1562, C1563, C1564, C1565
C1563	115	Front solenoid circuit shorted high	7.13 DTC C1561, C1562, C1563, C1564, C1565
C1564	117	Front release solenoid circuit open or high resistance	7.13 DTC C1561, C1562, C1563, C1564, C1565
C1565	119	Front release solenoid circuit shorted low	7.13 DTC C1561, C1562, C1563, C1564, C1565
C1567	112	Rear apply solenoid circuit open or high resistance	7.14 DTC C1567, C1568, C1571, C1572, C1573
C1568	114	Rear apply solenoid circuit shorted low	7.14 DTC C1567, C1568, C1571, C1572, C1573
C1571	116	Rear solenoid circuit shorted high	7.14 DTC C1567, C1568, C1571, C1572, C1573
C1572	118	Rear release solenoid circuit open or high resistance	7.14 DTC C1567, C1568, C1571, C1572, C1573
C1573	120	Rear release solenoid circuit shorted low	7.14 DTC C1567, C1568, C1571, C1572, C1573
P0031	82	Front HO2 heater low/open	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0032	83	Front HO2 heater shorted/high	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0051	84	Rear HO2 heater low/open	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0052	85	Rear HO2 heater shorted/high	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0107	58	MAP sensor failed low/open	6.6 DTC P0107, P0108
P0108	59	MAP sensor failed high/open port	6.6 DTC P0107, P0108
P0112	62	Intake air temp sensor low/shorted	6.7 DTC P0112, P0113

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
P0113	63	Intake air temp sensor high/open	6.7 DTC P0112, P0113
P0117	60	Engine temp sensor shorted low	6.8 DTC P0117, P0118
P0118	61	Engine temp sensor high/open	6.8 DTC P0117, P0118
P0122	44	Throttle position sensor low/open	6.9 DTC P0122, P0123
P0123	45	Throttle position sensor high	6.9 DTC P0122, P0123
P0131	86	Oxygen sensor low/engine lean (front)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0132	88	Engine running rich (front)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0134	90	Oxygen sensor high/open (front)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0151	87	Oxygen sensor low/engine lean (rear)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0152	89	Engine running rich (rear)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0154	91	Oxygen sensor high/open (rear)	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154
P0261	54	Fuel injector low/open (front)	6.11 DTC P0261, P0262, P0264, P0265
P0262	55	Fuel injector high/shorted (front)	6.11 DTC P0261, P0262, P0264, P0265
P0264	56	Fuel injector low/open (rear)	6.11 DTC P0261, P0262, P0264, P0265
P0265	57	Fuel injector high/shorted (rear)	6.11 DTC P0261, P0262, P0264, P0265
P0371	42	Crank position sensor too many pulses	6.12 DTC P0371, P0372, P0374
P0372	43	Crank position sensor too few pulses	6.12 DTC P0371, P0372, P0374
P0374	41	Crank position sensor no pulses	6.12 DTC P0371, P0372, P0374
P0444	74	Purge solenoid low/open	6.13 DTC P0444, P0445
P0445	75	Purge solenoid shorted/high	6.13 DTC P0444, P0445
P0502	70	Vehicle speed failed low	6.14 DTC P0502, P0503
P0503	71	Vehicle speed failed high	6.14 DTC P0502, P0503
P0506	76	Idle speed control - rpm too low	6.15 DTC P0506, P0507
P0507	77	Idle speed control - rpm too high	6.15 DTC P0506, P0507
P0562	64	ECM voltage low	3.8 DTC P0562
P0603	12	ECM EEPROM memory error	6.16 DTC P0603, P0605
P0605	11	ECM FLASH memory error	6.16 DTC P0603, P0605
P0641	40	5V Vref out of range	6.17 DTC P0641
P0661	80	Intake solenoid low/open	6.18 DTC P0661, P0662
P0662	81	Intake solenoid shorted/high	6.18 DTC P0661, P0662
P1009	13	Incorrect password	6.19 DTC P1009

Table 2-1. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
P1353	72	No combustion detected (front)	6.20 DTC P1353, P1356
P1356	73	No combustion detected (rear)	6.20 DTC P1353, P1356
P1475	78	Exhaust actuator position error	6.21 DTC P1475, P1478
P1478	79	Exhaust actuator shorted/high	6.21 DTC P1475, P1478
P1501	92	JSS sensor low	6.22 DTC P1501, P1502
P1502	93	JSS sensor high/open	6.22 DTC P1501, P1502
P1632	179	Odometer learned up	6.23 DTC P1632
P1655	94	ACR solenoid low/open	6.24 DTC P1655, P1656
P1656	95	ACR solenoid high	6.24 DTC P1655, P1656
P2300	46	Ignition coil driver low/open (front)	6.25 DTC P2300, P2301, P2303, P2304
P2301	47	Ignition coil driver high/shorted (front)	6.25 DTC P2300, P2301, P2303, P2304
P2303	48	Ignition coil driver low/open (rear)	6.25 DTC P2300, P2301, P2303, P2304
P2304	49	Ignition coil driver high/shorted (rear)	6.25 DTC P2300, P2301, P2303, P2304
U0001	1	CAN BUS fault	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274
U0011	2	CAN BUS low shorted to CAN BUS high	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274
U0100	4	Lost communication with ECM	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
U0121	8	Lost communication with ABS	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
U0140	3	Lost communication with BCM	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
U0141	6	Lost communication with LHCM	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
U0142	5	Lost communication with RHCM	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
U0156	7	Lost communication with speedometer	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156

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, use a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).

- Current DTCs reside in the memory of the ECM, BCM, instruments or ABS module (if equipped) until the DTC is resolved.
- DTCs are designated by a P, C, B or U depending on the type of code and what module sets them. The ECM sets "P" codes to indicate issues monitored by the ECM. The ABS module sets "C" codes indicating an issue with the ABS on the vehicle. The instruments or BCM can all set "B" codes. All the modules set "U" codes when there is

an issue causing the modules not to communicate properly.

- A historic DTC can be cleared by use of the odometer self-diagnostics or after a total of 20 error free ignition cycles (start and run cycle) have elapsed.

Current

Current DTCs are those which presently disrupt motorcycle operation and are set during the current ignition cycle. Verify DTCs are current by clearing the DTC and then operating the vehicle under the conditions for setting the DTC. To determine current DTCs are present, clear the DTCs and operate the vehicle within the parameters for setting the DTC. 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 20 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 20th error free cycle, the DTC will clear itself.

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 2-1](#).

After a repair is completed, restore connections, clear DTCs and start vehicle. Perform the odometer self-diagnostics test to verify repair and that all DTCs have been cleared. If any DTCs are still present, refer to [Table 2-1](#).

CLEARING DTCs

Clear DTCs after any diagnostic or repair procedure. The odometer is capable of displaying and clearing ECM, BCM, 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 BCM. The security lamp will be turned on when current codes are present in the BCM.

CHECK ENGINE LAMP

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

NOTES

- "IGN ON" means that 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 refer to [Table 2-1](#).
1. See [Figure 2-1](#). After the check engine lamp turns off following the first four second illumination period, one of two 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. If the lamp illuminates again and remains illuminated, a current DTC exists.
 2. The check engine lamp may not illuminate for less than 4 seconds under the following conditions:
 - a. IGN OFF/ON within 5 seconds.
 - b. Trip switch activated, then IGN ON within 5 seconds.
 - c. Run/stop switch cycled, then IGN ON within 5 seconds.
 - d. Security armed vehicles that are moved, then IGN ON, or IGN ON and FOB response is not immediately received (interference).
- Current DTC notification is not affected by above conditions.
3. 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. 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.

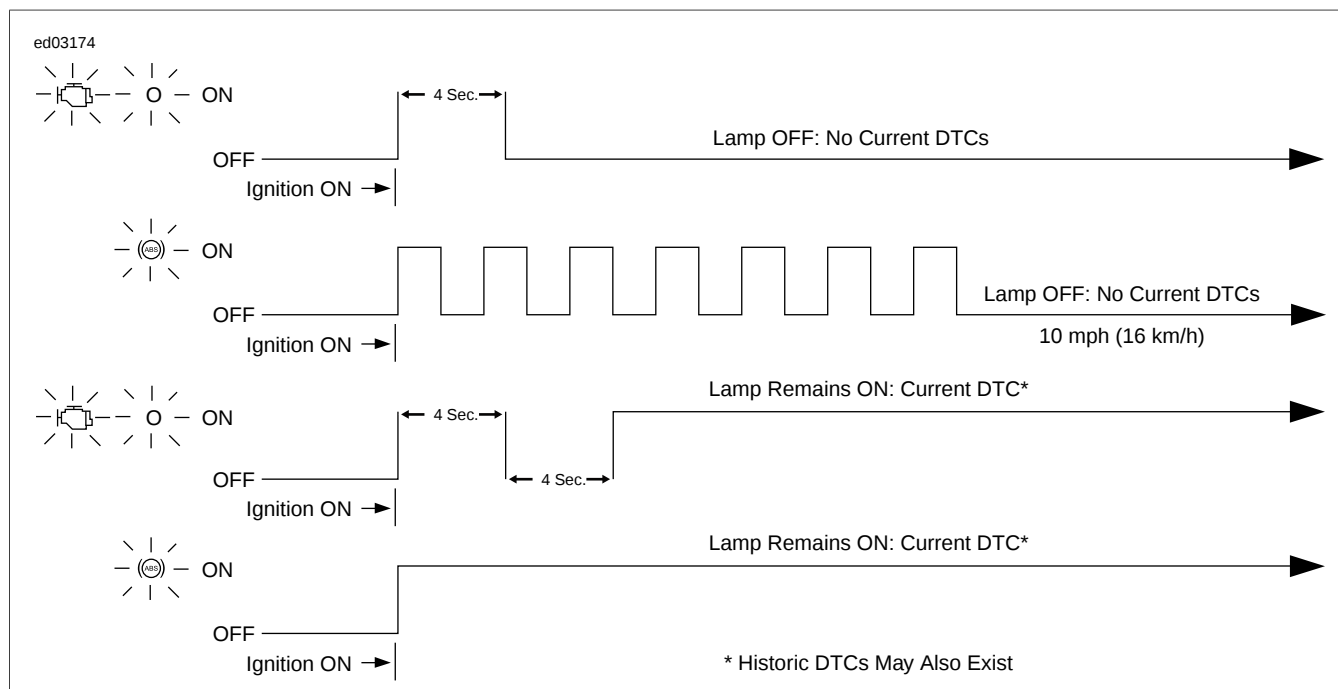


Figure 2-1. Check Engine Lamp and Security Lamp Operation

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 2-2](#) for a list of symptoms.

Table 2-2. Symptom Table

SYMPTOM	DIAGNOSTIC PROCEDURE
ABS indicator always on or inoperative	7.15 ABS INDICATOR ALWAYS ON OR INOPERATIVE
Any hand control switch inoperative	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
Auxiliary lamps/running lamps inoperative	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
Battery runs down during use	3.6 CHARGING SYSTEM
Charging system inoperative	3.6 CHARGING SYSTEM
Engine cranks, but will not start	6.26 ENGINE CRANKS, BUT WILL NOT START
Fuel gauge inaccurate, no DTCs	4.6 GAUGES
Hand control switch inoperative	5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270
Hesitation, loss of power	6.27 HESITATION, LOSS OF POWER
High beam indicator inoperative	4.5 INDICATOR LAMPS
Left hand controls inoperative	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
Low battery after extended IGN OFF	3.6 CHARGING SYSTEM
Low fuel lamp always on	4.5 INDICATOR LAMPS
Low fuel lamp flashes at steady rate	Fuel sender DTC set. See 2.1 INITIAL DIAGNOSTICS .
Low fuel lamp inoperative	4.5 INDICATOR LAMPS
Low or no charging	3.6 CHARGING SYSTEM
Neutral lamp inoperative	4.5 INDICATOR LAMPS
Misfire at idle or under load	6.29 MISFIRE AT IDLE OR UNDER LOAD
Odometer displays "DIAG" at IGN ON	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
Odometer self-diagnostics inoperative	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274

Table 2-2. Symptom Table

SYMPTOM	DIAGNOSTIC PROCEDURE
Oil pressure lamp always on	4.5 INDICATOR LAMPS
Oil pressure lamp inoperative	4.5 INDICATOR LAMPS
Overcharging	3.6 CHARGING SYSTEM
P&A battery power inoperative	5.1 ACCESSORIES: DTC B2112, B2113, B2114
Running lamps inoperative	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169
Security lamp inoperative	5.11 SECURITY SYSTEM
Speedometer inoperative	4.1 INSTRUMENTS
Starter does not spin	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	6.28 STARTS, THEN STALLS
Trip odometer reset switch inoperative	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
Trip switch functions will not enter self-diagnostics	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156
Turn signal indicator inoperative	4.5 INDICATOR LAMPS
Vehicle power inoperative	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156

SERIAL DATA COMMUNICATION

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

CAN bus circuits are used by modules and diagnostic tools to share information.

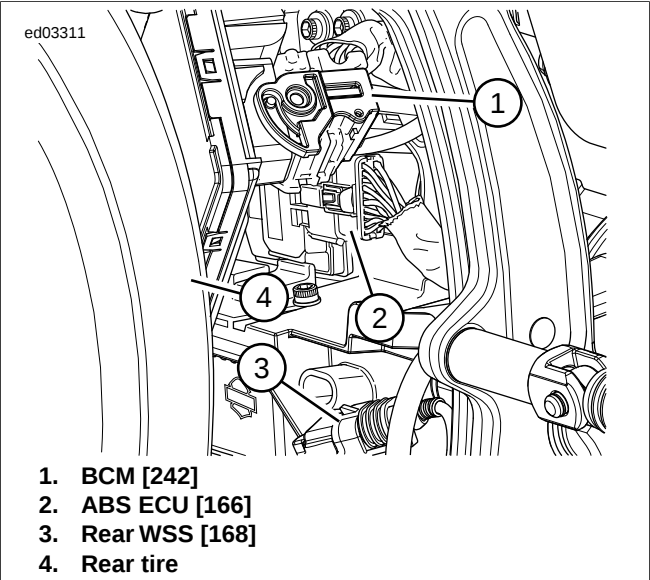


Figure 2-2. ABS [166]: Except FXSB

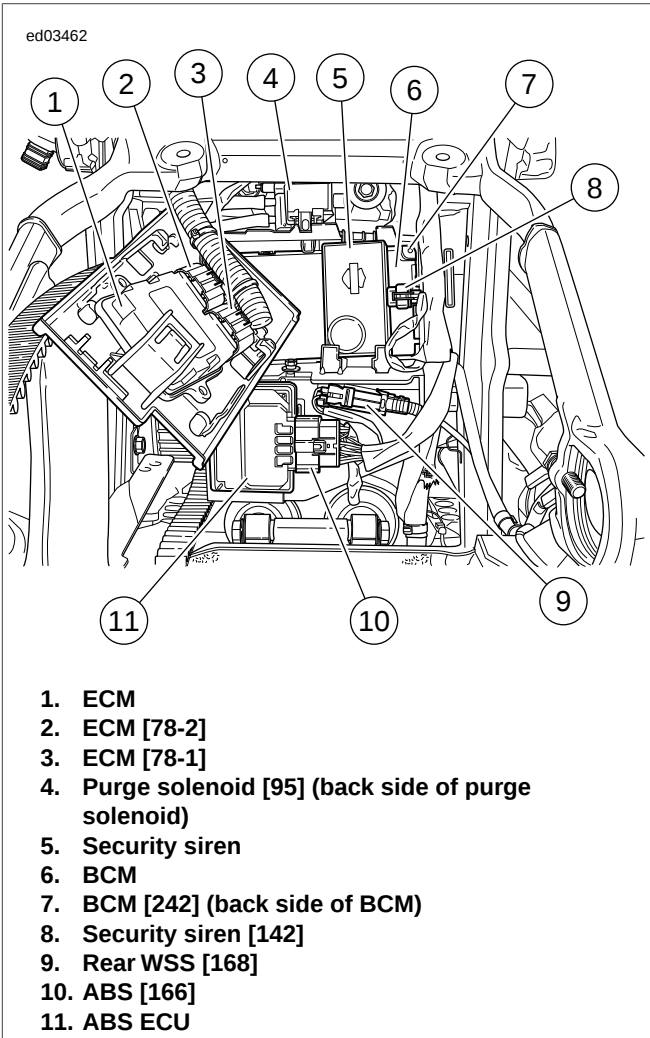


Figure 2-3. Electrical Panel: FXSB

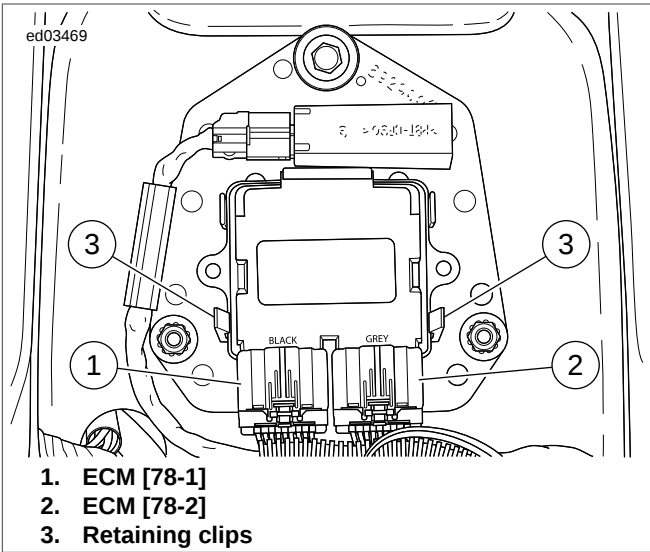


Figure 2-4. ECM [78-1] and [78-2]: Except FXSB

The speedometer, ECM, BCM, hand controls and ABS (if equipped) all communicate on the CAN bus. The CAN communication uses a (W/BK) and (W/R) wire in a twisted pair that runs to all the modules and is used to transfer data from one module to the other. This also runs to the DLC [91] and is used to communicate with the modules using DIGITAL TECHNICIAN II (Part No. HD-48650).

COMPONENTS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Electronic Control Module (ECM)

See [Figure 2-4](#). The ECM is located under the seat, except on some models it is located on the electrical panel behind the fender extension. The ECM monitors the engine sensors to enhance performance and driveability. This is done by adjusting the fuel and spark delivery based on the information provided by the sensors.

Speedometer

The speedometer contains part of the indicator and warning lamps for the motorcycle. It uses the CAN communication to receive information from the other modules to know which lamps to illuminate at any given time. Vehicle speed is also sent to the speedometer over the CAN bus. The LEDs in the indicator bar are directly wired to the speedometer. The speedometer turns the indicators on and off based off commands from the BCM over the CAN bus.

BCM

See [Figure 2-2](#). The BCM is located on the electrical panel behind the fender extension. The BCM supplies ignition and accessory power to most of the vehicle and controls the power mode of the electrical system. It controls the lighting along with other functions on the vehicle by using the switches as inputs and the power circuits for the lights as outputs. The BCM is also connected to the CAN bus and shares information with the other modules on the vehicle.

ABS Module

See [Figure 2-2](#). The ABS ECU is located on the electrical panel behind the fender extension. The ECU receives input from the front and rear WSS, and controls the front and rear HCUs accordingly. The ABS ECU communicates over the CAN bus to the speedometer to control the ABS indicator.

Hand Control Modules

The left and right hand control modules control all the switches and controls on the handlebars. The engine stop switch has a redundant wire directly to the BCM. In the event of a commu-

nication malfunction, this redundant circuit is used to keep the engine from shutting off until the switch is turned off.

The hand controls also control the turn signals and running lights (DOM) on vehicles where the front turn signals are wired to the hand controls.

Data Link Connector (DLC)

The DLC is located under the seat. The DLC is used to connect the DIGITAL TECHNICIAN II (Part No. HD-48650) to the motorcycle.

COMMUNICATION DTCS AND ERROR MESSAGES

There are several DTCs that may set due to an issue with the CAN bus communication. Different DTCs are set by different modules. If a module loses communication with the rest of the system it will set DTC U0001, but the DTC can not be retrieved until the CAN lines to that module are restored. If a module goes OFF line due to loss of PWR or GND or a loss of communication to that module, the module will not set a code, but the other modules will set DTCs indicating they are not able to communicate with it. When the speedometer recognizes a problem on the CAN bus it may display "BUS Err" on the odometer.

"VINERR" may also be displayed in the odometer if the speedometer and ECM are not seeing the same VIN in both modules. This will usually occur after replacing one of the two modules. The two modules must have the VINs match before they can share odometer mileage. Both the ECM and speedometer retain the odometer value. If the speedometer is replaced, it will display the odometer value stored in the ECM. The replacement speedometer will become locked to the ECM after 31.1 miles (50 km) have been accumulated. The trip B odometer will display the countdown mileage. Once the countdown reaches zero, the speedometer is locked to the ECM. If installed on another vehicle, the odometer will display "VINERR". If the speedometer is removed from the vehicle before the countdown reaches zero, it has not been locked to the ECM. This mileage countdown allows for a road test to verify that speedometer replacement was the proper repair.

Diagnostic Tips

Modules must have power and be grounded in order to communicate. Therefore, when checking any communication DTC be sure to check the power and ground connections on the suspected module. Bus Err may show on the odometer if the following are present:

- CAN wires shorted together.
- CAN wire shorted to PWR or GND.
- CAN transceiver on some module failed shorted.
- Non-compliant module connected to the CAN bus.

ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274

2.3

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

CAN communication uses a set of wires in a twisted pair. These two wires are designated as CAN low and CAN high circuits. Both circuits are connected to the ECM, BCM, instruments, both hand control modules and the ABS module (if equipped). The ECM and the right hand control module contain 120 Ohm terminating resistors. Typical resistance between the two circuits is approximately 60 Ohms.

- DTC U0001 indicates there is a fault on the CAN bus circuits. This code can be set by the ECM, BCM, instruments and ABS module (if equipped). This code is usually accompanied by other "U" codes, due to it causing a loss of communication between the modules on the CAN bus.
- DTC U0011 indicates the high and low CAN circuits are shorted together. This fault will be accompanied by other "U" codes and may cause the odometer display not to function.
- DTC B2274 indicates there is a fault with the battery fuse or the (R/O) wire.

NOTE

Always start from [2.1 INITIAL DIAGNOSTICS](#) before proceeding with this test.

Table 2-3. Code Description

DTC	DESCRIPTION
U0001	CAN bus fault
U0011	CAN bus low shorted to CAN bus high
B2274	Constant battery line fault

Diagnostic Tips

The speedometer does not have an ignition input. Instead, it receives a message over the CAN bus, indicating the IGN is ON. Also, the trip odometer reset switch is a CAN communication to the speedometer. Therefore, CAN bus errors can cause the odometer self-diagnostics to be completely inoperative or to only partially function. The speedometer backlighting may not function along with the hand control switches and the indicators. The odometer may read "BUS Err" in this condition, prior to the odometer becoming inoperative.

NOTE

If DIGITAL TECHNICIAN II (Part No. HD-48650) is connected to the DLC [91] and communicating with the vehicle, then the odometer self-diagnostics will not function properly. Disconnect DIGITAL TECHNICIAN II (Part No. HD-48650) before entering odometer self-diagnostics.

The BCM supplies power to several systems on the vehicle. When testing for a short to voltage, perform all tests before disconnecting the BCM to keep from powering down systems on the vehicle. If the short to voltage goes away when the BCM is disconnected, test for continuity between the circuit in question and BCM [242B] terminals F4, J3, L3, L4 and M2 to verify the tested circuit is not shorted to one of these circuits. If continuity is present, repair short to circuit instead of replacing the BCM.

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](#).

em01517

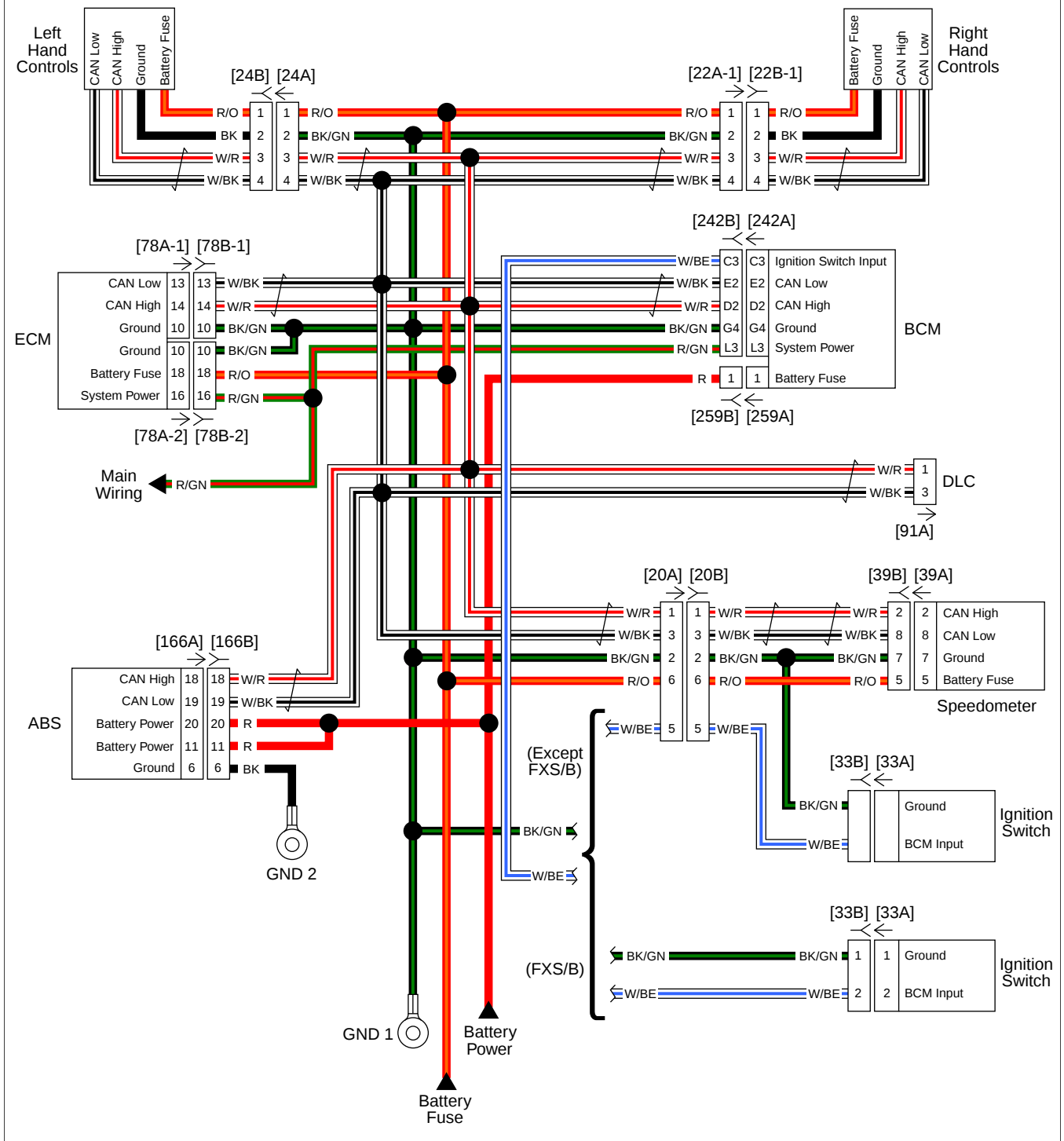


Figure 2-5. CAN Bus Circuit

ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-48642	BREAKOUT BOX
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 2-4. Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274 Diagnostic Faults

POSSIBLE CAUSES
Blown battery fuse
Open battery power circuit
Short between CAN low and high circuits
Open in CAN high circuit
Open in CAN low circuit
Short to ground on CAN high circuit
Short to ground on CAN low circuit
Short to voltage on CAN high circuit
Short to voltage on CAN low circuit

1. CAN Bus Shorted Together Test

- Turn IGN OFF.
- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between DLC [91A] terminals 1 and 3.
- Is resistance less than 50 Ohms?
 - Yes.** [Go to Test 2.](#)
 - No.** [Go to Test 9.](#)

2. Speedometer Test

- Disconnect speedometer [39].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes.** [Go to Test 3.](#)
 - No.** Replace speedometer.

3. ECM Test

- Disconnect ECM [78B-1].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes.** [Go to Test 4.](#)
 - No.** Replace ECM.

4. LHCM Test

- Disconnect LHCM [24].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes.** [Go to Test 5.](#)
 - No.** Replace LHCM.

5. RHCM Test

- Disconnect RHCM [22-1].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes, with tachometer.** [Go to Test 6.](#)
 - Yes, without tachometer.** [Go to Test 7.](#)
 - No.** Replace RHCM.

6. Tachometer Test

- Disconnect tachometer [108].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes.** [Go to Test 7.](#)
 - No.** Replace tachometer.

7. BCM Test

- Disconnect BCM [242].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes, with ABS.** [Go to Test 8.](#)
 - Yes, without ABS.** Repair short between high and low speed CAN circuits.
 - No.** Replace BCM.

8. ABS Test

- Disconnect ABS module [166].
- Is resistance between [91A] terminals 1 and 3 less than 50 Ohms?
 - Yes.** Repair short between high and low speed CAN circuits.
 - No.** Replace ABS module.

9. CAN High Circuit Short to Voltage Test

- Turn IGN ON.
- Test voltage between [91A] terminal 1 and ground.
- Is voltage greater than 4V?
 - Yes.** [Go to Test 10.](#)
 - No.** [Go to Test 18.](#)

10. Speedometer Test

- Turn IGN OFF.
- Disconnect speedometer [39].

3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Replace speedometer.

11. ECM Test

1. Turn IGN OFF.
2. Disconnect ECM [78B-1].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes.** [Go to Test 12.](#)
 - b. **No.** Replace ECM.

12. LHCM Test

1. Turn IGN OFF.
2. Disconnect LHCM [24].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes, with ABS.** [Go to Test 13.](#)
 - b. **Yes, without ABS.** [Go to Test 14.](#)
 - c. **No.** Replace LHCM.

13. ABS Test

1. Turn IGN OFF.
2. Disconnect ABS module [166].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes.** [Go to Test 14.](#)
 - b. **No.** Replace ABS module.

14. RHCM Test

1. Turn IGN OFF.
2. Disconnect RHCM [22-1].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes, with tachometer.** [Go to Test 15.](#)
 - b. **Yes, without tachometer.** [Go to Test 16.](#)
 - c. **No.** Replace RHCM.

15. Tachometer Test

1. Turn IGN OFF.
2. Disconnect tachometer [108].
3. Turn IGN ON.

4. Is voltage between [91A] terminals 1 and ground greater than 4V?
 - a. **Yes.** [Go to Test 16.](#)
 - b. **No.** Replace tachometer.

16. BCM Test

1. Disconnect BCM power [259].
2. Disconnect BCM [242].
3. Is voltage between [91A] terminal 1 and ground greater than 4V?
 - a. **Yes.** Repair short to voltage in (W/R) wire.
 - b. **No.** [Go to Test 17.](#)

17. CAN Low Circuit Short to Voltage Test

1. Test voltage between [91A] terminal 3 and ground.
2. Is voltage present?
 - a. **Yes.** Repair short to voltage in (W/BK) wire.
 - b. **No.** Replace BCM.

18. CAN High Circuit Short to Ground Test

1. Turn IGN OFF.
2. Test resistance between [91A] terminal 1 and ground.
3. Is resistance less than 1000 Ohms?
 - a. **Yes.** [Go to Test 19.](#)
 - b. **No.** [Go to Test 26.](#)

19. Speedometer Test

1. Disconnect speedometer [39].
2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 20.](#)
 - b. **No.** Replace speedometer.

20. ECM Test

1. Disconnect ECM [78B-1].
2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 21.](#)
 - b. **No.** Replace ECM.

21. LHCM Test

1. Disconnect LHCM [24].
2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 22.](#)
 - b. **No.** Replace LHCM.

22. RHCM Test

1. Disconnect RHCM [22-1].

2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes, with tachometer.** [Go to Test 23.](#)
 - b. **Yes, without tachometer.** [Go to Test 24.](#)
 - c. **No.** Replace RHCM.

23. Tachometer Test

1. Disconnect tachometer [108].
2. Is resistance between [91A] terminals 1 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 24.](#)
 - b. **No.** Replace tachometer.

24. BCM Test

1. Disconnect BCM [242].
2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes, with ABS.** [Go to Test 25.](#)
 - b. **Yes, without ABS.** Repair short to ground in (W/R) wire.
 - c. **No.** Replace BCM.

25. ABS Test

1. Disconnect ABS module [166].
2. Is resistance between [91A] terminal 1 and ground less than 1000 Ohms?
 - a. **Yes.** Repair short to ground in (W/R) wire.
 - b. **No.** Replace ABS module.

26. CAN Low Circuit Short to Ground Test

1. Test resistance between [91A] terminal 3 and ground.
2. Is resistance less than 1000 Ohms?
 - a. **Yes.** [Go to Test 27.](#)
 - b. **No.** [Go to Test 34.](#)

27. Speedometer Test

1. Disconnect speedometer [39].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 28.](#)
 - b. **No.** Replace speedometer.

28. ECM Test

1. Disconnect ECM [78B-1].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 29.](#)
 - b. **No.** Replace ECM.

29. LHCM Test

1. Disconnect LHCM [24].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 30.](#)
 - b. **No.** Replace LHCM.

30. RHCM Test

1. Disconnect RHCM [22-1].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes, with tachometer.** [Go to Test 31.](#)
 - b. **Yes, without tachometer.** [Go to Test 32.](#)
 - c. **No.** Replace RHCM.

31. Tachometer Test

1. Disconnect tachometer [108].
2. Is resistance between [91A] terminals 3 and ground less than 1000 Ohms?
 - a. **Yes.** [Go to Test 32.](#)
 - b. **No.** Replace tachometer.

32. BCM Test

1. Disconnect BCM [242].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes, with ABS.** [Go to Test 33.](#)
 - b. **Yes, without ABS.** Repair short to ground in (W/BK) wire.
 - c. **No.** Replace BCM.

33. ABS Test

1. Disconnect ABS module [166].
2. Is resistance between [91A] terminal 3 and ground less than 1000 Ohms?
 - a. **Yes.** Repair short to ground in (W/BK) wire.
 - b. **No.** Replace ABS module.

34. CAN Low Circuit Resistance to ECM Test

1. Disconnect ECM [78].
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], leaving [78A] disconnected.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 13.

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.

5. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [78B-1] terminal 13.
 - b. **No.** [Go to Test 35.](#)

35. CAN High Circuit Resistance to ECM Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 14.
2. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [78B-1] terminal 14.
 - b. **No.** [Go to Test 36.](#)

36. CAN Low Circuit Resistance to BCM Test

1. Remove cables and ECM BOB, connect ECM.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wiring harness [242B], leaving [242A] disconnected,
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal E2.
6. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [242B] terminal E2.
 - b. **No.** [Go to Test 37.](#)

37. CAN High Circuit Resistance to BCM Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal D2.
2. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [242B] terminal D2.
 - b. **No, with ABS.** [Go to Test 38.](#)
 - c. **No, without ABS.** [Go to Test 40.](#)

38. CAN Low Circuit Resistance to ABS Module Test

1. Remove cables and BCM BOB, connect BCM.
2. Disconnect ABS module [166].
3. Connect BREAKOUT BOX (Part No. HD-48642) to wiring harness [166B], leaving [166A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 19.

4. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [166B] terminal 19.
 - b. **No.** [Go to Test 39.](#)

39. CAN High Circuit Resistance to ABS Module Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 18.
2. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [166B] terminal 18.
 - b. **No, with tachometer.** [Go to Test 40.](#)
 - c. **No, without tachometer.** [Go to Test 42.](#)

40. CAN Low Circuit Resistance to Tachometer Test

1. Remove cables and ABS BOB, connect ABS module.
2. Disconnect tachometer [108].
3. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to wiring harness [108B], leaving [108A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 8.
4. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [108B] terminal 8.
 - b. **No.** [Go to Test 41.](#)

41. CAN High Circuit Resistance to Tachometer Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 2.
2. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [108B] terminal 2.
 - b. **No.** [Go to Test 42.](#)

42. CAN Low Circuit Resistance to Speedometer Test

1. Remove cables and ABS BOB, connect ABS module.
2. Remove tachometer BOB, connect tachometer.
3. Disconnect speedometer [39].
4. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to wiring harness [39B], leaving [39A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 8.

5. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [108B] terminal 8.
 - b. **No.** [Go to Test 43.](#)

43. CAN High Circuit Resistance to Speedometer Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 2.
2. Is resistance greater than 0.5 Ohm?
 - a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [39B] terminal 2.
 - b. **No.** [Go to Test 44.](#)

44. Speedometer Power Test

1. Test voltage between BOB terminal 5 and ground.
2. Is battery voltage present?
 - a. **Yes.** [Go to Test 37.](#)
 - b. **No.** Repair open in (R/O) wire.

45. Speedometer Ground Test

1. Test voltage between BOB terminals 5 and 7.
2. Is battery voltage present?
 - a. **Yes, speedometer setting code.** Replace speedometer.
 - b. **Yes, ECM setting code.** Replace ECM.
 - c. **No.** Repair open in (BK/GN) wire.

NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156

2.4

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The CAN bus circuit provides a means for the ECM, speedometer, BCM, hand control modules and the ABS module (if equipped) to communicate their current status. When all operating parameters on the CAN bus are within specifications, a state of health message is sent between the components.

The CAN bus is made up of two circuits. The (W/R) is the CAN bus high circuit and the (W/BK) is the CAN bus low circuit. Both of these circuits show around 2.5V when measured between each of the circuits and ground with the IGN ON. These circuits are connected to each module on the CAN bus network. A fault on either one of these circuits will cause several modules to set "U" codes and may cause a complete loss of communication between all modules.

Table 2-5. Code Description

DTC	DESCRIPTION
U0100	Lost communication with ECM, set by BCM or speedometer
U0121	Lost communication with ABS, set by BCM or speedometer
U0140	Lost communication with BCM, set by speedometer, ECM or ABS (if equipped)
U0141	Lost communication with LHCM, set by BCM, speedometer or ECM
U0142	Lost communication from RHCM, set by BCM, ECM or ABS (if equipped)
U0156	Lost communication from speedometer, set by BCM or ECM

Diagnostic Tips

Modules must have power in order to communicate on the CAN bus. It is important to check for good power and ground on any module that is not communicating effectively on the CAN bus network. At least two modules will set a lost communication DTC when one module has lost the ability to communicate on the CAN bus. When two or more modules are setting the same U-code this indicates a problem with the device the code is set against. If two or more modules are intermittently setting the same U-code, it indicates an intermittent problem with the device the code is set against or intermittent CAN, power or ground wires to the device. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#) to test wiring to the component.

The BCM supplies power to several systems on the vehicle. When testing for a short to voltage, perform all tests before disconnecting the BCM to keep from powering down systems on the vehicle. If the short to voltage goes away when the BCM is disconnected, test for continuity between the circuit in question and BCM [242B] terminals F4, J3, L3, L4 and M2 to verify the tested circuit is not shorted to one of these circuits. If continuity is present, repair shorted circuit instead of replacing the BCM.

Historic U-codes may be found if battery power has been lost for any reason or if the main or battery fuse have been disconnected and reconnected. This may also happen if during diagnostics using DIGITAL TECHNICIAN II (Part No. HD-48650). The diagnostics connector has been disconnected before vehicle has been powered down. This is not an indication of a problem and does not cause any loss of functionality.

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](#).

em01517

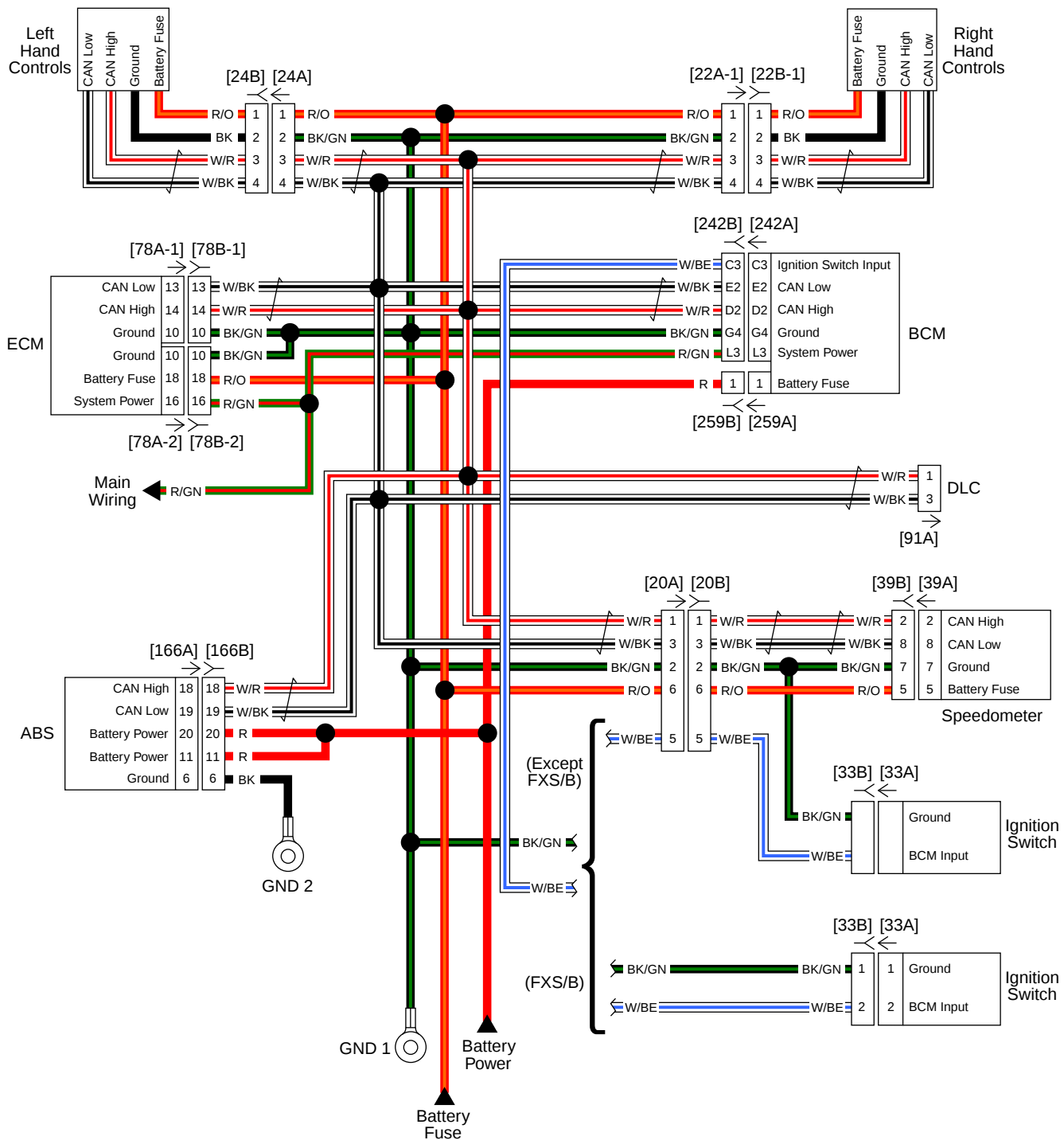


Figure 2-6. CAN Bus Circuit

DTC U0100

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 2-6. DTC U0100 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the ECM
Open in CAN low circuit to the ECM
Open in ECM system power circuit
Open in ECM ground circuit

1. Module Test

1. View odometer.
2. Is only the BCM setting DTC?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No, ABS module only.** [Go to Test 7.](#)
 - c. **No, speedometer only.** [Go to Test 8.](#)
 - d. **No, tachometer only.** [Go to Test 9.](#)
 - e. **No, multiple modules.** [Go to Test 2.](#)

2. System Power Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness connectors [78B-1] and [78B-2], leaving [78A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for voltage between BOB [78-2] terminal 16 and ground.
6. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (R/GN) wire.

3. ECM [78-1] Ground Test

1. Turn IGN OFF.
2. Test continuity between BOB [78-1] terminal 10 and ground.
3. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (BK/GN) wire.

4. ECM [78-2] Ground Test

1. Test continuity between BOB [78-2] terminal 10 and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (BK/GN) wire.

5. CAN High Circuit Continuity Test

1. Test continuity between BOB [78-1] terminal 14 and DLC [91A] terminal 1.
2. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (W/R) wire.

6. CAN Low Circuit Continuity Test

1. Test continuity between BOB [78-1] terminal 13 and [91A] terminal 3.
2. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (W/BK) wire.

7. Verify ABS Module Test

1. Turn IGN OFF.
2. Replace ABS module with a known good ABS module.
3. Turn IGN ON.
4. Attempt to start vehicle.
5. Check DTC.
6. Is DTC U0100 present?
 - a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
 - b. **No.** Replace ECM.

8. Verify Speedometer Test

1. Turn IGN OFF.
2. Replace speedometer with a known good speedometer.
3. Turn IGN ON.
4. Attempt to start vehicle.
5. Check DTC.
6. Is DTC U0100 present?
 - a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
 - b. **No.** Replace speedometer.

9. Verify Tachometer Test

1. Turn IGN OFF.
2. Replace tachometer with a known good tachometer.
3. Turn IGN ON.
4. Attempt to start vehicle.

5. Check DTC.
6. Is DTC U0100 present?
 - a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
 - b. **No.** Replace tachometer.

10. Verify BCM Test

1. Replace BCM with a known good BCM.
2. Turn IGN ON.
3. Attempt to start vehicle.
4. Check DTC.
5. Is DTC U0100 present?
 - a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
 - b. **No.** Replace BCM.

DTC U0121

PART NUMBER	TOOL NAME
HD-48642	ABS BREAKOUT BOX

Table 2-7. DTC U0121 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the ABS module
Open in CAN low circuit to the ABS module
Open in ABS system power circuit
Open in ABS ground circuit

1. ABS Voltage Test

1. Turn IGN OFF.
2. Connect ABS BREAKOUT BOX (Part No. HD-48642) to the wiring harness [166B], leaving the [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Test voltage between BOB terminal 20 and ground.
4. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R) wire.

2. ABS Ground Test

1. Test voltage between BOB terminals 20 and 6.
2. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

3. CAN High Circuit Continuity Test

1. Turn IGN OFF.
2. Test continuity between BOB terminal 18 and DLC [91A] terminal 1.

3. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test for continuity between BOB terminal 19 and [91A] terminal 3.
2. Is continuity present?
 - a. **Yes.** Replace the ABS module.
 - b. **No.** Repair open in (W/BK) wire.

NO VEHICLE POWER: DTC U0140

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 2-8. No Vehicle Power Diagnostic Faults: DTC U0140

POSSIBLE CAUSES
Open in CAN high circuit to the BCM
Open in CAN low circuit to the BCM
Open in ignition switch circuit
Short to ground in ignition switch circuit
Short to voltage in ignition switch circuit
Ignition switch malfunction
Open in BCM battery power circuit
Open in BCM ground circuit

1. Fuse Test

1. Verify all fuses are good.
2. Are fuses good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair fuse.

2. Ignition Switch Ground Test

1. Turn IGN OFF.
2. Disconnect ignition switch [33].
3. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [33B] terminal 1 and ground.
4. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK/GN) ground wire.

3. Ignition Switch Test

1. Turn IGN ON.
2. Test resistance between [33A] terminals 1 and 2.

3. Is resistance between 50-500 Ohms?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace the ignition switch.

4. Ignition Switch Accessory Test

1. Turn IGN to ACC.
2. Test resistance between [33A] terminals 1 and 2.
3. Is resistance between 400-1900 Ohms?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace ignition switch.

5. Ignition Switch Signal Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test continuity between [33B] terminal 2 (W/BE) wire and BOB terminal C3.
5. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (W/BE) wire.

6. Switch Signal Short to Ground Test

1. Test continuity between [33B] terminal 2 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (W/BE) wire.
 - b. **No.** [Go to Test 7.](#)

7. Ignition Switch Signal Short to Voltage Test

1. Disconnect [242B].
2. Connect [242B] to BOB.
3. Turn IGN ON.
4. Test voltage between [33B] terminal 2 (W/BE) wire and ground.
5. Is voltage present?
 - a. **Yes.** Repair short to voltage in (W/BE) wire.
 - b. **No.** [Go to Test 8.](#)

8. BCM Ground Test

1. Turn IGN OFF.
2. Connect [33].
3. Test continuity between BOB terminal G4 (BK/GN) wire and ground.

4. Is continuity present?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Repair open in (BK/GN) wire.

9. CAN High Circuit Continuity Test

1. Test continuity between BOB terminal D2 and DLC [91A] terminal 1 (W/R) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No.** Repair open in (W/R) wire.

10. CAN Low Circuit Continuity Test

1. Test continuity between BOB terminal E2 and [91A] terminal 3 (W/BK) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Repair open in (W/BK) wire.

11. BCM Voltage Test

1. Disconnect BCM power [259B].
2. Test voltage between [259B] terminal 1 and ground.
3. Is battery voltage present?
 - a. **Yes.** Replace the BCM.
 - b. **No.** Repair open in (R) wire.

LEFT HAND CONTROLS INOPERATIVE: DTC U0141

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 2-9. Left Hand Controls Inoperative, DTC U0141
Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the LHCM
Open in CAN low circuit to the LHCM
Open in LHCM battery power circuit
Open in LHCM ground circuit

1. LHCM Voltage Test

1. With IGN OFF, disconnect LHCM [24A].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between LHCM [24A] terminal 1 and ground.
3. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R/O) wire.

2. LHCM Test

1. Test voltage between [24A] terminals 1 and 2.

2. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test continuity between [24A] terminal 3 and DLC [91A] terminal 1.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test continuity between [24A] terminal 4 and [91A] terminal 3.
2. Is continuity present?
 - a. **Yes.** Replace the LHCM.
 - b. **No.** Repair open in (W/BK) wire.

DTC U0142

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 2-10. DTC U0142 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the RHCM
Open in CAN low circuit to the RHCM
Open in RHCM battery power circuit
Open in RHCM ground circuit

1. Fuse Test

1. Check battery fuse.
2. Is fuse good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair as needed, replace fuse.

2. RHCM Voltage Test

1. Turn IGN OFF.
2. Disconnect LHCM [24A].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between RHCM [22A-1] terminal 1 and ground.
4. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R/O) wire.

3. CAN High Circuit Continuity Test

1. Test continuity between [22A-1] terminal 3 and DLC [91A] terminal 1.

2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test continuity between [22A-1] terminal 4 and [91A] terminal 3.
2. Is continuity present?
 - a. **Yes.** Replace the RHCM.
 - b. **No.** Repair open in (W/BK) wire.

SPEEDOMETER INOPERATIVE: DTC U0156

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

Table 2-11. DTC U0156 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the speedometer
Open in CAN low circuit to the speedometer
Open in speedometer battery power circuit
Open in speedometer ground circuit

1. Speedometer Voltage 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], leaving the [39A] disconnected.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R/O) wire.

2. Speedometer Ground Test

1. Test voltage between BOB terminals 5 and 7.
2. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test continuity between BOB terminal 2 and DLC [91A] terminal 1.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test continuity between BOB terminal 8 and [91A] terminal 3.
2. Is continuity present?
 - a. **Yes.** Replace speedometer.
 - b. **No.** Repair open in (W/BK) wire.

NOTES

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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.

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 using an automatic, self monitoring battery charger approved for AGM batteries.

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)

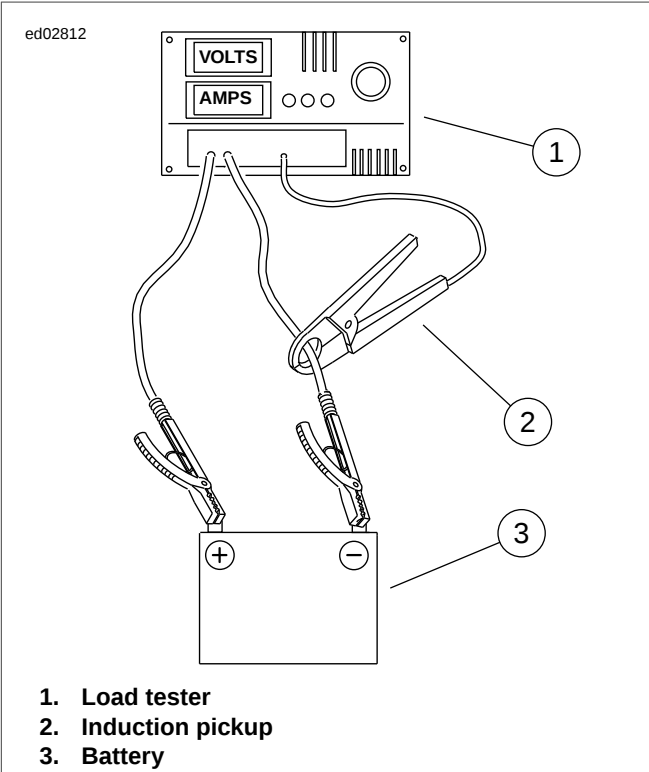


Figure 3-2. Load Test Battery

Table 3-2. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
Softail models	315	155

STARTING SYSTEM

3.2

DESCRIPTION AND OPERATION

Battery voltage is supplied to the BCM at all times through the main fuse. The BCM provides and monitors a voltage signal to the ignition switch. This signal changes depending on the position of the IGN switch.

When the engine stop switch is in the RUN position, a CAN message is sent, signaling the BCM that the switch is in the RUN position. If CAN communication is interrupted while the engine is running, the BCM checks for the signal from the redundant engine stop switch circuit.

When the start switch is pressed, a CAN message is sent to the BCM. The BCM provides power to the starter solenoid. This energizes the solenoid and full battery power is sent to the starter. The BCM disables the starter solenoid if the start switch is pressed for more than 10 seconds.

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:

- 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 has a one-way clutch. 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.

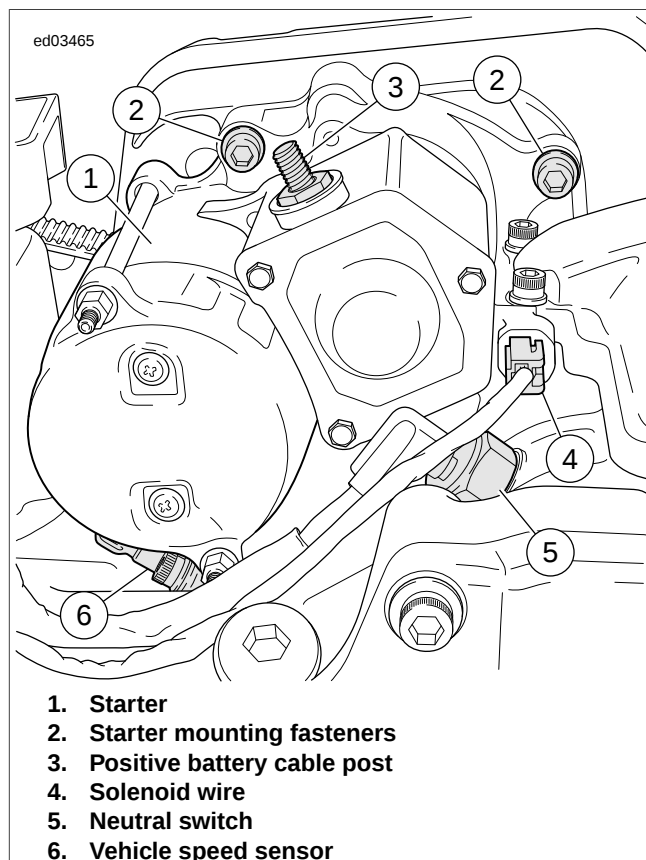


Figure 3-3. Starter

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 BCM. The BCM 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, a CAN message is sent, signaling the BCM that the switch is in the RUN position. If CAN communication is interrupted while engine is running, a redundant engine stop switch circuit allows communication to the BCM.

Start Switch

The start switch is a push button switch located in the right hand controls. When the start switch is pressed, a CAN message is sent to the BCM.

BCM

The BCM supplies ignition and accessory power to most of the vehicle. It controls the lighting along with other functions on the vehicle by using the switches as inputs and the power circuits for the lights and other electrical loads as outputs.

Ignition Switch

The BCM provides and monitors a voltage signal to the ignition switch, which is an open circuit in the OFF position. The ignition switch routes the signal through a 200 Ohm resistor to ground in the IGN position or through a 800 Ohm resistor to ground in the ACC position. The difference in resistance in the ignition switch informs the BCM of the switch position.

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 overcharging by the regulator during use.

Battery condition can be determined by a voltage test, a charging and a load test. See [3.1 BATTERY TESTING](#).

The battery must be fully charged to perform a conductance test or 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 assemblies with cracked or missing teeth. Rounding of pinion gear teeth is considered normal. If replacing pinion gear, 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](#).

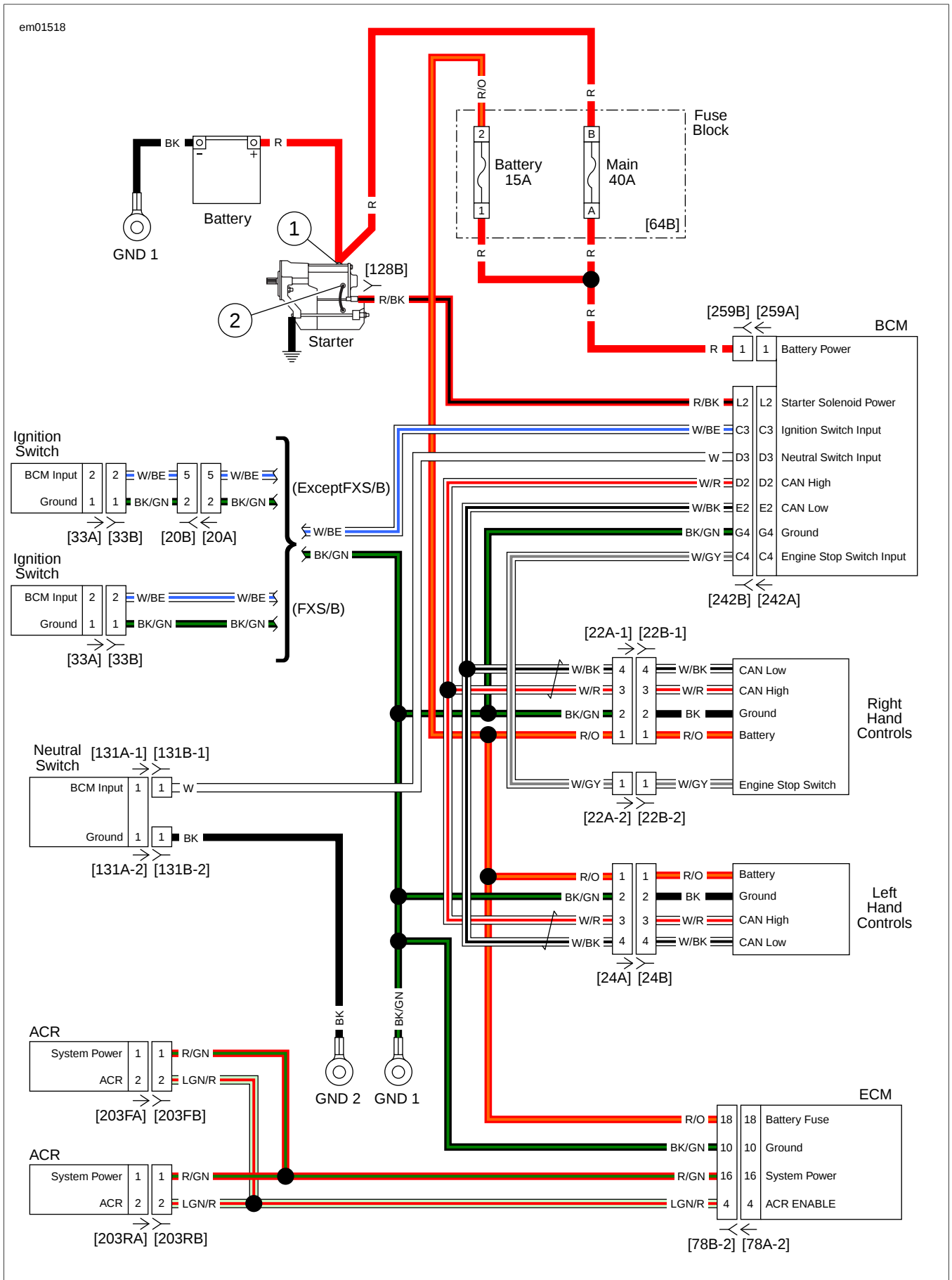


Figure 3-4. Starting Circuit

STARTER TROUBLESHOOTING

The troubleshooting tables contain detailed procedures to solve and correct problems. Follow [3.2 STARTING SYSTEM](#) to dia-

gnose 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 BCM ground wire.	Tighten connections or repair or replace wire(s).
Start switch or engine stop switch	Stuck switch or open switch.	Replace RHCM.
Neutral switch	Switch or wiring from neutral switch to BCM failed open.	Replace neutral switch or repair open.
Clutch switch	Clutch switch always open.	Replace clutch switch.
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.
ACR (if equipped)	ACR failure.	Replace ACR.
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
Starter solenoid	Coil shorted.	Replace starter solenoid assembly.
	Contact plate melted and stuck.	Replace starter solenoid assembly.

STARTER TESTING

Table 3-6. Starter Testing Diagnostic Faults

POSSIBLE CAUSES
Short to voltage at starter solenoid
Start switch malfunction
Short to voltage on BCM supply circuit

1. Starting System Operational Test

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

2. Audible Noise Test

- While listening for audible clicking noise from the starter solenoid, press the start switch.
- Is there a click?
 - Yes, starter solenoid clicks.** See [3.2 STARTING SYSTEM, Starter Solenoid Clicks](#).
 - No.** See [3.2 STARTING SYSTEM, Nothing Clicks](#).

3. Starter Solenoid Test

- Disconnect starter solenoid [128].
- Does starter stop?
 - Yes.** [Go to Test 4](#).
 - No.** Replace starter solenoid assembly. **(5845)**

4. Checking DTCs Test

- Check for DTCs.
- Is DTC B2122 present?
 - Yes.** See [3.3 DTC B2121, B2122, B2123, B2124](#).
 - No.** Replace BCM. **(5838)**

NOTHING CLICKS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-7. Nothing Clicks Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open fuse
Neutral switch malfunction
Open neutral circuit
Ignition switch malfunction
Open ignition circuit

NOTE

Verify that vehicle is in neutral. Check that the key fob is present and in working order (if security equipped). Verify the engine stop switch is in RUN position.

1. Battery Test

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

2. Fuse Test

- Verify all fuses are good.
- Are fuses good?
 - Yes.** [Go to Test 3](#).
 - No.** Replace fuse and repair circuit accordingly. If problem is still present, then continue tests. [Go to Test 3](#).

3. Ignition Circuit Test

- Turn IGN ON.

2. Do odometer, headlamp and tail lamps illuminate?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No. Odometer is inoperative, but headlamp and tail lamps illuminate.** See [2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274.](#)
 - c. **No. Odometer, headlamp and tail lamps inoperative.** See [2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140.](#)

4. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage at [128B] (R/BK) wire during the first 4-5 seconds, while start button is pressed.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** [Go to Test 6.](#)

5. 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. **(5817)**
 - b. **Yes. Engine cranks, but at a slower speed.** See [3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.](#)
 - c. **No.** Replace starter solenoid. **(5845)**

6. Neutral Switch Test

1. With IGN ON and the transmission in neutral, observe the neutral lamp.
2. Is the neutral lamp illuminated?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** See [4.5 INDICATOR LAMPS, Neutral Lamp Inoperative.](#)

7. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and BCM [242A]. See [1.2 DIAGNOSTIC TOOLS.](#)
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test continuity between BOB terminal L2 and [128B].

5. Is continuity present?
 - a. **Yes.** [Go to Test 8.](#)
 - b. **No.** Repair open in (W) wire. **(5041)**

8. BCM Test

1. Turn IGN OFF, turn engine stop switch to OFF.
2. Disconnect BCM and replace with known good BCM.
3. Turn IGN ON.
4. Turn engine stop switch to RUN, attempt to start vehicle.
5. Does engine crank?
 - a. **Yes.** Replace BCM. **(5838)**
 - b. **No.** Replace RHCM. **(6166)**

STARTER SOLENOID CLICKS

Table 3-8. 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 battery test. See [3.1 BATTERY TESTING.](#)
2. Did battery pass test?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace battery.

2. Starter Voltage Drop Test

1. Perform voltage drop tests from battery (+) to starter stud on starter (BK) wire. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.](#)
2. Is voltage drop greater than 1.0V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 5.](#)

3. 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 4.](#)
 - b. **No.** Replace starter solenoid assembly. **(5845)**

4. 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)**

5. Starter Ground Circuit Voltage Drop Test

1. Perform voltage drop test from battery (-) terminal to ground.
2. Is voltage drop greater than 1.0V?
 - a. **Yes.** Inspect (BK) wire for damage from battery (-) terminal to chassis ground, repair or replace if necessary. [Go to Test 6.](#)
 - b. **No.** [Go to Test 7.](#)

6. 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 [3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.](#)
 - c. **No.** Replace starter. **(5817)**

7. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See [3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.](#)
2. Perform Starter Motor Free Running Current Draw Test (on bench). See [3.5 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 3-9. Starter Spins But Does Not Engage Diagnostic Faults

POSSIBLE CAUSES
Clutch assembly
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.

NOTE

*Inspect ACR operation (if equipped) before installation of **new** starter clutch assembly.*

3. Is damage present?
 - a. **Yes.** Replace the clutch assembly or clutch shell and sprocket. **(5825)**
 - b. **No.** Replace the clutch assembly. **(5837)**

STARTER STALLS OR SPINS TOO SLOWLY

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 3-10. 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 battery test. See [3.1 BATTERY TESTING.](#)
2. Did battery pass test?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace battery.

2. Starter Stud Voltage Drop Test

1. Perform voltage drop test from battery (+) terminal to starter stud on starter (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. ACR Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wire harness [78B-1], [78B-2] and [78A-1], [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper between BOB [78-2] terminal 16 and terminal 18.
6. Jumper between BOB [78-2] terminal 4 and terminal 10.
7. Does ACR's click?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace front and rear ACR solenoids.

5. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See [3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test](#).

2. Perform Starter Motor Free Running Current Draw Test (on bench). See [3.5 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)**

6. Starter Solenoid Voltage Drop Starter Side Test

1. Perform voltage drop test between battery (+) terminal to starter solenoid terminal 2.
2. Is voltage drop greater than 1.0V?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair connection or (BK) wire between starter solenoid and starter. **(5041)**

7. Starter Solenoid Battery Side Voltage Drop Test

1. Perform voltage drop test between battery (+) terminal and starter solenoid terminal 1 (R) wire.
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.** Repair or replace starter solenoid assembly. **(5845)**

DTC B2121, B2122, B2123, B2124

3.3

DESCRIPTION AND OPERATION

The starter solenoid circuit is controlled and monitored by the BCM. The BCM receives a CAN message from the start switch in the RHCM to engage the starter. Voltage is sent from the BCM to the starter solenoid [128] (R/BK) wire. The BCM disables the starter solenoid if the start switch is pressed for more than 10 seconds.

Table 3-11. Code Description

DTC	DESCRIPTION
B2121	Starter output open
B2122	Starter output shorted high
B2123	Starter output shorted low
B2124	Starter output overloaded

Conditions for Setting

DTC B2121 will set if the starter solenoid circuit draws less than 600 milliamps. DTC B2124 will set if the starter solenoid circuit draws more than 12 Amps.

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](#).

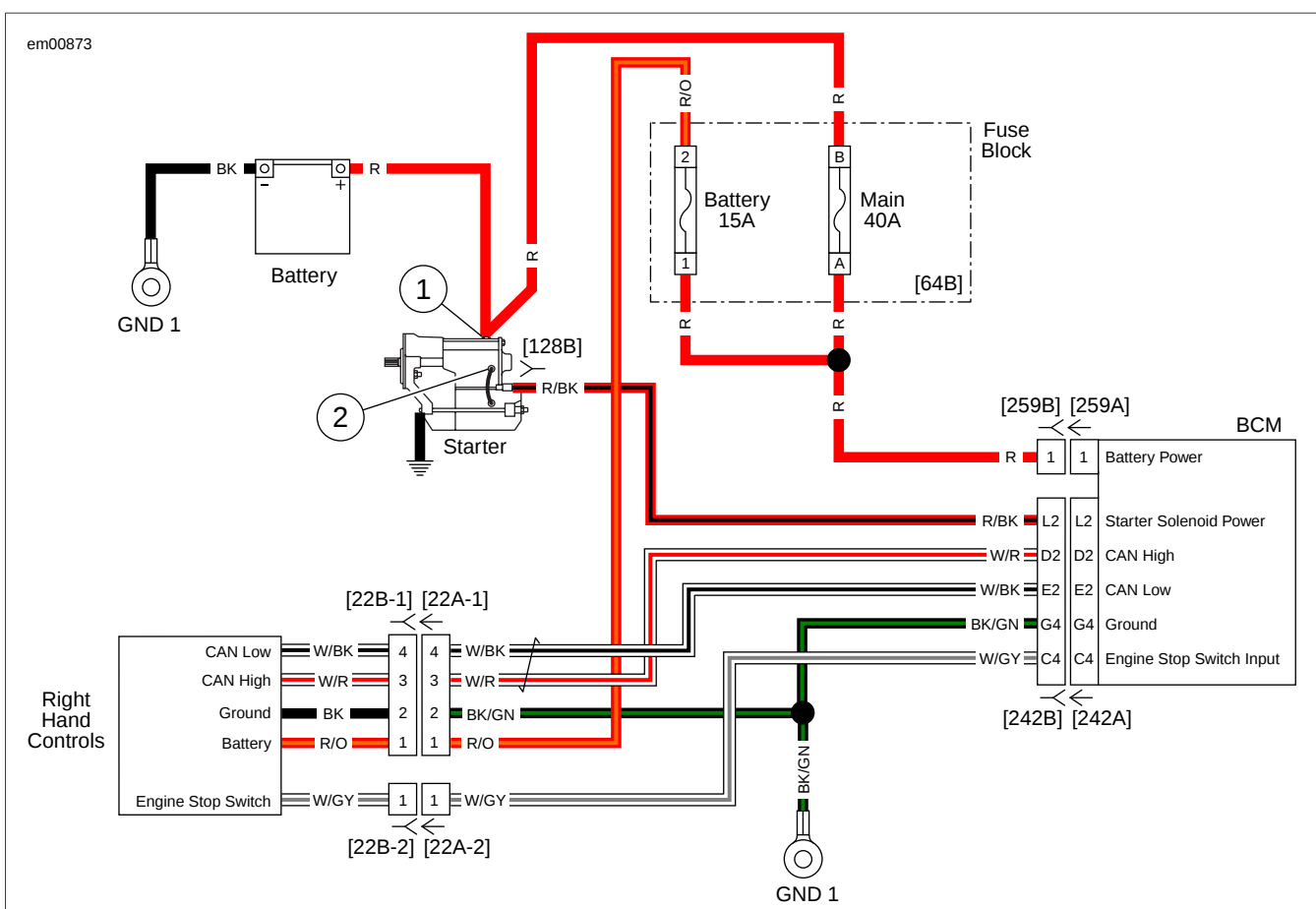


Figure 3-5. Starter

DTC B2121

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-12. DTC B2121 Diagnostic Faults

POSSIBLE CAUSES
Open in starter circuit
Open in starter solenoid

1. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for battery voltage at [128B] (R/BK) during the first 4-5 seconds while start button is pressed.
4. Is battery voltage present?
 - a. **Yes.** Replace starter solenoid assembly. **(5845)**
 - b. **No.** [Go to Test 2.](#)

2. Starter Solenoid Supply Voltage Test

1. Turn IGN OFF.
2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test voltage at BOB terminal L2 during the first 4-5 seconds while start button is pressed.
5. Is voltage present?
 - a. **Yes.** Repair open in (R/BK) wire between [242B] terminal L2 and [128B]. **(5041)**
 - b. **No.** Replace BCM.

DTC B2122

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-13. DTC B2122 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Short in starter solenoid

1. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage at [128B] (R/BK).
4. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace starter solenoid assembly. **(5845)**

2. Starter Solenoid Supply Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON, test voltage at BOB terminal L2 without pressing the start button.
5. Is voltage present?
 - a. **Yes.** Repair short to voltage in (R/BK) wire between [242B] terminal L2 and [128B]. **(5041)**
 - b. **No.** Replace BCM.

DTC B2123

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-14. DTC B2123 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Short in starter solenoid

1. Starter Solenoid Supply Continuity Test

1. With IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal L2 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground in (R/BK) wire between [242B] terminal L2 and [128B]. **(5041)**
 - b. **No.** Replace BCM.

DTC B2124

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-15. DTC B2124 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Starter solenoid malfunction
Corrosion at connector

1. Starter Solenoid [128] Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Inspect [128] and (R/BK) wire for damage or corrosion.
4. Is any present?
 - a. **Yes.** Repair or replace [128] and (R/BK) wire.
 - b. **No.** [Go to Test 2.](#)

2. Starter Solenoid Circuit Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [128B] (R/BK) wire and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace starter solenoid assembly. **(5845)**

3. Starter Solenoid Supply Continuity Test

1. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal L2 and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground in (R/BK) wire between [242B] terminal L2 and [128B]. **(5041)**
 - b. **No.** Replace BCM.

TESTING STARTER ON MOTORCYCLE

3.4

STARTER CURRENT DRAW TEST

PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE

NOTES

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

Check starter current draw with the FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) before disconnecting battery. Proceed as follows:

1. Verify that transmission is in neutral.
2. Disconnect CKP sensor [79].

3. Clamp the FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) around the positive starter cable to starter solenoid.

NOTE

After seeing the start button pressed for 10 seconds, the BCM will stop voltage to the starter solenoid automatically.

4. With IGN ON, press start button and 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 [3.5 TESTING STARTER ON BENCH, Free Running Current Draw Test](#).

TESTING STARTER ON BENCH

3.5

FREE RUNNING CURRENT DRAW TEST

PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE

- Place starter in vise. Use a clean shop towel to prevent scratches or other damage.
- See [Figure 3-6](#). Attach one heavy jumper cable (6 gauge minimum).
 - Connect one end to the starter mounting flange.
 - Connect the other end to the battery (-) terminal of a fully charged battery.
- Connect a second heavy jumper cable (6 gauge minimum).
 - Connect one end to the battery (+) terminal of the battery.
 - Connect the other end to the battery terminal on the starter. Clamp the FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) around the cable.

CAUTION

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

- Connect a smaller jumper cable (14 gauge minimum).
 - Connect one end to the positive (+) terminal of the battery.
 - Connect the other end to the solenoid relay terminal.
- Check ammeter reading.
 - Ammeter should show 90A maximum.
 - If reading is higher, replace starter.
 - If starter current draw on vehicle was over 120A and this test was within specification, there may be a problem with engine or primary drive.

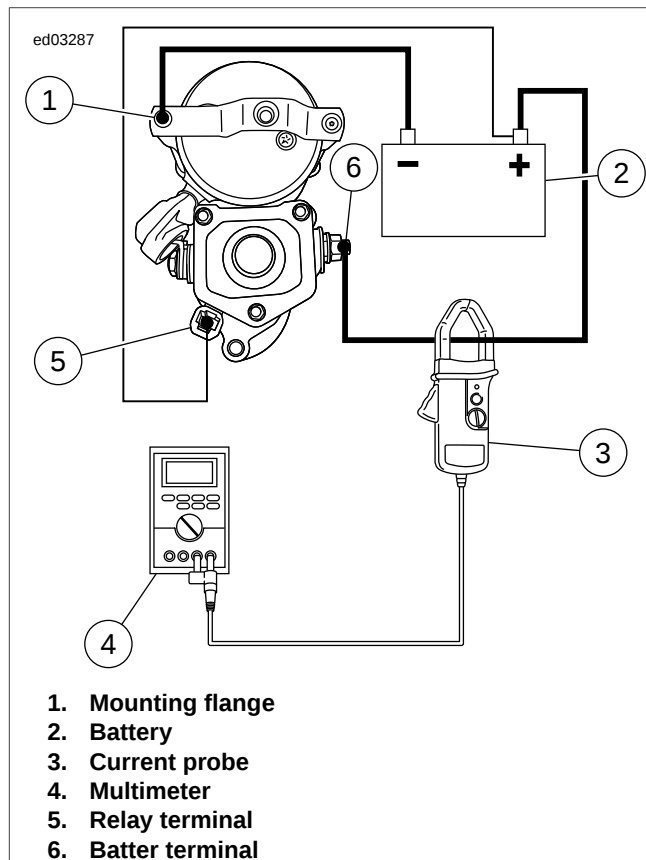


Figure 3-6. Free Running Current Draw Test

STARTER SOLENOID

Do not disassemble solenoid. Before testing, disconnect field wire from solenoid motor terminal as shown in [Figure 3-7](#).

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

- See [Figure 3-7](#). Using a 12V battery, connect three separate test leads as follows:
 - Solenoid housing to negative battery post.
 - Solenoid motor terminal to negative battery post.
 - Solenoid relay terminal to positive battery post.
- Observe starter shaft.
 - If starter shaft extends strongly, solenoid is working properly.
 - If starter shaft does not extend strongly, replace solenoid assembly.

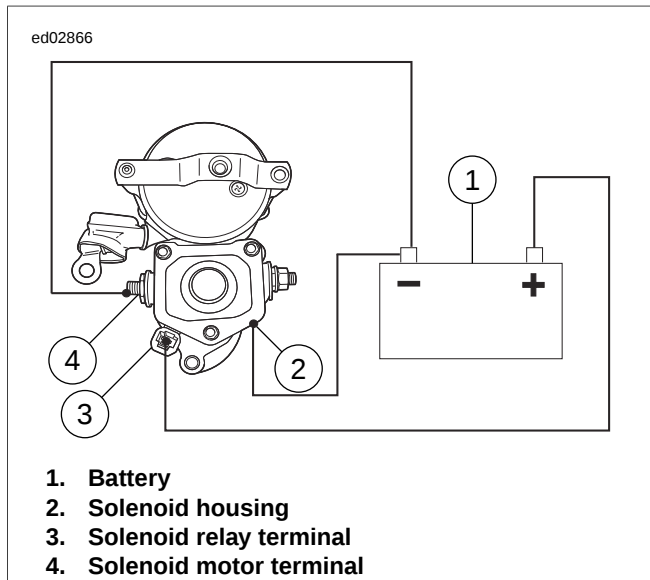


Figure 3-7. Pull-In Test

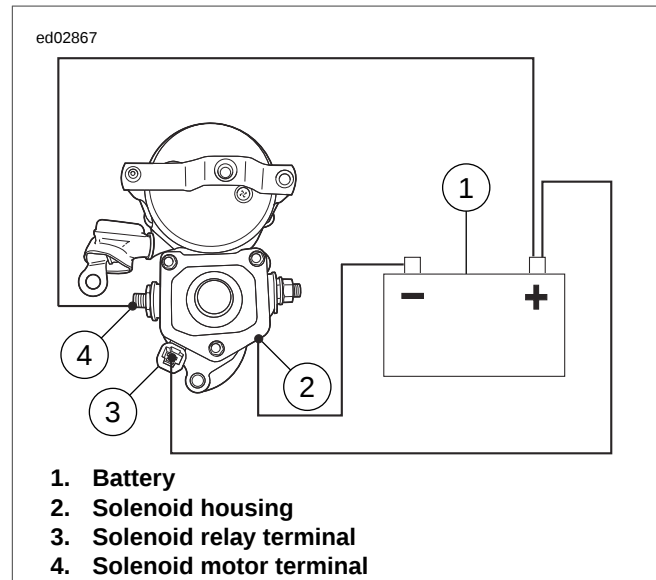


Figure 3-8. Hold-In Test

SOLENOID HOLD-IN TEST

1. See [Figure 3-8](#). With test leads still connected in the manner specified in the previous [3.5 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.

SOLENOID RETURN TEST

1. See [Figure 3-9](#). With test leads still connected in the manner specified at the end of [3.5 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.

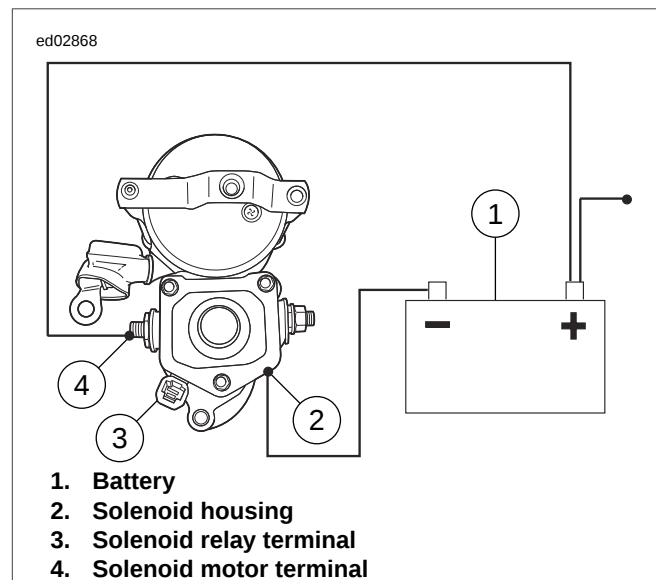


Figure 3-9. Return Test

CHARGING SYSTEM

3.6

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 3-10](#). The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating.

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](#).

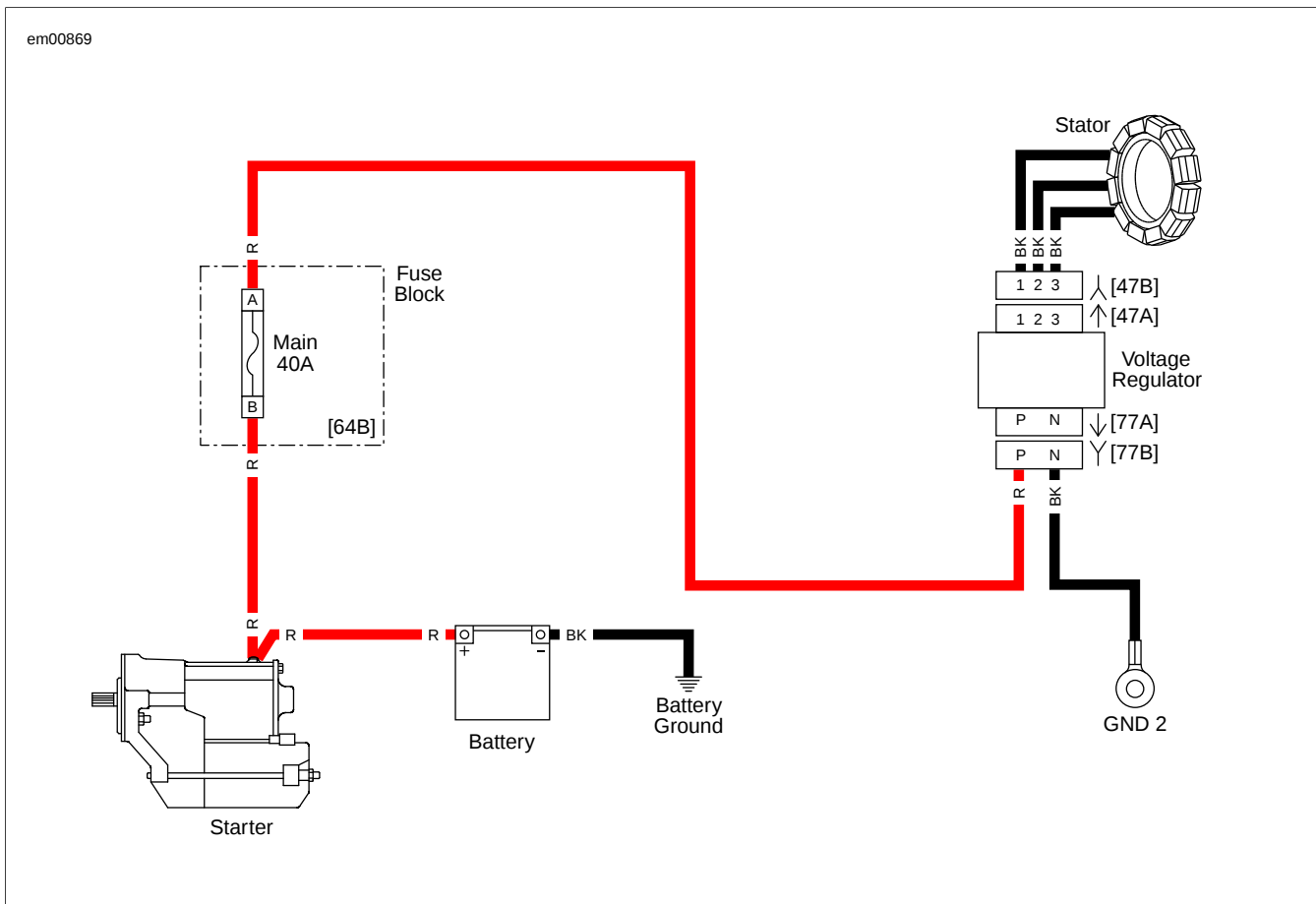


Figure 3-10. Charging System Circuit

LOW OR NO CHARGING

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-16. 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 battery test. See [3.1 BATTERY TESTING](#).
2. Did battery pass test?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace battery.

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 AC output test. See [3.6 CHARGING SYSTEM, Battery Charging Tests](#).
2. Did output test pass?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** [Go to Test 4.](#)

4. Stator Test

1. Perform stator test. See [3.6 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. Remove center bolt and inspect for signs of the center hole becoming oval.
3. Verify 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. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [77B] terminal + and main fuse [5B].
3. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open wire between voltage regulator [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 [77B] terminal - and ground.
2. Is resistance less than 0.5 Ohms?
 - a. **Yes.** Replace voltage regulator. (5316)
 - b. **No.** Repair open wire between voltage regulator [77B] terminal - and ground (BK) wire. (5041)

OVERCHARGING

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-17. Overcharging Diagnostic Faults

POSSIBLE CAUSES
Voltage regulator malfunction
Open in GND 1 circuit

1. Battery Voltage Test

1. With 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. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [77B] terminal - and ground.
3. Is resistance less than 0.5 Ohms?
 - a. **Yes.** Replace voltage regulator. **(5316)**
 - b. **No.** Repair open wire between [77B] terminal - and ground (BK) wire. **(5041)**

LOW BATTERY AFTER EXTENDED IGN OFF

Table 3-18. 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 [3.6 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 3-19. 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 [3.6 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. Connect ammeter between x and y to test.

1. If vehicle is equipped with security, 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 will occur directly after connecting meter. This should drop to the values shown in [Table 3-20](#) in less than 30 seconds.

4. See [Figure 3-11](#). Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect ammeter to main fuse socket terminals. With this arrangement, you will also pick up any regulator drain.
5. With IGN OFF and all lights and accessories off, observe current reading.
 - a. Add voltage regulator draw to appropriate value for BCM and ECM. If observed ammeter reading is less than listed in [Table 3-20](#).
 - b. A higher reading indicates excessive current draw. Any accessories must be considered and checked for excessive drain.

Table 3-20. Milliampere Draw Test

ITEM	MAXIMUM DRAW IN MILLI-AMPERES
LHCM	1.0
RHCM	1.0
Speedometer	1.0
Tachometer (if equipped)	1.0
Regulator	1.0
ABS (if equipped)	1.0
BCM	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.	

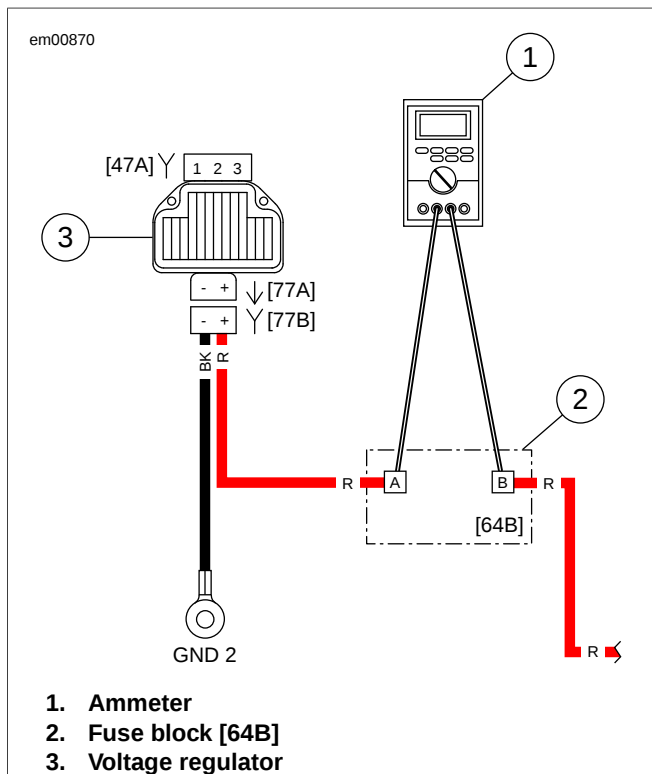


Figure 3-11. Milliampere Draw Test (Ignition Turned to OFF)

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)

- See [Figure 3-12](#). Connect load tester.
 - Connect negative and positive leads to battery terminals.
 - Place load tester induction pickup over battery negative cable.
- With IGN OFF, disconnect voltage regulator [77].
- Start engine.
- Turn all continuously running lights and accessories ON (headlamp on high beam).
- Run engine at 3000 rpm and make note of the current draw.
- Turn engine OFF.
- With IGN OFF, connect voltage regulator [77].

- Remove the induction pickup from the battery negative cable.
- Place induction pickup over positive regulator cable.
- 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.

- Increase the load as required to obtain a constant 13.0V.
- Current output should be 35-50A. Make note of current output.

NOTE

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

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

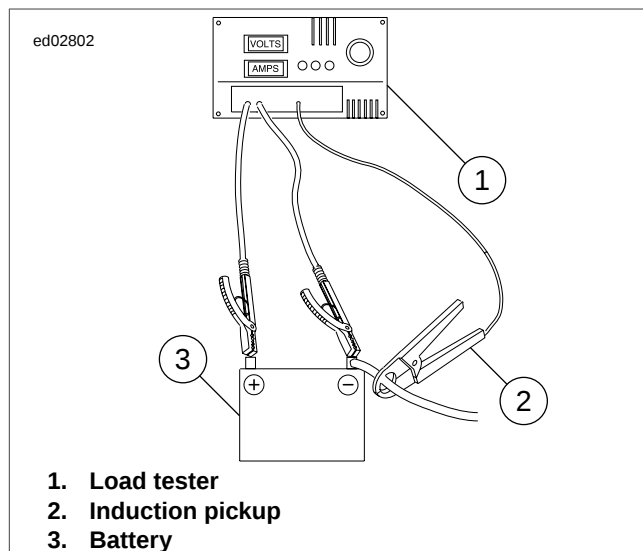


Figure 3-12. Check Current Draw (Ignition Switch On)

Stator Test

- Turn IGN OFF.
- See [Figure 3-13](#). Connect an ohmmeter.
 - Disconnect voltage regulator connector from alternator stator wiring.
 - Insert one ohmmeter lead into a stator connector socket.
 - Attach the other lead to a suitable ground.
- Test for continuity.
 - A good stator will show no continuity (open circuit) between all stator sockets and ground.
 - Any other reading indicates a grounded stator which must be replaced.

4. See [Figure 3-14](#). Remove ground lead. Measure resistance across stator [47B] terminals 1-2, 2-3 and 3-1.
 - a. Resistance across all the stator terminals should be 0.1-0.3 Ohm.
 - b. If the resistance is out of range, replace the stator.

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.

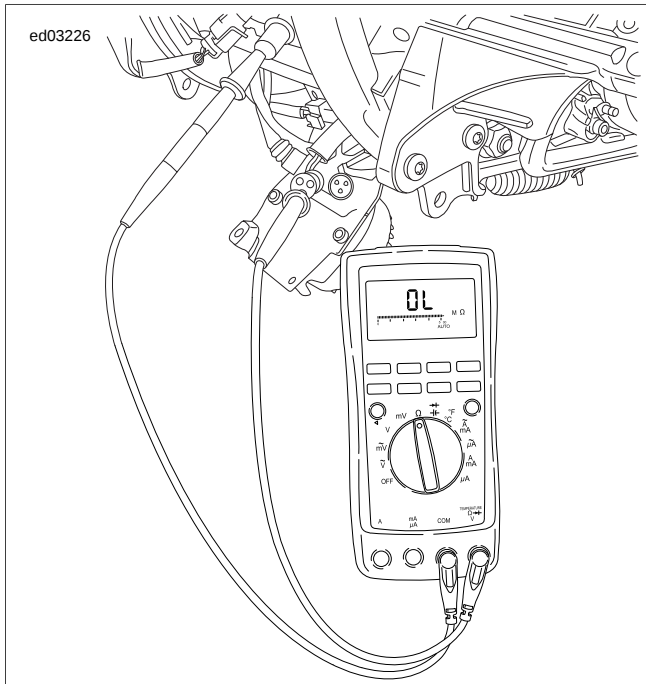


Figure 3-13. Test for Grounded Stator (Typical)

AC Output Test

1. See [Figure 3-15](#). 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 32-46 VAC (approximately 16-22 per 1000 rpm).
 - d. Repeat test using terminals 2 to 3 and 1 to 3.
2. Compare test results to specifications.
 - a. If the output is below specifications, charging problem could be a faulty rotor or stator.
 - b. If output is within specifications, charging problem might be faulty voltage regulator. Replace as required.

3. Check the output again as previously described under Total Current Draw and Output Test.

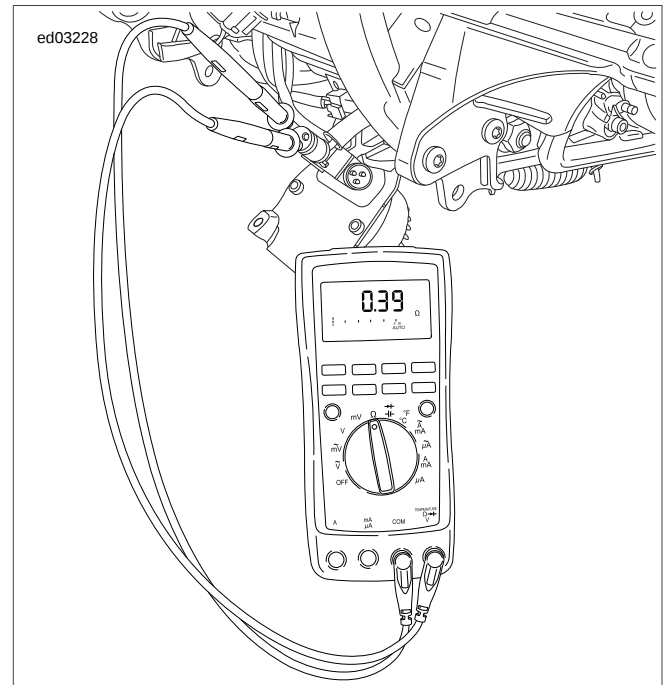


Figure 3-14. Check for Stator Resistance (Typical)

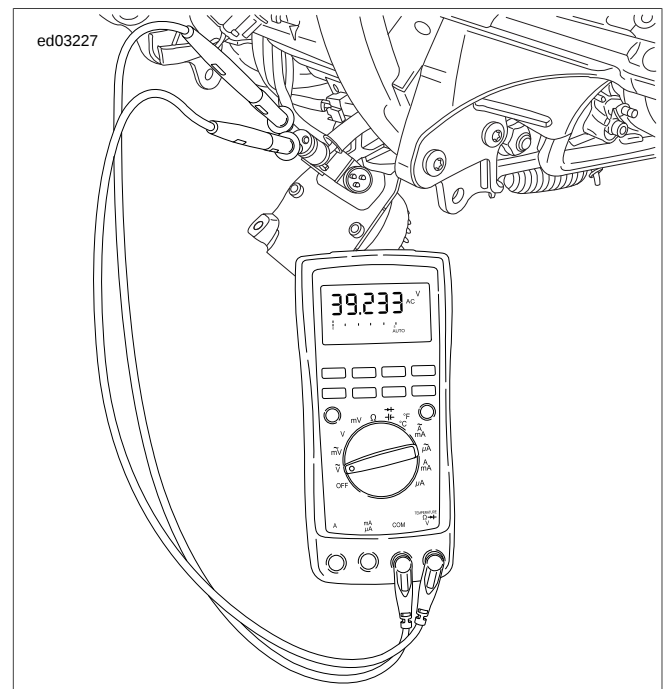


Figure 3-15. Check Stator AC Voltage Output (Typical)

DTC C0562, C0563, C1222, C1223

3.7

DESCRIPTION AND OPERATION

Battery voltage is monitored by the ABS module. DTCs set if monitoring finds irregular voltage readings.

DTC C0562 and C0563

Battery voltage is monitored by the ABS module on both terminals 11 and 20.

- DTC C0562 is displayed when the ABS ECU falls below 10.5V during a non-ABS event or the ABS ECU falls below 8.7V during an ABS event.
- DTC C0563 is displayed when the ABS ECU exceeds 17.0V during a non-ABS event.

DTC C1222 and C1223

Battery voltage is monitored by the ABS module on terminal 11 and on terminal 20.

- DTC C1222 is displayed when the voltage of terminal 11 falls below 2.0V of terminal 20.
- DTC C1223 is displayed when the voltage of terminal 20 falls below 2.0V of terminal 11.

Table 3-21. Code Description

DTC	DESCRIPTION
C0562	ABS voltage low
C0563	ABS voltage high
C1222	ABS voltage low - terminal 11
C1223	ABS voltage low - terminal 20

DIAGNOSTICS

Diagnostic Tips

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

- The charging system is malfunctioning.
- There is excessive battery draw and/or extended idling in heavy traffic.
- A faulty system ground is present.
- Shorted ABS actuator circuit.

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 an unapproved constant current 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](#).

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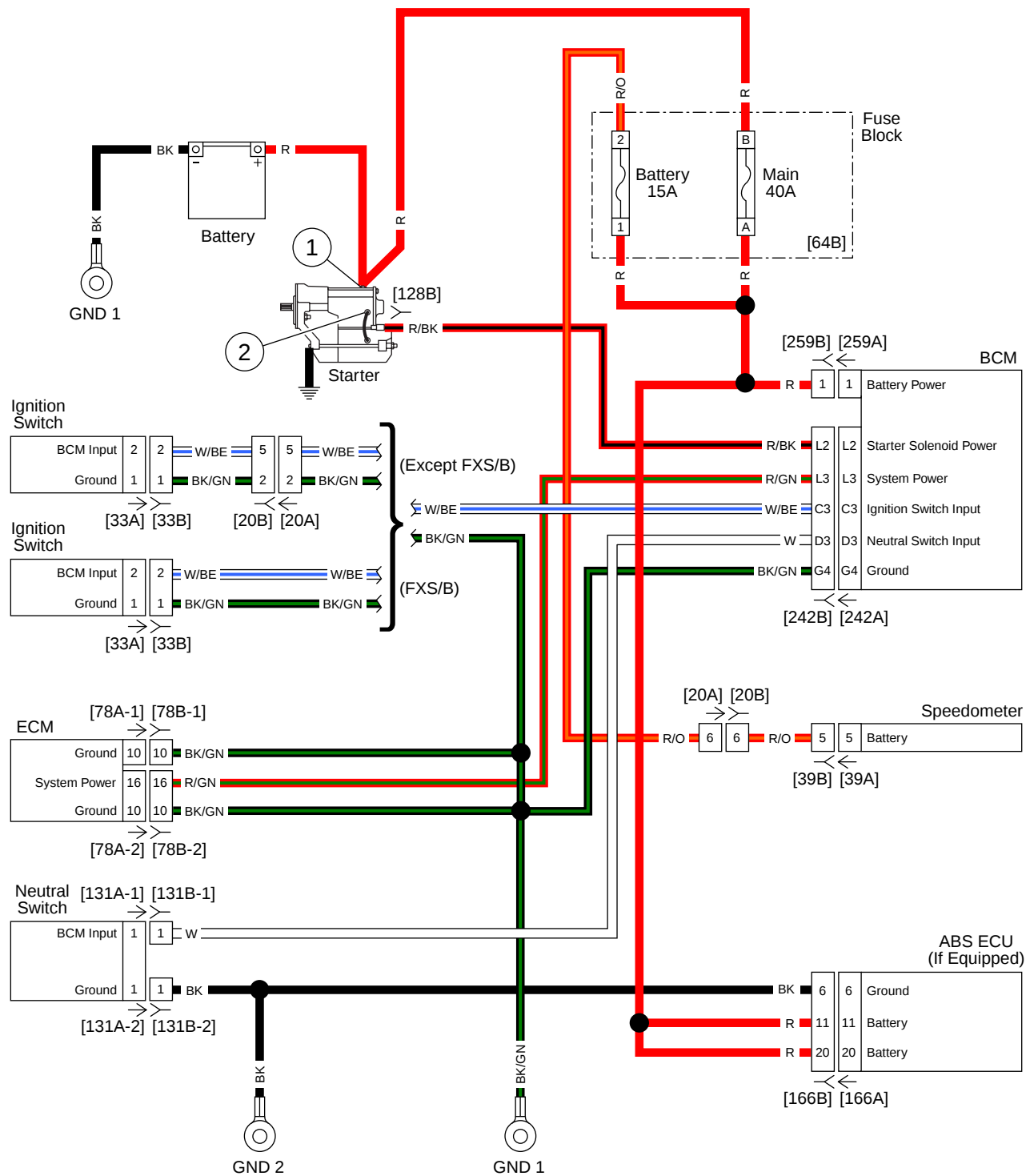


Figure 3-16. High and Low Voltage Modules

DTC C0562

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX

Table 3-22. DTC C0562 Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open ABS module ground circuit
Open ABS module battery circuit

1. Battery Test

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

2. Charging System Test

1. Perform charging system test. See [3.6 CHARGING SYSTEM, Low or No Charging](#).
2. Is charging system working properly?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair charging system.

3. ABS ECU Battery Voltage Test

1. Turn IGN OFF.
2. Disconnect ABS module [166].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) between wire harness [166A] and [166B]. See [1.2 DIAGNOSTIC TOOLS](#).
4. With engine stop switch in the RUN position and transmission in neutral, turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 11 and 6.
6. Is battery voltage present?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** [Go to Test 4.](#)

4. ABS ECU Battery Voltage Drop Test

1. Perform a voltage drop test between battery (+) terminal and BOB terminal 11. 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. ABS ECU Ground Circuit Voltage Test

1. Perform a voltage drop test between BOB terminal 6 and battery (-) terminal.

2. Is voltage drop greater than 0.5V?
 - a. **Yes.** Repair wiring between [166B] terminal 6 and battery negative.
 - b. **No.** Problem may be intermittent. Locate and repair bad connection. Perform [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#). If no problem is found, then continue with tests. [Go to Test 9.](#)

6. Main Fuse Voltage Drop Test

1. Perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair or replace (R) wire between [64B] socket terminal A and BCM power [259B].

7. Fuse Block Voltage Drop Test

1. Perform a voltage drop test between [64B] socket terminal B and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 8.](#)
 - b. **No.** Repair or replace [64B] socket terminals A and B.

8. Fuse Block Supply Voltage Drop Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
 - b. **No.** Repair or replace (R) wire between starter terminal 1 and [64B] socket terminal B.

9. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does DTC set?
 - a. **Yes.** One of the ABS actuators circuit may be shorted. See [7.6 DTC C1052, C1102](#) and [7.11 DTC C1192, C1193](#).
 - b. **No.** System working properly.

DTC C0563

Table 3-23. DTC C0563 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction

1. Charging System Test

1. Perform charging system tests. See [3.6 CHARGING SYSTEM](#).

2. Is charging system good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair charging system. [Go to Test 2.](#)

2. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does DTC C0563 set?
 - a. **Yes.** Replace ABS module.
 - b. **No.** System working properly.

DTC C1222, C1223

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	BREAKOUT BOX

Table 3-24. DTC C1222, C1223 Diagnostic Faults

POSSIBLE CAUSES
Wiring harness malfunction

1. ABS ECU Battery Voltage Test

1. Turn IGN OFF.
2. Disconnect ABS module [166].
3. Connect BREAKOUT BOX (Part No. HD-48642) between wire harness [166A] and [166B]. See [1.2 DIAGNOSTIC TOOLS](#).

4. With the engine stop switch in the RUN position and the transmission in neutral, turn the IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 11 and 20.
6. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R) wire.

2. ABS ECU Battery Voltage Drop Test

1. Perform a voltage drop test between breakout box terminals 11 and 20.
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** Repair or replace (R) wire between fuse block [64B] socket terminal A and [166B].
 - b. **No.** Inspect [166B] for terminal pins backing out or for fraying. Repair if necessary. [Go to Test 3.](#)

3. 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.** One of the ABS actuators circuit may be shorted. See [7.6 DTC C1052, C1102](#) and [7.11 DTC C1192, C1193](#).
 - b. **No.** System working properly.

DTC P0562

DESCRIPTION AND OPERATION

Battery voltage is monitored by the ECM on the system power terminal 16 of [78-2]. The system power is supplied to the ECM from the BCM system power terminal L3.

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.

Table 3-25. Code Description

DTC	DESCRIPTION
P0562	ECM voltage low

DIAGNOSTICS

Diagnostic Tips

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

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](#).

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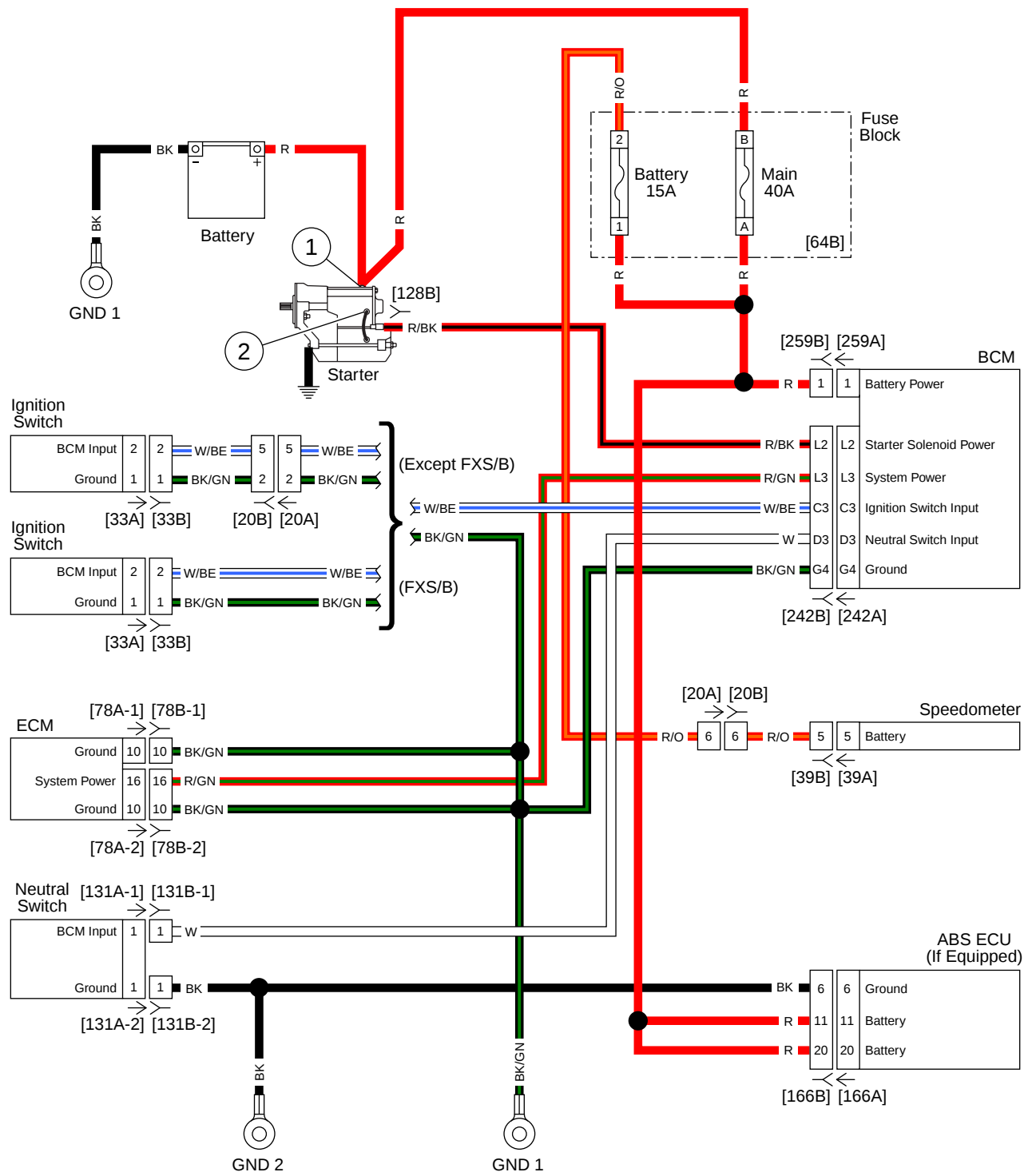


Figure 3-17. High and Low Voltage Modules

DTC P0562

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 3-26. DTC P0562 Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open ECM ground circuit
Open ECM system power circuit

1. Battery Test

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

2. Charging System Test

1. Perform charging system test. See [3.6 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. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness connectors [78B-1] and [78B-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start vehicle.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 16 and 10 of [78-2].
6. Is voltage greater than 12.2V?
 - a. **Yes.** System is working properly.
 - b. **No.** [Go to Test 4.](#)

4. ECM System Power Test

1. Test voltage between BOB terminal 16 of [78-2] and ground.

2. Is voltage greater than 12.2V?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** [Go to Test 7.](#)

5. ECM Ground [78-1] Circuit Test

1. Turn IGN OFF.
2. Test resistance between BOB terminal 10 of [78-1] and ground.
3. Is resistance greater than 1 Ohm?
 - a. **Yes.** Repair wiring between ECM [78B-1] terminal 10 and ground.
 - b. **No.** [Go to Test 6.](#)

6. ECM Ground [78-2] Circuit Test

1. Test resistance between BOB terminal 10 of [78-2] and ground.
2. Is resistance greater than 1 Ohm?
 - a. **Yes.** Repair wiring between ECM [78B-2] terminal 10 and ground.
 - b. **No.** Problem may be intermittent. Locate and repair bad connection. Perform [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop](#). If no problem is found, then continue with tests. [Go to Test 12.](#)

7. BCM System Power Test

1. Turn IGN OFF.
2. Remove BOB from ECM.
3. Connect [78A] to [78B].
4. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Start vehicle.
7. Test voltage between BOB terminal L3 and ground.
8. Is voltage greater than 12.2V?
 - a. **Yes.** Repair (R/GN) wire between [242B] terminal L3 and [78B-2] terminal 16. **(5041)**
 - b. **No.** [Go to Test 8.](#)

8. BCM Power Test

1. Turn IGN OFF.
2. Disconnect BCM power [259].
3. Test voltage at [259B].
4. Is battery voltage present?
 - a. **Yes.** Replace BCM.
 - b. **No.** [Go to Test 9.](#)

9. Main Fuse Voltage Test

1. Connect [259].

2. Turn IGN ON.
3. Leaving main fuse in place, perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
4. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No.** Repair or replace (R) wire between fuse block [64B] socket terminal A and [259B].

10. Fuse Block Voltage Drop Test

1. Leaving main fuse in place, perform a voltage drop test between fuse block [64B] socket terminal B and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Repair or replace fuse block [64B] socket terminals A and B.

11. Fuse Block Supply Voltage Drop Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
 - b. **No.** Repair or replace (R) wire between starter terminal 1 and fuse block [64B] socket terminal B.

12. Repair Validation Test

1. Clear DTCs.
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 B2203

3.9

DESCRIPTION AND OPERATION

The ignition switch turns on the BCM and the BCM then turns on all the other components. The ignition switch has three positions: OFF, IGN and ACC. However, there are only two wires coming from the ignition switch. There is a ground wire and a signal wire that runs to the BCM.

There are two resistors built into the ignition switch:

- 200 Ohms for the IGN position.
- 800 Ohms for the ACC position.

The BCM will see a different voltage depending on which position the ignition switch is in.

DTC B2203 is set when the BCM indicates a short to ground between [242B] and [33B] in the (W/BE) wire.

Table 3-27. Code Description

DTC	DESCRIPTION
B2203	Ignition switch input shorted low

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](#).

em01519

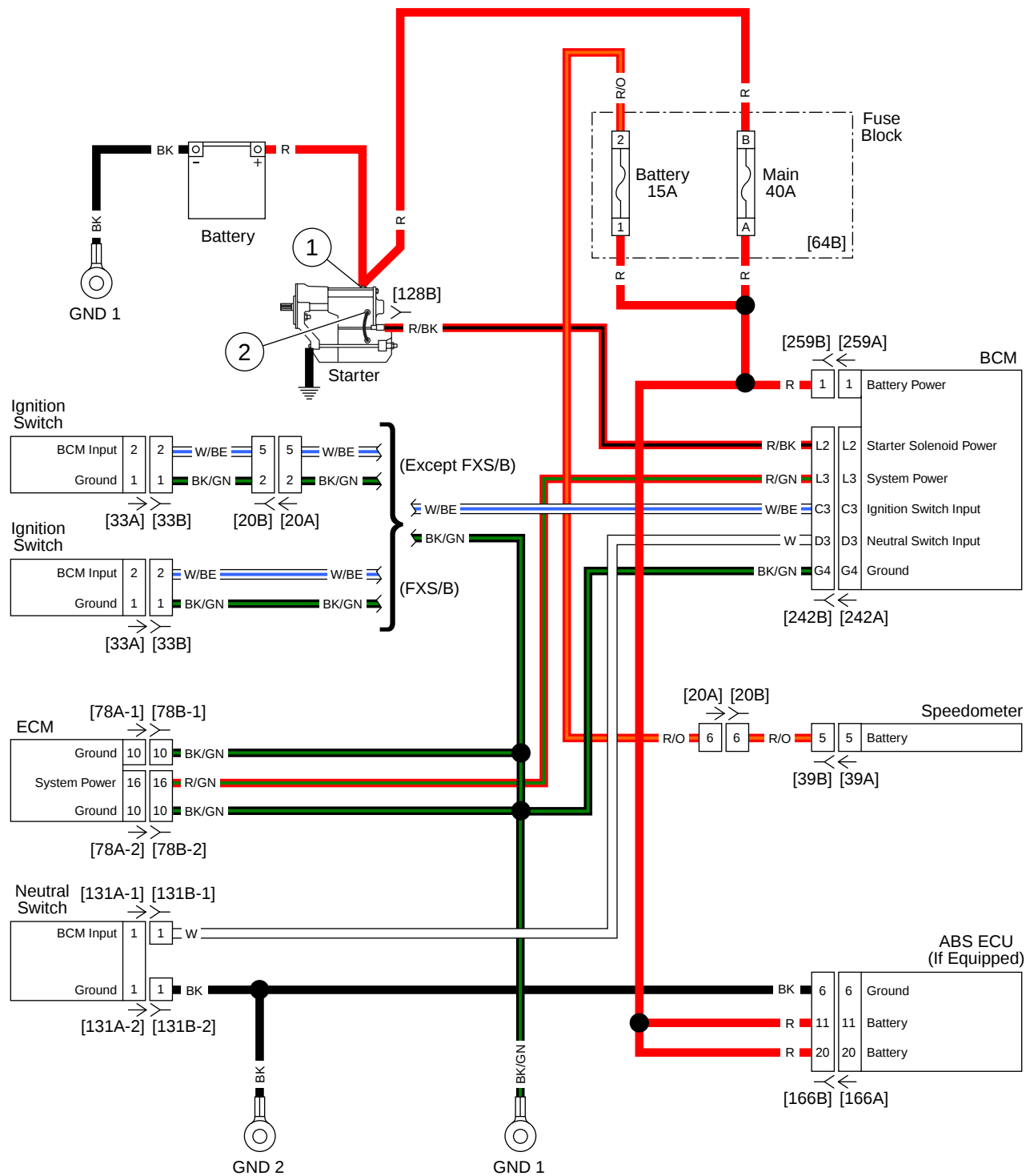


Figure 3-18. High and Low Voltage Modules

DTC B2203

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-28. DTC B2203 Diagnostic Faults

POSSIBLE CAUSES
Short in ignition switch
Ignition switch malfunction

1. Ignition Continuity [242B] Test

1. Turn IGN OFF.
2. Disconnect ignition switch [33].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal C3 and ground.

6. Is continuity present?
 - a. **Yes.** Repair short to ground in (W/BE) wire. **(5041)**
 - b. **No.** [Go to Test 2.](#)

2. Ignition Switch Run Test

1. Turn IGN ON.
2. Test resistance between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.
3. Is resistance between 50-400 Ohms?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace ignition switch. **(7287)**

3. Ignition Switch ACC Test

1. Turn IGN ACC.
2. With IGN ACC, test resistance between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.
3. Is resistance between 500-1900 Ohms?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace ignition switch. **(7287)**

4. Ignition Switch OFF Test

1. Turn IGN OFF.
2. Test continuity between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.
3. Is continuity present?
 - a. **Yes.** Replace ignition switch. **(7287)**
 - b. **No.** Replace BCM.

DTC B2206, B2208

3.10

DESCRIPTION AND OPERATION

The RHCM is monitored by the BCM. If the communication between the BCM and the RHCM fails to meet normal operating parameters, a DTC is set.

These DTCs are set outside of CAN communication and only refer to the redundant engine stop switch (W/GY) wire from the RHCM.

- DTC B2206 is set when the BCM indicates an open between [242B] terminal C4 and the engine stop switch.
- DTC B2208 is set when the BCM indicates a short to ground between [242B] terminal C4 and the engine stop switch.

Table 3-29. Code Description

DTC	DESCRIPTION
B2206	Engine stop switch input open/shorted high
B2208	Engine stop switch input shorted low

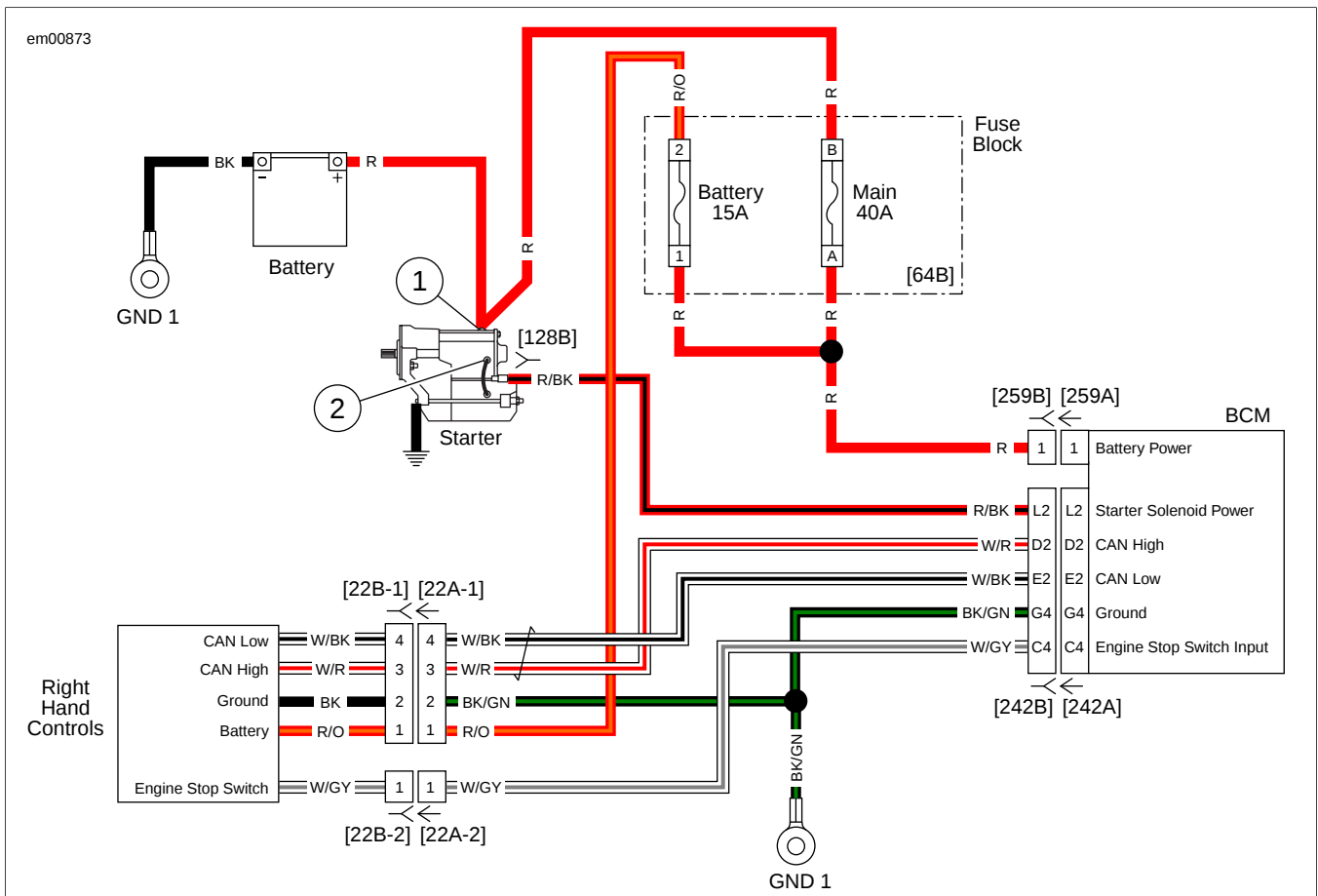


Figure 3-19. Starter

DTC B2206

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-30. DTC B2206 Diagnostic Faults

POSSIBLE CAUSES
Open in engine stop circuit

1. BCM Supply Voltage Test

1. With IGN OFF, disconnect RHCM [22-2].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage at [22A-2] (W/GY) wire during the first 4-5 seconds after IGN ON.
3. Is voltage present?
 - a. **Yes.** Replace RHCM.
 - b. **No.** [Go to Test 2.](#)

2. BCM Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test voltage at BOB terminal C4 during the first 4-5 seconds after IGN ON.
5. Is voltage present?
 - a. **Yes.** Repair open in (W/GY) wire between [242B] terminal C4 and [22A-2].
 - b. **No.** Replace BCM.

DTC B2208

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-31. DTC B2208 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in engine stop circuit

1. BCM to Ground Continuity Test

1. With IGN OFF, disconnect RHCM [22-2].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [22A-2] (W/GY) wire and ground.
3. Is continuity present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair short to ground between [22B-2] (W/GY) wire and RHCM. **(5041)**

2. BCM Voltage Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between [242B] and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground between [242B] terminal C4 and [22A-2] (W/GY) wire. **(5041)**
 - b. **No.** Replace BCM.

DTC B2271, B2272

3.11

DESCRIPTION AND OPERATION

Battery voltage is constantly monitored by the BCM and speedometer. Any voltage readings outside of normal parameters set a DTC.

DTC B2271

The BCM monitors [259] terminal 1 for battery power.

DTC B2271 is displayed when battery voltage is less than 9.0V.

DTC B2272

The BCM monitors [259] terminal 1 and the speedometer monitors terminal 5 for battery power.

- DTC B2272 (BCM) is displayed when battery voltage is greater than 16.1V for longer than 5 seconds.
- DTC B2272 (Speedometer) is displayed when battery voltage is greater than 16.0V for longer than 5 seconds.

NOTE

ECM, ABS, ECU and/or BCM may also set a battery voltage DTC.

Table 3-32. Code Description

DTC	DESCRIPTION
B2271	BCM voltage low
B2272	BCM voltage high
B2272	Speedometer voltage high

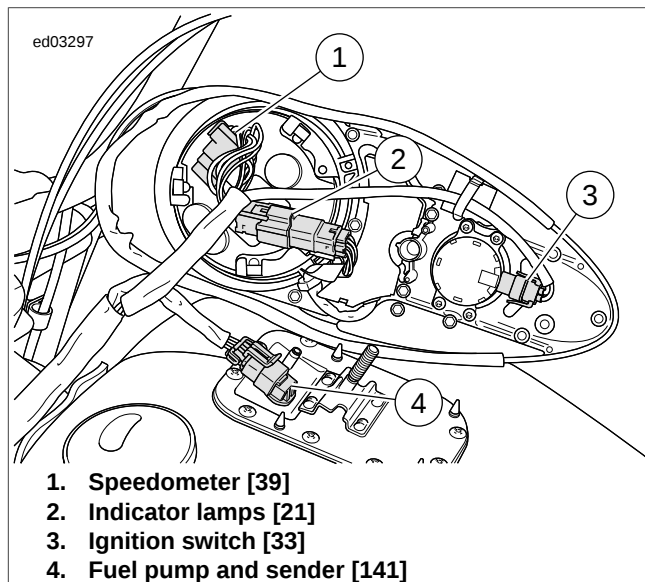


Figure 3-20. Under Console: Except FXS/B

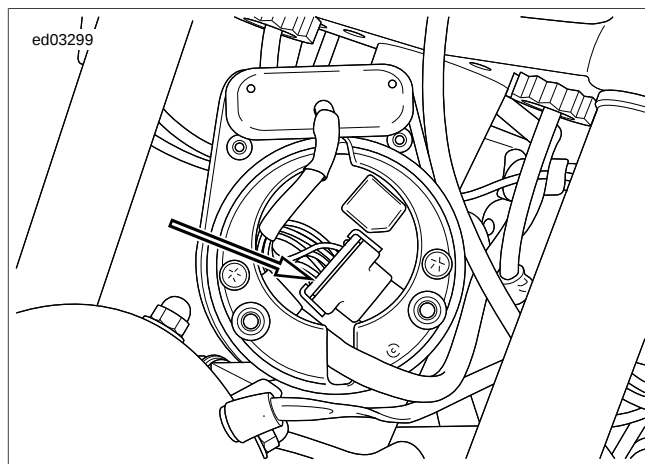


Figure 3-21. Speedometer [39]: FXS/B Typical

Diagnostic Tips

High voltage DTC may set when the vehicle is placed on an unapproved constant current battery charger, on fast charge, 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](#).

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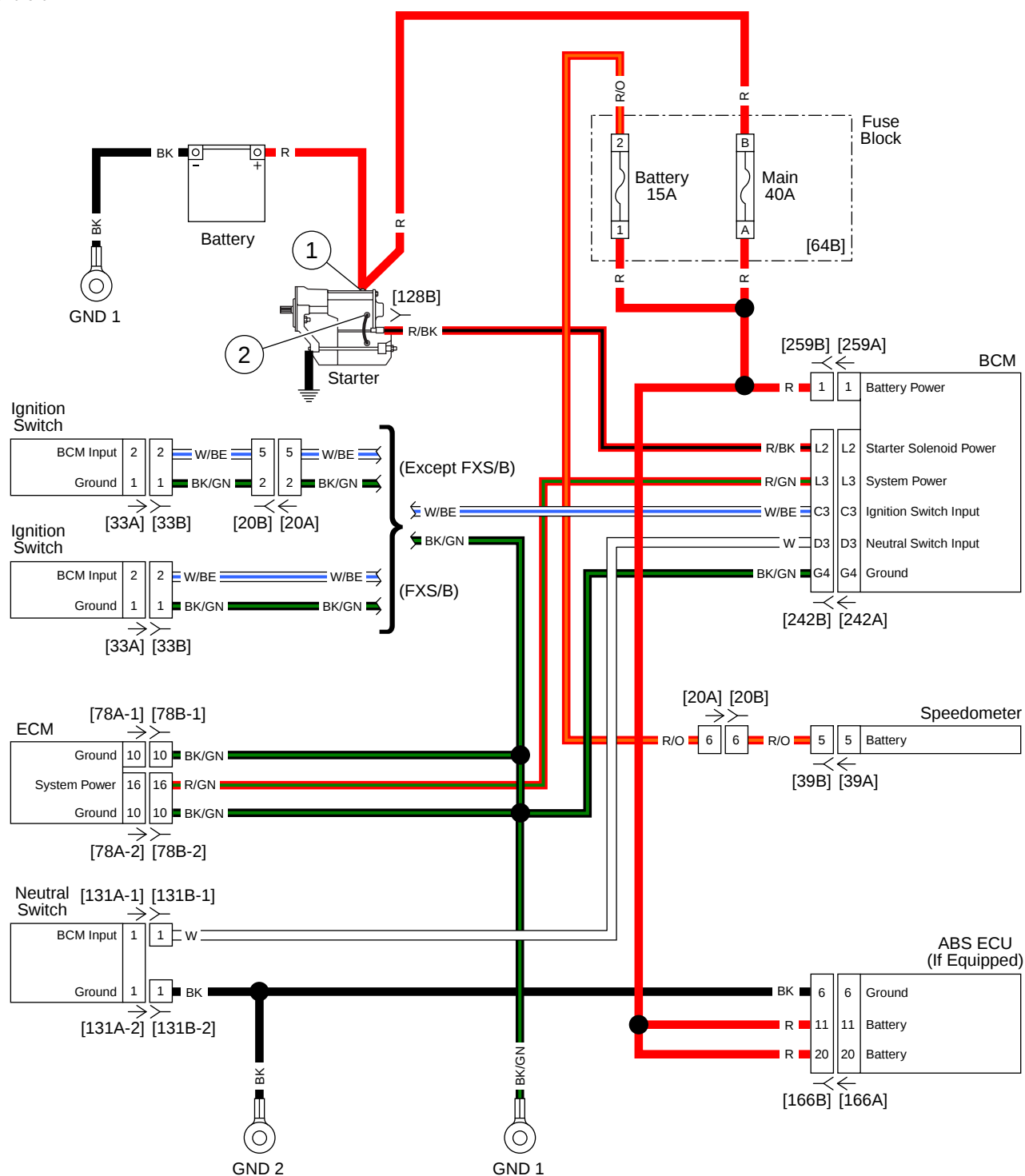


Figure 3-22. High and Low Voltage Modules

DTC B2271

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-33. DTC B2271 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction
BCM power circuit
Open in battery power circuit

1. Battery Test

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

2. Charging System Test

1. Perform charging system test. See [3.6 CHARGING SYSTEM, Low or No Charging](#).
2. Is charging system working properly?
 - a. **Yes.** [Go to Test 3](#).
 - b. **No.** Repair charging system. [Go to Test 7](#).

3. BCM Power Test

1. Turn IGN OFF.
2. Disconnect BCM power [259].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [259B] to ground.
4. Is battery voltage present?
 - a. **Yes.** Replace BCM.
 - b. **No.** [Go to Test 4](#).

4. Main Fuse Voltage Test

1. Perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 5](#).
 - b. **No.** Repair or replace (R) wire between fuse block [64B] socket terminal A and [259B].

5. Fuse Block Voltage Test

1. Perform a voltage drop test between fuse block [64B] socket terminal B and battery (+).

2. Is voltage drop greater than 0.5V?
 - a. **Yes.** [Go to Test 6](#).
 - b. **No.** Repair or replace fuse block [64B] socket terminals A and B.

6. Fuse Block Supply Voltage Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
 - a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
 - b. **No.** Repair or replace (R) wire between starter terminal 1 and fuse block [64B] socket terminal B.

7. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does code set?
 - a. **Yes.** Replace BCM.
 - b. **No.** System working properly.

DTC B2272

Table 3-34. DTC B2272 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction

1. Charging System Test

1. Perform charging system tests. See [3.6 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.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does DTC reset?
 - a. **Yes. DTC set by speedometer.** Replace speedometer.
 - b. **Yes. DTC set by BCM.** Replace BCM.
 - c. **No.** System working properly.

NOTES

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NOTES

DESCRIPTION AND OPERATION

See [Figure 4-1](#). The speedometer contains several indicators. These indicators include the check engine, security, low battery and low fuel lamps. The cruise control indicator may also be shown depending on vehicle configuration.

Trip Odometer Reset Switch Operation

Pressing the trip odometer reset switch, located on the left hand controls, provides the following functions:

- Change the odometer display between total mileage, trip odometer A and trip B, fuel range values, 12/24 hour clock and tachometer with gear indication.
- 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](#).

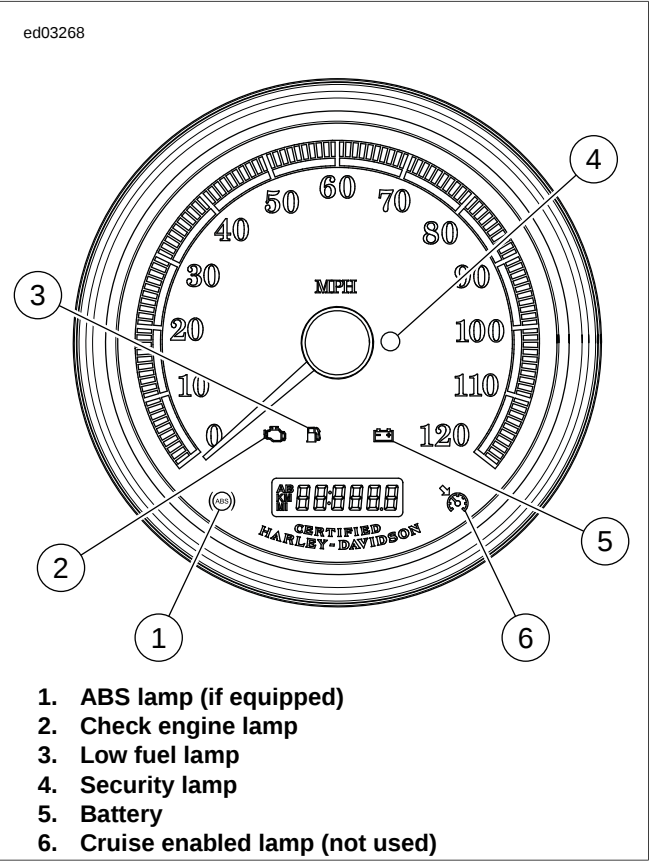


Figure 4-1. Indicator Lamps

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.

SPEEDOMETER THEORY OF OPERATION

The speed sensor is mounted at the back of the 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 CAN bus data then sent to the speedometer. The speedometer converts the data to control the position of the speedometer needle. It also provides input to the BCM for turn signal cancellation.

INSTRUMENT DIAGNOSTICS

The speedometer monitors direct inputs from sensors and switches, along with receiving information from the other modules over the CAN bus lines. It sets codes when the parameters for the inputs are out of range.

Table 4-1. Code Description

DTC	DESCRIPTION
B1200	Instrument internal fault
B1210	Fuel level sender shorted low/open
B1211	Fuel level sender shorted high
P1632	Odometer learned up
B2255	Trip switch stuck closed

DTC B1210, B1211

DESCRIPTION AND OPERATION

The fuel level is monitored by the speedometer [39] at terminal 9 (W/Y) wire. The low fuel warning lamp serves two functions. It is used to indicate a low fuel condition and to communicate a circuit problem with the fuel sender circuit. The speedometer will flash the low fuel warning lamp on and off at a steady rate when a current fuel level sender DTC is set.

- If the voltage on terminal 9 exceeds the lower limit for greater than or equal to 15 seconds, a DTC B1210 will be set. The low fuel warning lamp will flash on and off at a steady rate.
- If the voltage on terminal 9 exceeds the upper limit (or is open) for greater than or equal to 15 seconds, a DTC B1211 will set. The low fuel warning lamp will flash on and off at a steady rate.

Table 4-2. Code Description

DTC	DESCRIPTION
B1210	Fuel sender shorted low/fuel gauge circuit open
B1211	Fuel sender shorted high/open

Voltage is supplied to the fuel level sender on the (W/Y) wire from the fuel gauge. As the fuel level changes the resistance of the sender changes. The fuel gauge and the low fuel lamp are controlled through the (W/Y) wire based off the change in the resistance of the fuel level sender.

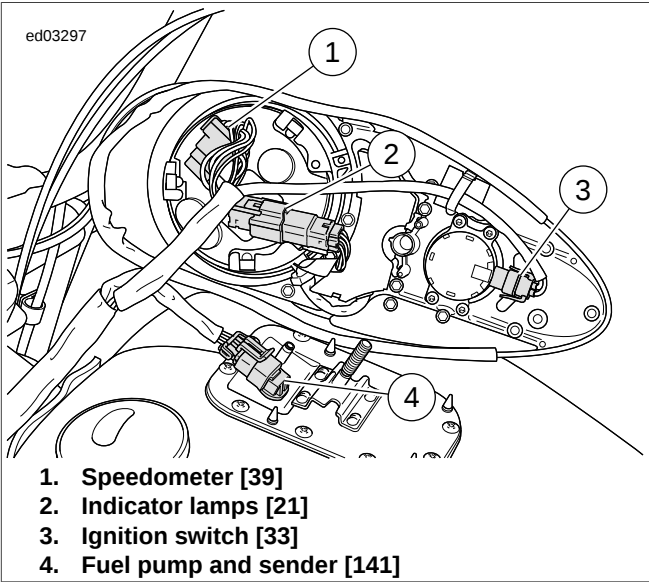


Figure 4-2. Under Console: Except FXS/B

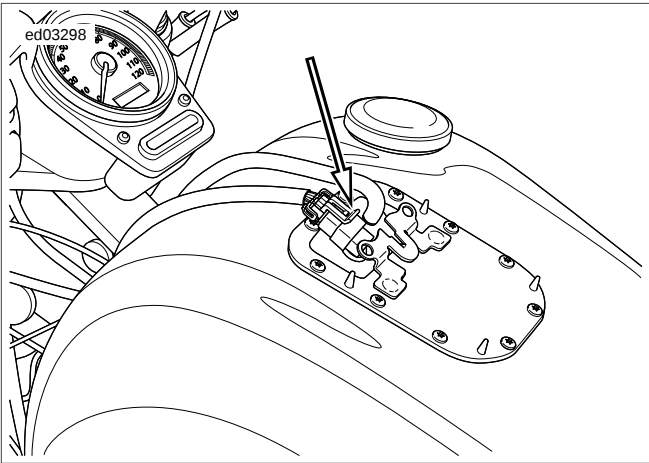


Figure 4-3. Under Console [141]: FXS/B Typical

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](#).

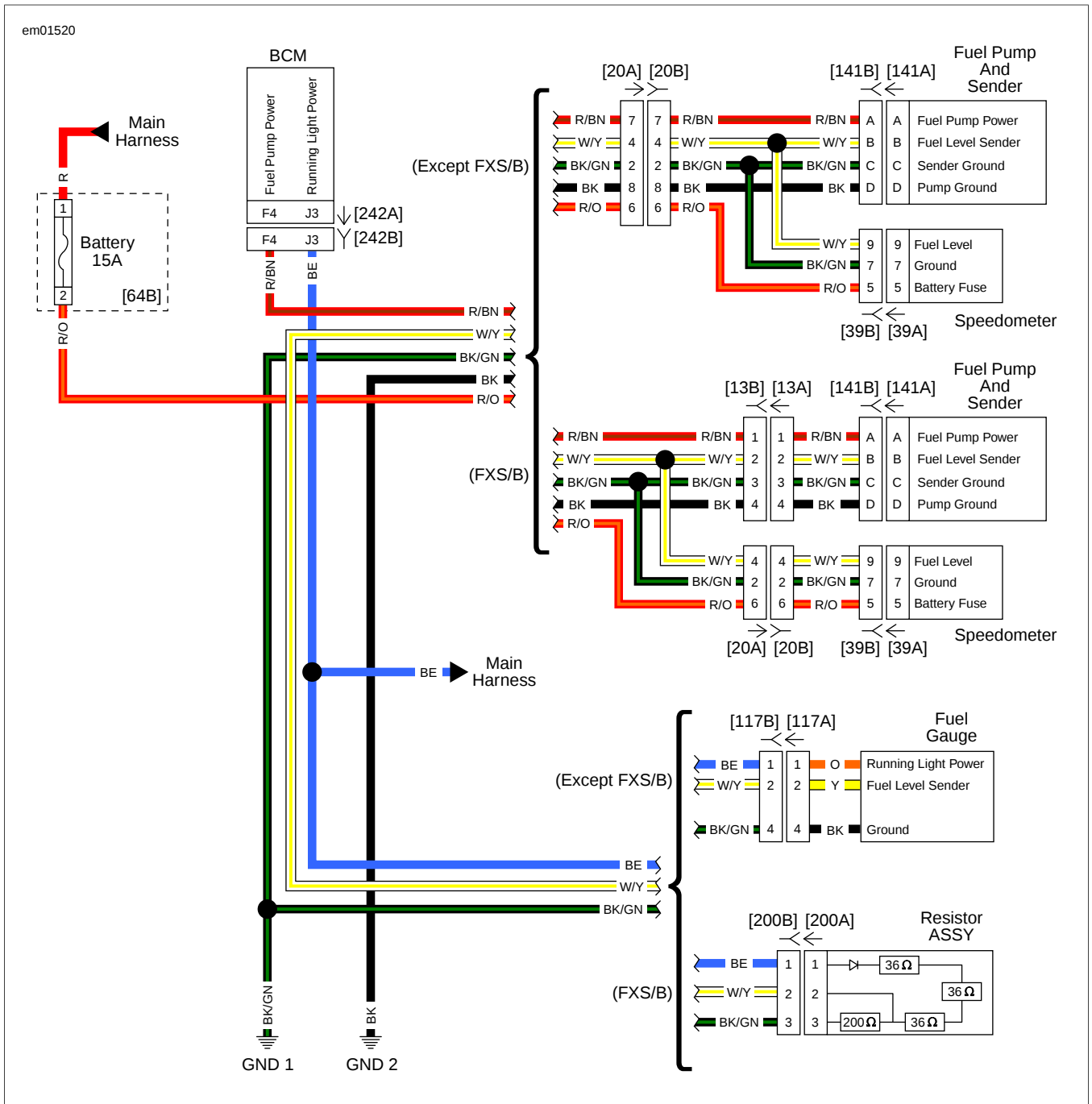


Figure 4-4. Fuel Sensor Circuit

DTC B1210: EXCEPT FXS/B

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 4-3. DTC B1210 Diagnostic Faults: Except FXS/B

POSSIBLE CAUSES
Short to ground in fuel level sender circuit
Fuel level sender assembly malfunction
Open fuel gauge circuit
Fuel gauge malfunction

1. BCM Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Turn IGN ON.
6. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal J3 and ground.
7. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace BCM.

2. Fuel Gauge Power Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Test continuity between BOB terminal J3 and [117B] terminal 1 (BE) wire.
4. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open between [117B] terminal 1 and [242] terminal J3 (BE) wire.

3. Fuel Level Sender Voltage Test

1. Disconnect speedometer [39].
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.

3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 2.0V?
 - a. **Yes.** Replace speedometer.
 - b. **No.** [Go to Test 4.](#)

4. Fuel Pump and Sender Test

1. Turn IGN OFF.
2. Disconnect fuel pump and sender assembly [141].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 2.0V?
 - a. **Yes.** Replace fuel pump and sender assembly.
 - b. **No.** [Go to Test 5.](#)

5. Fuel Gauge Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [117B] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (BE) wire between fuel gauge terminal 1 and BCM.

6. Fuel Gauge Circuit Test

1. Turn IGN OFF.
2. Test continuity between [117B] terminal 2 and BOB terminal 9.
3. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open in (W/Y) wire between fuel gauge and speedometer.

7. Fuel Gauge Circuit Test

1. Test continuity between [117B] terminal 2 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (W/Y) wire.
 - b. **No.** Replace fuel gauge.

DTC B1210: FXS/B

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 4-4. DTC B1210 Diagnostic Faults: FXS/B

POSSIBLE CAUSES
Short to ground in fuel level sender circuit
Fuel level sender assembly malfunction
Open fuel gauge circuit
Resistor assembly malfunction

1. BCM Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Turn IGN ON.
6. Test voltage between BOB terminal J3 and ground.
7. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace BCM.

2. Fuel Resistor Assembly Power Test

1. Turn IGN OFF.
2. Disconnect resistor assembly [200].
3. Test continuity between BOB terminal J3 and [200B] terminal 1 (BE) wire.
4. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open between [200B] terminal 1 and [242] terminal J3 (BE) wire.

3. Fuel Level Sender Voltage Test

1. Disconnect speedometer [39].
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
3. Turn IGN ON.

4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 2.0V?
 - a. **Yes.** Replace speedometer.
 - b. **No.** [Go to Test 4.](#)

4. Fuel Pump and Sender Test

1. Turn IGN OFF.
2. Disconnect fuel pump and sender assembly [141].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 2.0V?
 - a. **Yes.** Replace fuel pump and sender assembly.
 - b. **No.** [Go to Test 5.](#)

5. Fuel Gauge Voltage Test

1. Turn IGN OFF.
2. Disconnect resistor assembly [200].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [200B] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (BE) wire between [200B] terminal 1 and BCM.

6. Fuel Level Sender Circuit Test

1. Turn IGN OFF.
2. Test continuity between [200B] terminal 2 and BOB terminal 9.
3. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open in (W/Y) wire between fuel gauge and speedometer.

7. Fuel Level Sender Circuit Test

1. Test continuity between [200B] terminal 2 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (W/Y) wire.
 - b. **No.** Replace resistor assembly.

DTC B1211: EXCEPT FXS/B

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

Table 4-5. DTC B1211 Diagnostic Faults: Except FXS/B

POSSIBLE CAUSES
Open ground circuit
Short to voltage in fuel level sensor circuit
Fuel gauge malfunction
Fuel level sender malfunction
Open fuel level sender circuit

1. Fuel Level Sender Voltage Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
4. Turn IGN ON.
5. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 9 and ground.
6. Is voltage greater than 8.0V?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No, voltage between 2-8V.** Replace speedometer.
 - c. **No, voltage below 2V.** [Go to Test 8.](#)

2. Fuel Pump and Sender Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 8.0V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 4.](#)

3. Fuel Level Sender Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.

5. Is voltage greater than 8.0V?
 - a. **Yes.** Repair short to voltage on (W/Y) wire.
 - b. **No.** Replace fuel pump and sender assembly.

4. Fuel Level Sender Circuit Open Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Test for continuity between [117B] terminal 2 and [141B] terminal B.
4. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (W/Y) wire between fuel gauge and fuel level sender.

5. Fuel Level Sender Ground Circuit Test

1. Test continuity between [141B] terminal C and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (BK/GN) wire.

6. Fuel Gauge Ground Circuit Test

1. Test continuity between [117B] terminal 4 and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open between [117] terminal 4 (BK/GN) wire and ground.

7. Fuel Sender Resistance Test

1. Test resistance between [141A] terminals B and terminal C.
2. Is resistance greater than 260 Ohms?
 - a. **Yes.** Replace the fuel level sender.
 - b. **No.** Replace the fuel gauge.

8. Fuel Gauge Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Test voltage between [117B] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Repair open in (BE) wire between fuel gauge terminal 1 and BCM.

9. Fuel Gauge Test

1. Turn IGN OFF.
2. Test continuity between [117B] terminal 2 and BOB terminal 9.

3. Is continuity present?
 - a. **Yes.** Replace fuel gauge.
 - b. **No.** Repair open in (W/Y) wire between fuel gauge and speedometer.

DTC B1211: FXS/B

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

Table 4-6. DTC B1211 Diagnostic Faults: FXS/B

POSSIBLE CAUSES
Open ground circuit
Short to voltage in fuel level sensor circuit
Fuel level sender malfunction
Open fuel level sender circuit

1. Fuel Level Sender Voltage Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
4. Turn IGN ON.
5. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 9 and ground.
6. Is voltage greater than 8.0V?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No, voltage between 2-8V.** Replace speedometer.
 - c. **No, voltage below 2V.** [Go to Test 8.](#)

2. Fuel Pump and Sender Test

1. Turn IGN OFF.
2. Disconnect resistor assembly [200].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 8.0V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 4.](#)

3. Fuel Level Sender Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Turn IGN ON.

4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 8.0V?
 - a. **Yes.** Repair short to voltage on (W/Y) wire.
 - b. **No.** Replace fuel pump and sender assembly.

4. Fuel Level Sender Circuit Open Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Test continuity between [200B] terminal 2 and [141A] terminal B.
4. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (W/Y) wire between resistor assembly and fuel level sender.

5. Fuel Level Sender Ground Circuit Test

1. Test continuity between [141B] terminal C and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (BK/GN) wire.

6. Resistor Assembly Ground Circuit Test

1. Test continuity between [200B] terminal 3 and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open between [200] terminal 3 (BK/GN) wire and ground.

7. Fuel Sender Resistance Test

1. Test resistance between [141A] terminals B and terminal C.
2. Is resistance greater than 260 Ohms?
 - a. **Yes.** Replace fuel level sender.
 - b. **No.** Replace resistor assembly.

8. Resistor Assembly Voltage Test

1. Turn IGN OFF.
2. Disconnect resistor assembly [200].
3. Turn IGN ON.
4. Test voltage between [200B] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Repair open in (BE) wire between resistor assembly terminal 1 and BCM.

9. Resistor Assembly Test

1. Turn IGN OFF.
2. Test continuity between [200B] terminal 2 and BOB terminal 9.

3. Is continuity present?
 - a. **Yes.** Replace resistor assembly.
 - b. **No.** Repair open in (W/Y) wire between resistor assembly and speedometer.

TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255

4.3

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Trip Odometer Reset Switch Closed

DTC B2255 will be set if trip odometer reset switch is closed for more than two minutes. This code can be set by the speedometer or the BCM. It will normally be set by both if there is a concern with the trip odometer reset switch.

Odometer self-diagnostics will not function if the switch is stuck since it won't be possible to toggle the switch to navigate through the different diagnostic steps in the odometer.

- A stuck trip odometer reset switch disables odometer self-diagnostics.
- If DIGITAL TECHNICIAN II (Part No. HD-48650) is connected to the DLC [91] and communicating with the vehicle

then the odometer self-diagnostics will not function properly.

- Disconnect DIGITAL TECHNICIAN II (Part No. HD-48650) before entering odometer self-diagnostics.

Table 4-7. Code Description

DTC	DESCRIPTION
B2255	Trip switch stuck

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](#).

em01517

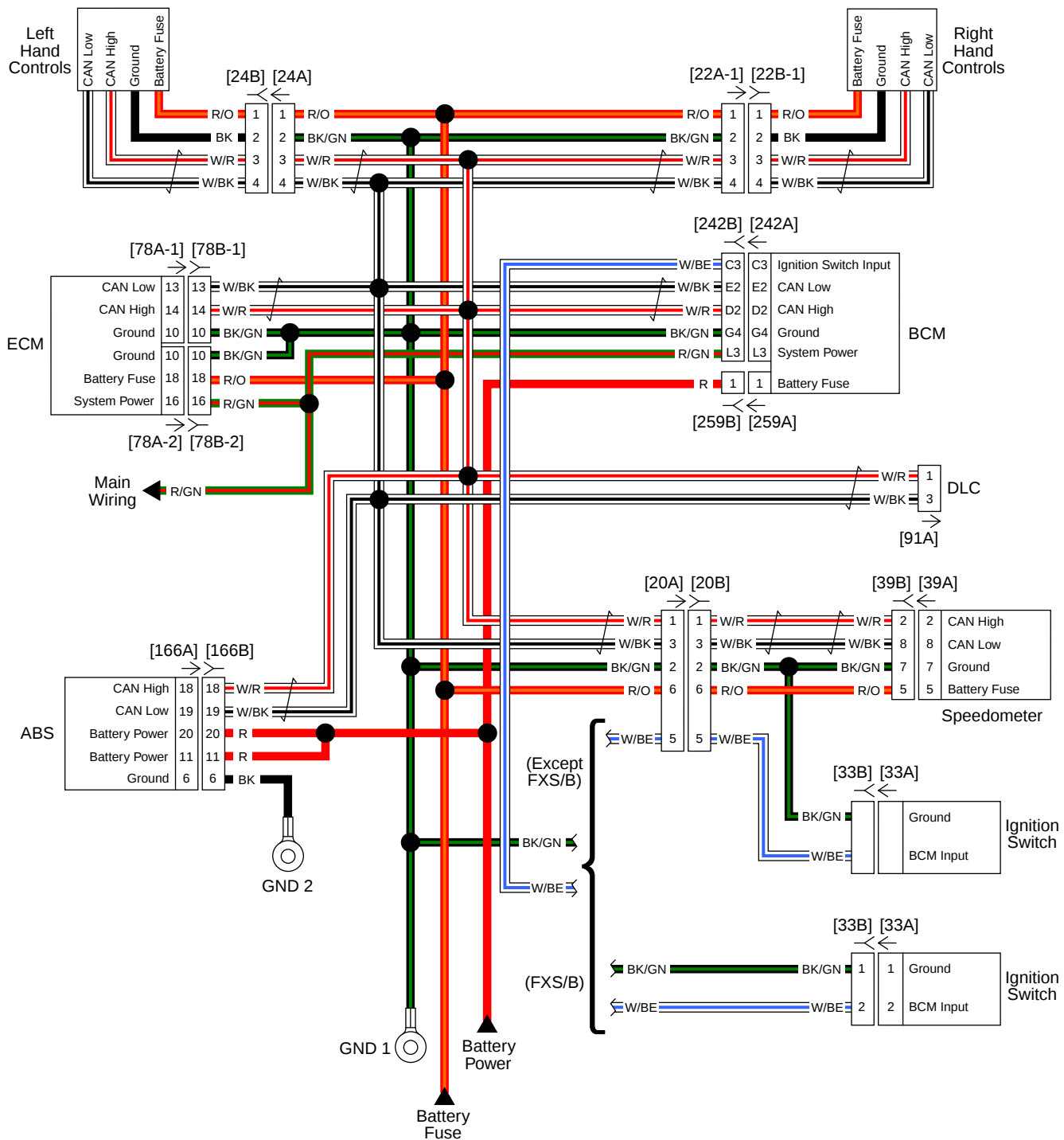


Figure 4-5. CAN Bus Circuit

TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255

Table 4-8. Trip Odometer Functions Inoperative, DTC B2255 Diagnostic Faults

POSSIBLE CAUSES
Instrument malfunction
Trip odometer reset switch malfunction

1. Trip Switch Test

1. Check trip switch for damage or obstruction.
2. Is switch moving freely?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Remove obstruction, if switch will not move freely replace LHCM.

2. Odometer Test

1. Turn IGN ON.
2. Press and release the trip odometer reset switch.

3. Does the odometer cycle through the different odometer counters?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 3.](#)

3. Speedometer "WOW" Test

1. Turn IGN OFF.
2. Turn IGN ON, while pressing trip odometer reset switch.
3. Does speedometer needle sweep its full range of motion?
 - a. **Yes.** System functioning properly. Test for intermittent condition. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)
 - b. **No.** Replace speedometer.

4. LHCM Test

1. Operate other switches on the LHCM.
2. Do any of the switches operate?
 - a. **Yes.** Replace the LHCM.
 - b. **No.** See [2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Left Hand Controls Inoperative: DTC U0141.](#)

NO INSTRUMENT POWER, DTC B1200

4.4

DESCRIPTION AND OPERATION

See [Figure 4-6](#). The speedometer receives battery power at terminal 5. This is supplied through the battery fuse located in fuse block [64]. The speedometer receives a message from the BCM over the CAN bus to know if the ignition switch is in the IGN or ACC position. When the ignition switch is in the ACC position, the speedometer illuminates the backlighting, the odometer and the security lamp.

When the ignition switch is in the IGN position, the speedometer illuminates the check engine, low fuel level, security and ABS

lamp (if equipped). The backlighting, odometer, neutral lamp and low oil lamp also illuminate with the IGN ON.

The speedometer has an internal fault code DTC B1200. The speedometer will set this code if it detects a malfunction inside the speedometer.

Table 4-9. Code Description

DTC	DESCRIPTION
B1200	Instrument internal fault

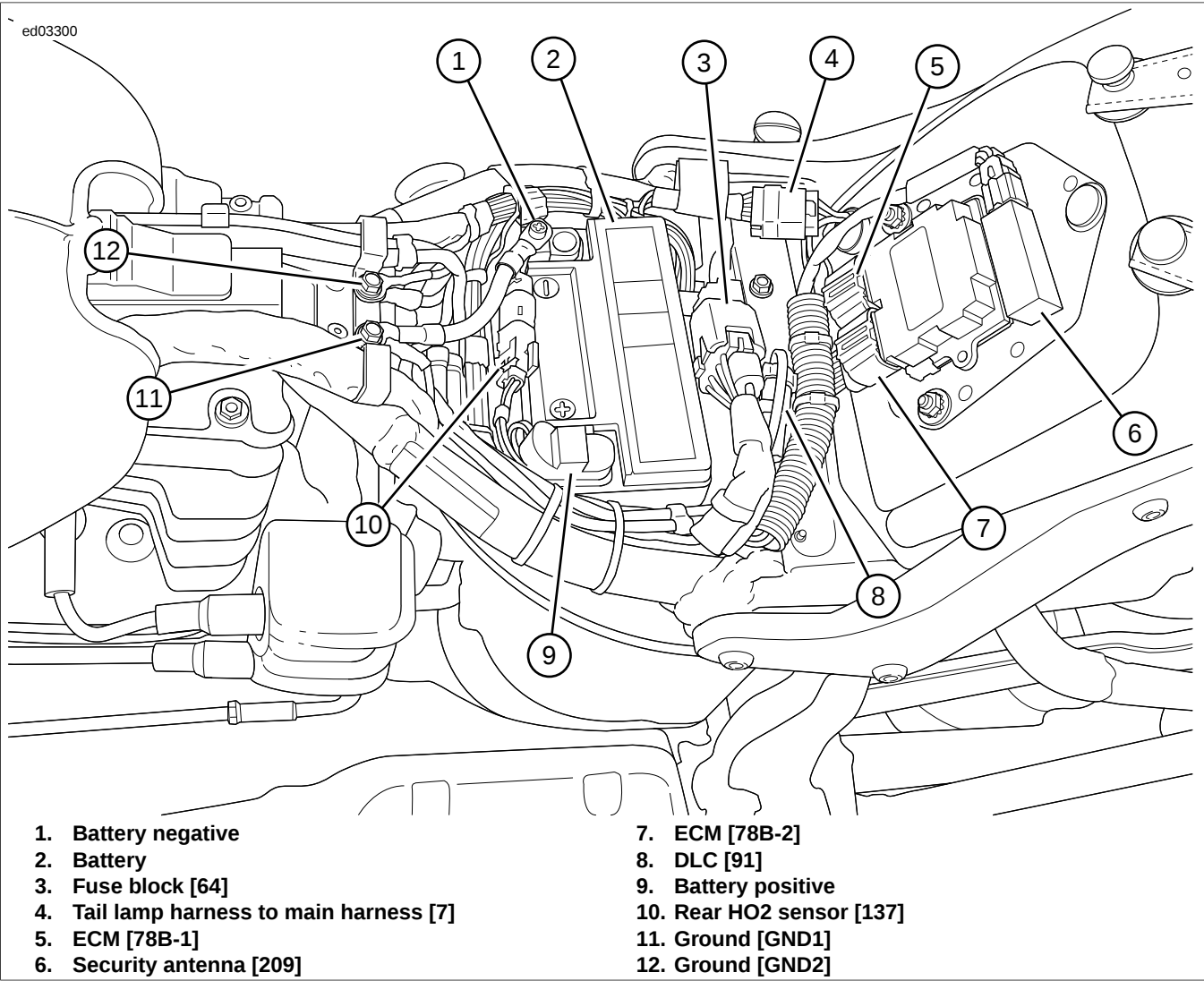


Figure 4-6. Under Seat: Except FXS/B and FLS

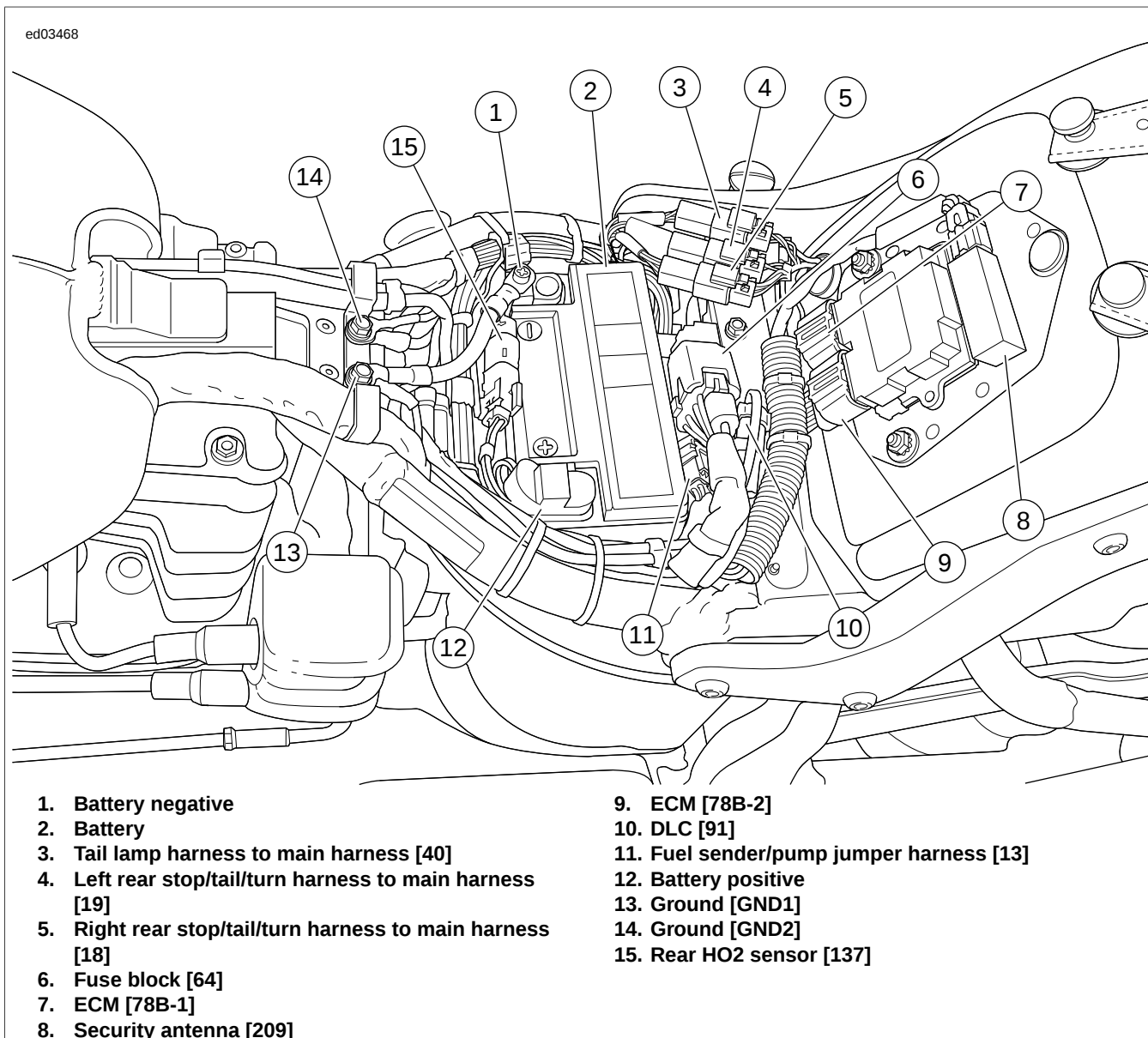


Figure 4-7. Under Seat: FXS and FLS

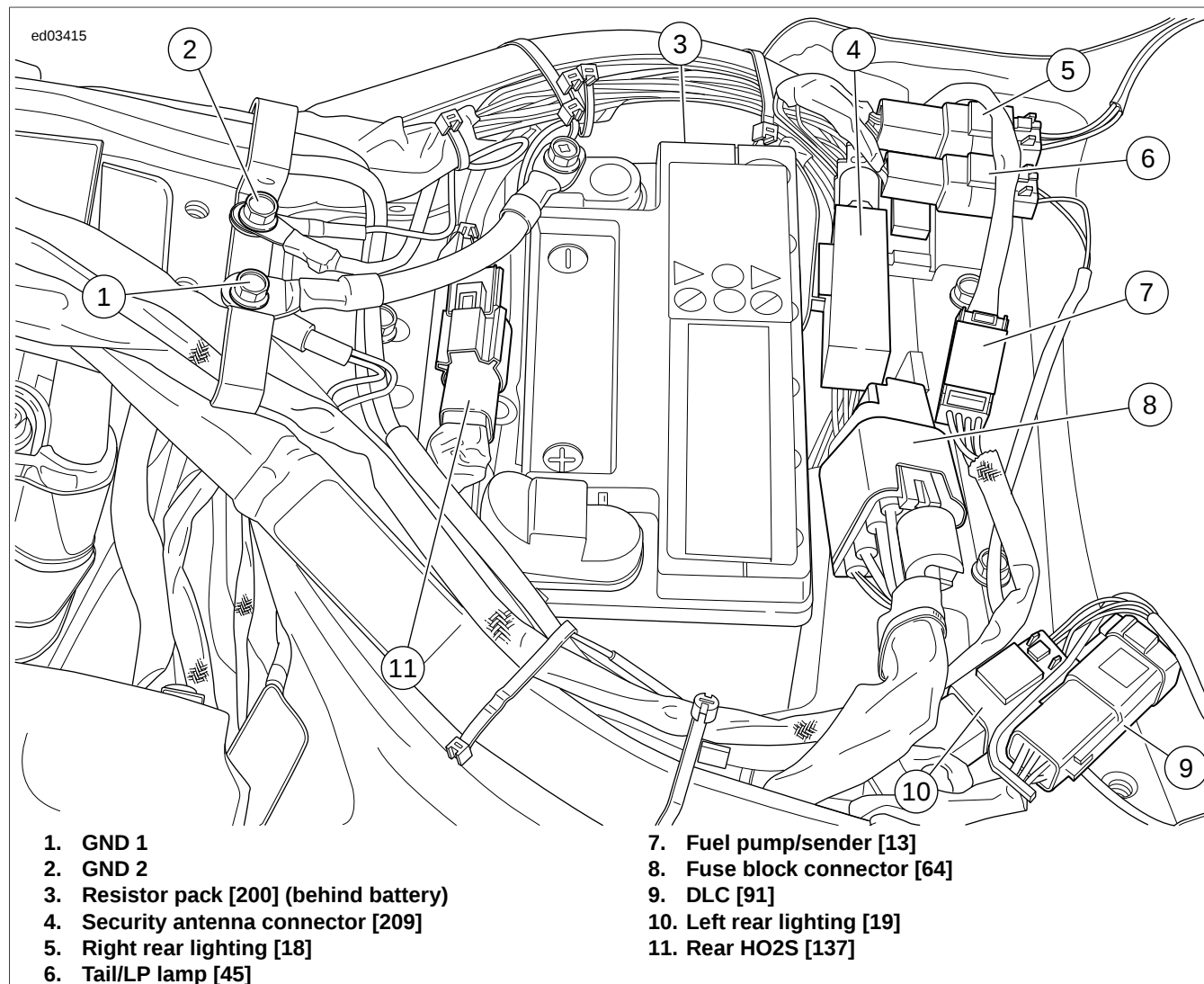


Figure 4-8. Under Seat: FXSB

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](#).

em01517

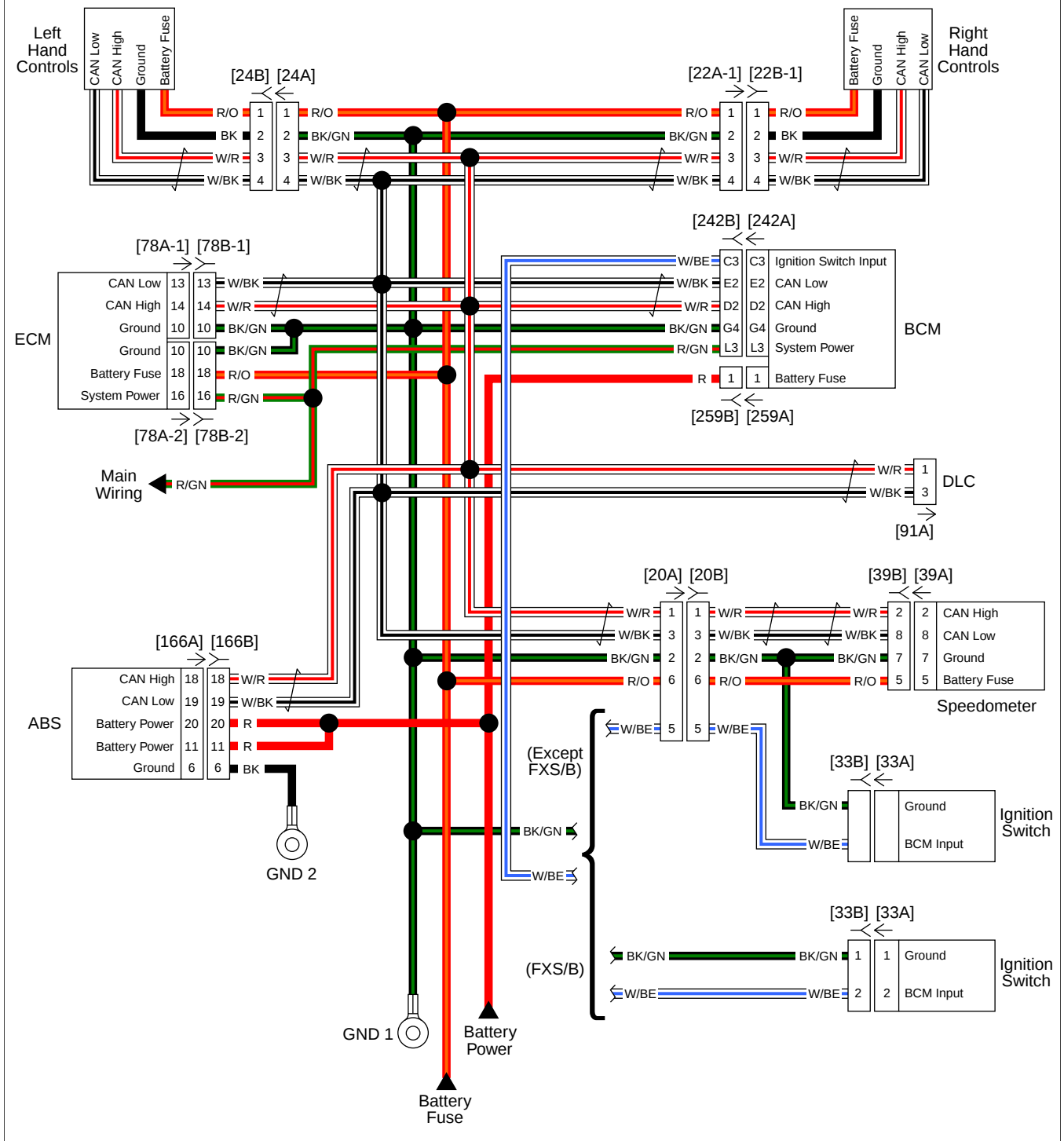


Figure 4-9. CAN Bus Circuit

NO INSTRUMENT POWER

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

Table 4-10. No Instrument Power Diagnostic Faults

POSSIBLE CAUSES
Open battery circuit
Open ground circuit
Open in CAN bus circuit to speedometer

1. Battery Circuit Test

- Turn IGN ON.
- Does the headlamp or tail lamp illuminate?
 - Yes.** [Go to Test 2.](#)
 - No.** See [2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140.](#)

2. Accessory Function Test

- Attempt to start the vehicle.
- Does the engine crank?
 - Yes.** [Go to Test 3.](#)
 - No.** See [2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274.](#)

3. Battery Circuit to Speedometer Test

- Turn IGN OFF.
- Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected. See [1.2 DIAGNOSTIC TOOLS.](#)
- Test voltage between BOB terminal 5 and ground.
- Is battery voltage present?
 - Yes.** [Go to Test 4.](#)
 - No.** Repair open between [39B] terminal 5 and [64B] socket terminal 2 (R/O) wire. **(5041)**

4. Ground Circuit Test

- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 7 and ground.
- Is continuity present?
 - Yes.** Replace speedometer. **(6020)**
 - No.** Repair open in (BK/GN) wire. **(5041)**

DTC B1200

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

Table 4-11. DTC B1200 Diagnostic Faults

POSSIBLE CAUSES
Open in speedometer battery power circuit
Open in speedometer ground circuit

1. Speedometer Voltage Test

- Turn IGN OFF.
- Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the wiring harness [39B], leaving [39A] disconnected. See [1.2 DIAGNOSTIC TOOLS.](#)
- Test voltage between BOB terminal 5 and ground.
- Is battery voltage present?
 - Yes.** [Go to Test 2.](#)
 - No.** Repair open in (R/O) wire.

2. Speedometer Ground Test

- Test voltage between BOB terminals 5 and 7.
- Is battery voltage present?
 - Yes.** Replace speedometer.
 - No.** Repair open in ground circuit.

INDICATOR LAMPS

4.5

DESCRIPTION AND OPERATION

See [Figure 4-10](#). The battery, check engine, security, sixth gear, cruise control, ABS and low fuel indicators are located in the speedometer. The other indicators are located in the indicator bar separate from the speedometer.

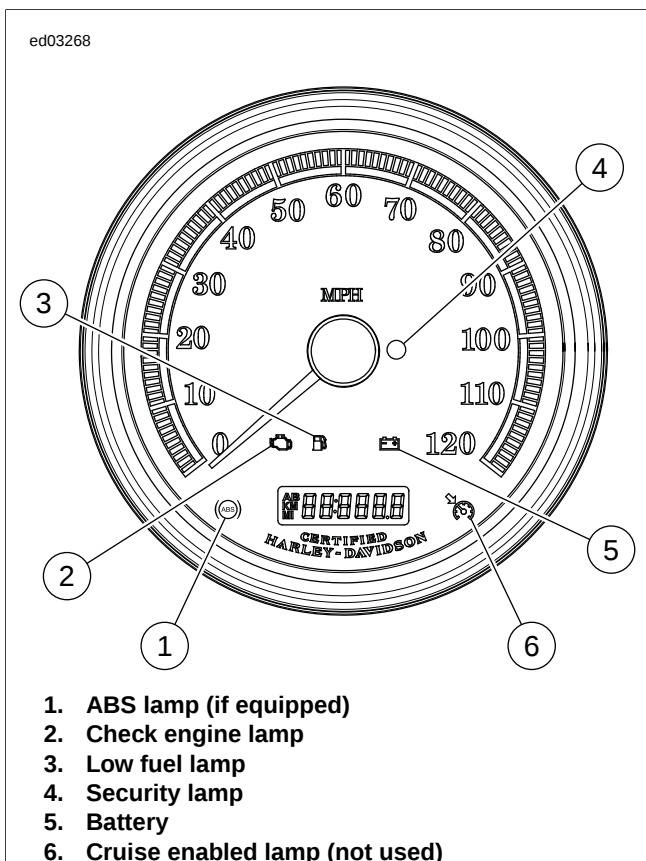


Figure 4-10. Indicator Lamps

ABS Indicator

The speedometer illuminates the ABS indicator when the following occurs:

- The ECU detects an ABS disabling malfunction. The ECU sends a serial data message to the instrument requesting illumination.
- The speedometer performs a bulb check.
- The speedometer detects a loss of communication with the ECU.
- The ABS light may flash when the IGN is turned on. This will continue until the vehicle is driven to verify WSS operation.

The ECU sends a message to the instrument when a malfunction that disables ABS operation is detected. Depending on the fault, the ABS indicator may stay on even after the malfunction is corrected. The indicator will not go off until the vehicle is operated at speeds greater than 10 mph (16 km/h). It is important to verify that this is not the cause of an ABS indicator,

which is illuminated when no DTCs are set, before attempting to diagnose other possible causes.

Security Lamp

When the IGN is turned ON, the security lamp will illuminate for approximately four seconds and then turn off. The BCM controls the security lamp by sending a CAN message to the speedometer. After the security lamp turns off following the first four second illumination period, one of two events may occur.

- The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the BCM.
- If the lamp remains on beyond the four-second period, a current DTC exists.

Check Engine Lamp

When the IGN is ON, the check engine lamp will illuminate for approximately four seconds and then turn off. The ECM controls the check engine lamp by sending a CAN message to the speedometer. After the check engine lamp turns off following the first four second illumination period, one of two events may occur.

- The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
- If the lamp remains on beyond the four-second period, a current DTC exists.

The check engine lamp may not illuminate for less than 4 seconds under the following conditions:

- IGN OFF/ON within 5 seconds.
- Trip switch activated, then IGN ON within 5 seconds.
- Run/stop switch cycled, then IGN ON within 5 seconds.
- Security armed vehicles that are moved, then IGN ON, or IGN ON and FOB response is not immediately received (interference).

Current DTC notification is not affected by above conditions.

Low Battery Lamp

The BCM sends a message to the speedometer to control the low battery lamp. The speedometer will turn the lamp on if the BCM identifies a low voltage condition on [259] terminal 1.

Low Fuel Indicator

See [Figure 4-11](#). The low fuel indicator is controlled at terminal 9 (W/Y) of the speedometer. The fuel gauge or resistor assembly sends voltage on the (W/Y) wire to the low fuel lamp and fuel level sender. When the fuel drops below 1.0 gal (3.8 L), it signals the speedometer to activate the low fuel lamp. The low fuel lamp will also flash on and off at a steady rate if there is a problem with the circuit.

The low fuel lamp will not turn off until there is sufficient fuel in the tank, the ignition switch has been turned off and back on, and the vehicle has begun forward speed.

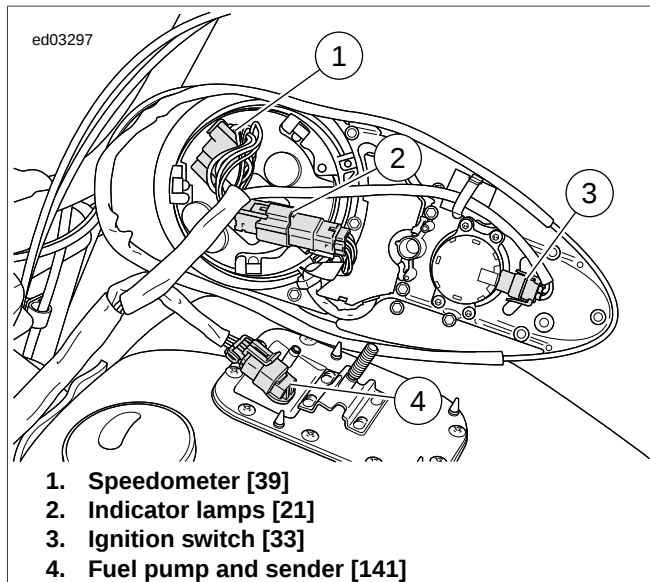


Figure 4-11. Under Console: Except FXS/B

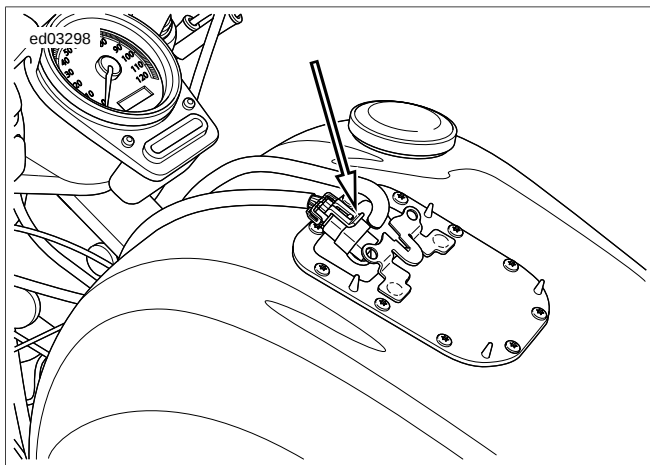


Figure 4-12. Under Console [141]: FXS/B Typical

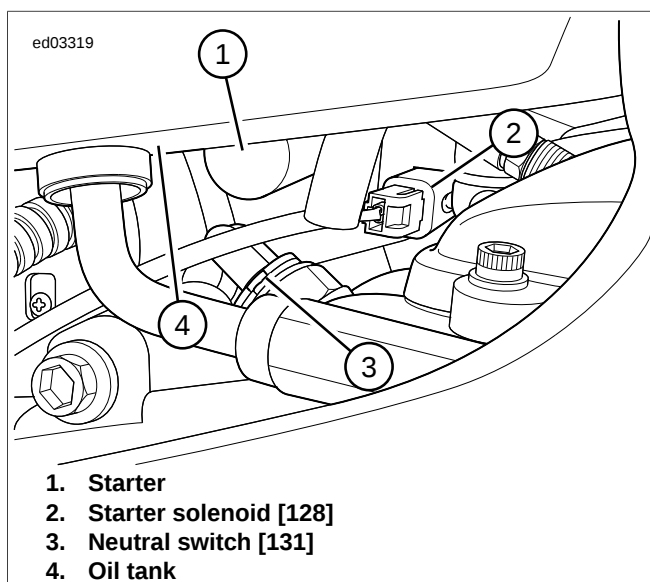


Figure 4-13. Under Oil Tank Right Side

Neutral Indicator

See [Figure 4-14](#). The neutral indicator is controlled through the (W) wire connected to the speedometer. When the transmission is in neutral, the neutral switch closes and supplies a ground to the BCM on terminal D3. The BCM then sends a message to the speedometer over the CAN bus indicating the transmission is in neutral. The speedometer supplies ground to the neutral indicator causing it to illuminate.

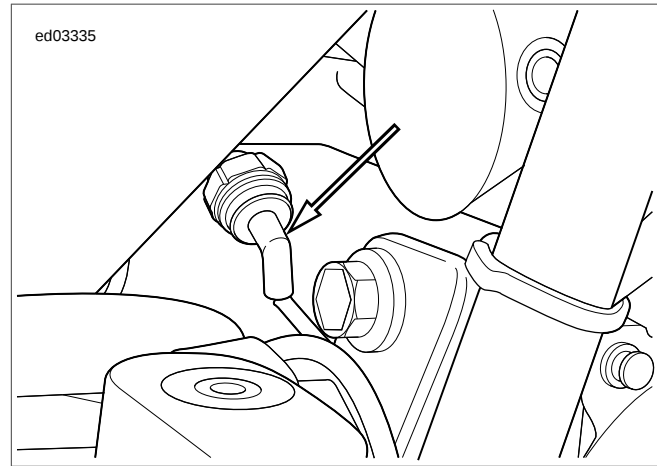


Figure 4-14. Oil Pressure Switch [120]

Oil Pressure Indicator

See [Figure 4-14](#). The oil pressure indicator is connected to the speedometer. The switch closes when oil pressure is low and supplies ground to the BCM at terminal E3. The BCM then sends a message to the speedometer over the CAN bus indicating the oil pressure is low. The speedometer supplies ground to the oil pressure indicator causing it to illuminate. This is why the oil pressure indicator is illuminated with the IGN ON and the engine OFF.

Turn Signal Indicators

The turn signal indicators are controlled by the speedometer. When the BCM receives a CAN bus message from the left or right turn signal switch it flashes the correct turn signals. At the same time the BCM sends a message to the speedometer over the CAN bus indicating which turn signal to operate. The speedometer supplies ground to the corresponding turn signal indicator causing it to illuminate.

High Beam Indicator

This circuit is grounded by the speedometer when the headlamp switch is placed in the high beam position. In the high position, a message is sent over the CAN bus to the speedometer and the BCM. The speedometer controls the indicator and the BCM controls the headlamp.

Diagnostic Tips

After replacing a component in the fuel circuit, verify the tank is full of fuel and that the main fuse is removed for 2 minutes and reinstalled to turn low fuel lamp off.

Some unauthorized P&A fuel gauges may cause the fuel circuit to report inaccurate readings.

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](#).

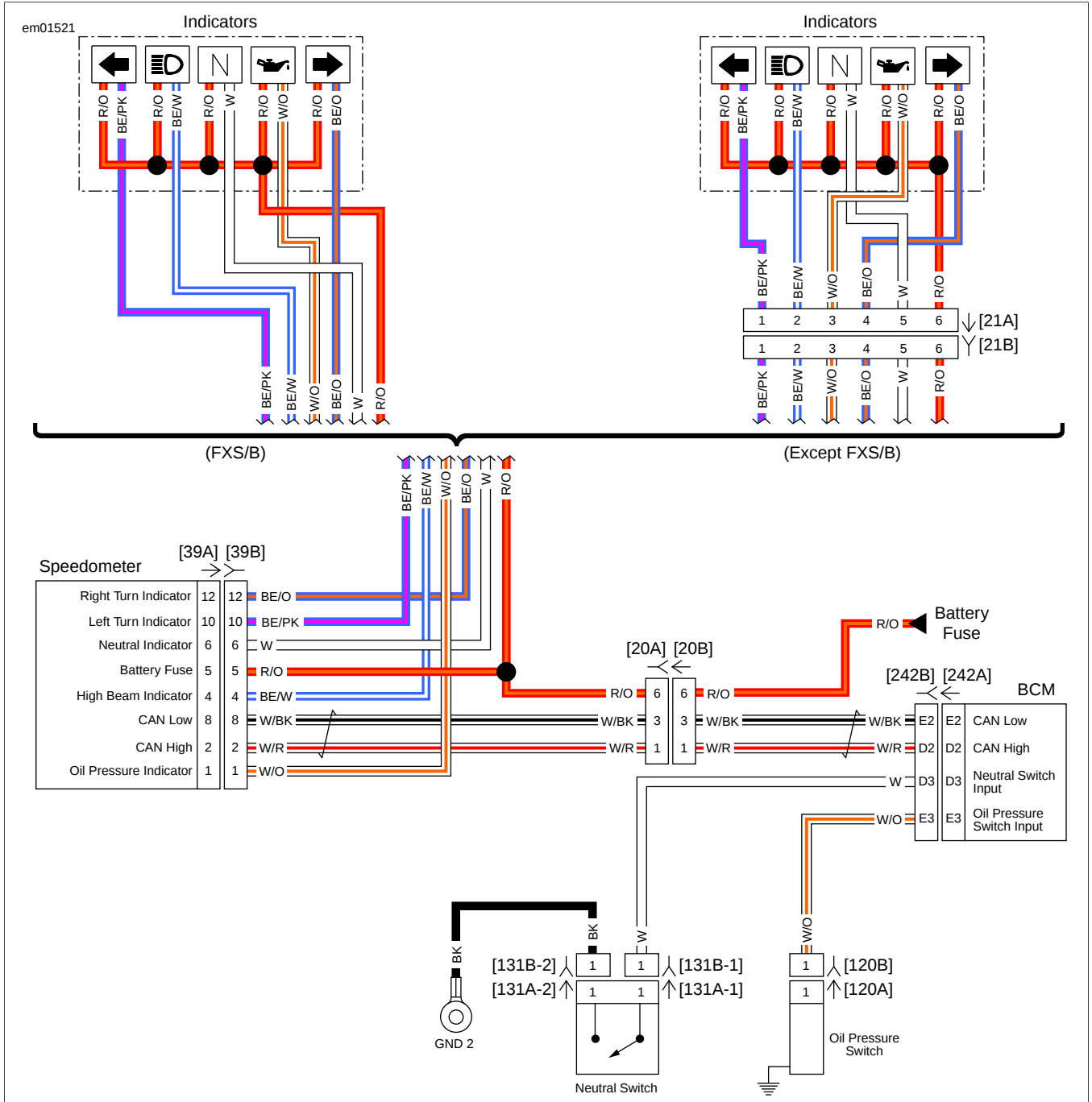


Figure 4-15. Indicator Lamps

LOW FUEL LAMP ALWAYS ON

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

Table 4-12. Low Fuel Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Fuel pump and sender assembly malfunction
Fuel system reset
Excessive resistance in fuel sender circuit

1. Fuel Sender Circuit Resistance Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) between harness adapters [39A] and [39B].
4. Test resistance between BOB terminal 9 and [141B] terminal B (W/Y).
5. Is resistance greater than 0.5 Ohms?
 - a. **Yes.** Repair excessive resistance between [39B] terminal 9 and [141B] terminal B (W/Y).
 - b. **No. With fuel gauge.** [Go to Test 2.](#)
 - c. **No. Without fuel gauge.** [Go to Test 3.](#)

2. Fuel Gauge Circuit Resistance Test

1. Disconnect fuel gauge [117].
2. Test resistance between BOB terminal 9 and [117B] terminal 2 (W/Y).
3. Is resistance greater than 0.5 Ohms?
 - a. **Yes.** Repair excessive resistance between [39B] terminal 9 and [117B] terminal 2 (W/Y).
 - b. **No.** [Go to Test 4.](#)

3. Resistance Assembly Circuit Resistance Test

1. Disconnect resistance assembly [200].
2. Test resistance between BOB terminal 9 and [200B] terminal 2 (W/Y).
3. Is resistance greater than 0.5 Ohms?
 - a. **Yes.** Repair excessive resistance between [39B] terminal 9 and [200B] terminal 2 (W/Y).
 - b. **No.** [Go to Test 4.](#)

4. Fuel Level Test

1. Connect [141].
2. Connect [117] or [200].

3. Verify fuel tank is at least half full.
4. Is fuel tank at least half full?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** [Go to Test 5.](#)

5. Fuel Sender High Test

1. Turn IGN ON.
2. Record voltage between BOB terminal 9 and ground.
3. Turn IGN OFF.
4. Fill tank with fuel.
5. Turn IGN ON.
6. Record voltage between BOB terminal 9 and ground.
7. Did voltage decrease?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Replace fuel sender.

6. Fuel Sender Low Test

1. Turn IGN ON.
2. Record voltage between BOB terminal 9 and ground.
3. Turn IGN OFF.
4. Drain fuel tank.
5. Turn IGN ON.
6. Record voltage between BOB terminal 9 and ground.
7. Did voltage increase?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Replace fuel sender.

7. Speedometer Test

1. Turn IGN OFF.
2. Fill tank with fuel if needed.
3. Remove main fuse for 2 minutes and install.
4. Turn IGN ON.
5. Is indicator still illuminated?
 - a. **Yes.** Replace speedometer.
 - b. **No.** System working correctly.

OIL PRESSURE LAMP ALWAYS ON

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-96921-52D	OIL PRESSURE GAUGE SET

Table 4-13. 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

- Turn IGN ON.
- Does oil pressure lamp illuminate?
 - Yes.** [Go to Test 2.](#)
 - No.** See [4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative.](#)

2. Engine Running Test

- Start engine.
- Does oil pressure lamp turn OFF and stay off?
 - Yes.** Oil pressure lamp is operating properly. Test for intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)
 - No.** [Go to Test 3.](#)

3. Oil Pressure Sensor Test

- Disconnect oil pressure switch [120].
- Does oil pressure lamp turn OFF when the engine is running?
 - Yes.** [Go to Test 5.](#)
 - No.** [Go to Test 4.](#)

4. Oil Pressure Circuit Test

- Turn IGN OFF.
- Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS.](#)
- Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
- Turn IGN ON.
- Test voltage between BOB terminal E3 and ground.

- Is battery voltage present?
 - Yes.** [Go to Test 6.](#)
 - No.** Replace BCM. **(5863)**

5. Mechanical Test

- Inspect engine for any issues that impact oil pressure.
- Using OIL PRESSURE GAUGE SET (Part No. HD-96921-52D), verify engine oil pressure.
- Is oil pressure within specification?
 - Yes.** Replace oil pressure switch. **(5161)**
 - No.** Repair as needed.

6. Oil Pressure Switch Circuit Test

- Disconnect [242A].
- Test continuity between BOB terminal E3 and ground.
- Is continuity present?
 - Yes.** Repair short to ground. **(5041)**
 - No.** [Go to Test 7.](#)

7. Speedometer Test

- Turn IGN OFF.
- Remove BCM BOB.
- Connect [242].
- Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected. See [1.2 DIAGNOSTIC TOOLS.](#)
- Test continuity between BOB terminal 1 and ground.
- Is continuity present?
 - Yes.** Repair short to ground in (W/O) wire. **(5041)**
 - No.** Replace speedometer. **(6020)**

OIL PRESSURE LAMP INOPERATIVE

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

Table 4-14. Oil Pressure Lamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open oil pressure circuit
Indicator malfunction

1. Oil Pressure Lamp Function Test

- Turn IGN ON.

2. Does oil pressure lamp illuminate?
 - a. **Yes.** Test for intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).
 - b. **No.** [Go to Test 2](#).

2. Speedometer Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper BOB terminal 1 to ground.
6. Does oil pressure lamp turn ON?
 - a. **Yes.** Replace speedometer. **(6020)**
 - b. **No. FXS/B.** Repair or replace the indicator harness. **(5191)**
 - c. **No. Except FXS/B.** [Go to Test 3](#).

3. Oil Pressure Circuit Test

1. Turn IGN OFF.
2. Disconnect indicator [21]
3. Test continuity between [21B] terminal 3 (W) wire and BOB terminal 1.
4. Is continuity present?
 - a. **Yes.** Repair or replace the indicator harness. **(5191)**
 - b. **No.** Repair open between [21] and [39] (W/O) wire. **(5041)**

NEUTRAL LAMP ALWAYS ON

Table 4-15. Neutral Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Short to ground in neutral switch circuit
Short to ground in neutral indicator circuit

1. Neutral Lamp Function Test

1. With the vehicle in neutral, turn IGN ON.
2. Does neutral lamp illuminate?
 - a. **Yes.** [Go to Test 2](#).
 - b. **No.** See [4.5 INDICATOR LAMPS, Neutral Lamp Inoperative](#).

2. Indicator Harness Test

1. Disconnect speedometer [39].

2. Did neutral lamp turn OFF?
 - a. **Yes.** Replace speedometer. **(6020)**
 - b. **No.** Repair short to ground in (W) wire between neutral indicator and speedometer. **(5041)**

NEUTRAL LAMP INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 4-16. 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.
2. Does neutral lamp illuminate?
 - a. **Yes.** Test for intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).
 - b. **No.** [Go to Test 2](#).

2. BCM Message Test

1. Verify transmission is in neutral.
2. With clutch lever released, start engine.
3. Does engine start?
 - a. **Yes.** [Go to Test 6](#).
 - b. **No.** [Go to Test 3](#).

3. Neutral Switch Test

1. Turn IGN OFF.
2. Disconnect the neutral switch [131].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump the (W) wire to the (BK) ground wire.
4. Does neutral lamp turn ON?
 - a. **Yes.** Replace neutral switch. **(5157)**
 - b. **No.** [Go to Test 4](#).

4. Ground Wire Test

1. Jump the (W) wire of the neutral switch to ground.

2. Does neutral lamp turn on?
 - a. **Yes.** Repair open in (BK) ground wire. **(5041)**
 - b. **No.** [Go to Test 5.](#)

5. Neutral Switch Power Circuit Open Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Test continuity between terminal D3 and [131B-1] (W) wire.
6. Is continuity present?
 - a. **Yes.** Replace BCM. **(5863)**
 - b. **No.** Repair open in (W) wire between indicators and neutral switch. **(5041)**

6. Speedometer Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
4. Turn IGN ON.
5. Jump BOB terminal 6 to ground.
6. Does neutral lamp illuminate?
 - a. **Yes.** Replace speedometer. **(6020)**
 - b. **No. FXS/B.** Replace indicator harness. **(5191)**
 - c. **No. Except FXS/B.** [Go to Test 7.](#)

7. Neutral Indicator Circuit Test

1. Turn IGN OFF.
2. Disconnect indicator [21].
3. Test continuity between [21B] terminal 5 and BOB terminal 6.
4. Is continuity present?
 - a. **Yes.** Replace indicator harness. **(5191)**
 - b. **No.** Repair open in (W) wire between [21B] and [39B]. **(5041)**

HIGH BEAM INDICATOR LAMP ALWAYS ON

Table 4-17. High Beam Indicator Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Short to ground in high beam indicator circuit

1. High Beam Indicator Function Test

1. With IGN ON, operate the headlamp switch.
2. Do high and low beam headlamps function correctly?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See [5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139.](#)

2. High Beam Indicator Circuit Test

1. With IGN OFF, disconnect speedometer [39].
2. Turn IGN ON.
3. Does high beam indicator illuminate?
 - a. **Yes. FXS/B.** Replace indicator harness. **(5191)**
 - b. **Yes. Except FXS/B.** [Go to Test 3.](#)
 - c. **No.** Replace speedometer. **(6020)**

3. High Beam Indicator Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect indicators [21].
3. Test continuity between [21B] terminal 2 and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground in (BE/W) wire between [21B] and [39B]. **(5041)**
 - b. **No.** Replace indicator harness. **(5191)**

HIGH BEAM INDICATOR LAMP INOPERATIVE

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

Table 4-18. 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 high and low beam headlamps function correctly?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See [5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139.](#)

2. High Beam Indicator Circuit Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Turn IGN ON.
4. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
5. Jump BOB terminal 4 to ground.
6. Does high beam indicator illuminate?
 - a. **Yes.** Replace speedometer. **(6020)**
 - b. **No. FXS/B.** Replace indicator harness. **(5191)**
 - c. **No. Except FXS/B.** [Go to Test 3.](#)

3. High Beam Indicator Circuit Open Test

1. Turn IGN OFF.
2. Disconnect indicator [21].
3. Test continuity between [21B] terminal 2 and BOB terminal 4.
4. Is continuity present?
 - a. **Yes.** Replace indicator harness. **(5191)**
 - b. **No.** Repair open in (BE/W) wire between [21B] and [39B]. **(5041)**

TURN SIGNAL INDICATOR LAMP ALWAYS ON

Table 4-19. Turn Signal Indicator Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Short to ground turn signal circuit

1. Turn Signal Function Test

1. With IGN ON, operate turn signals.
2. Do 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 speedometer [39].
2. Turn IGN ON.

3. Does turn signal indicator illuminate?
 - a. **Yes. FXS/B.** Replace indicator harness. **(5191)**
 - b. **Yes. Except FXS/B.** [Go to Test 3.](#)
 - c. **No.** Replace speedometer. **(6020)**

3. Turn Signal Indicator Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect indicators [21].
3. Test continuity between [21B] terminal 1 and ground (left) or [21B] terminal 4 and ground (right).
4. Is continuity present?
 - a. **Yes.** Repair short to ground in (BE/PK) (left) or (BE/O) (right) between [21B] and [39B]. **(5041)**
 - b. **No.** Replace indicator harness. **(5191)**

TURN SIGNAL INDICATOR INOPERATIVE

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

Table 4-20. Turn Signal Indicator Inoperative Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Open turn signal circuit

1. Turn Signal Function Test

1. With IGN ON, operate turn signals.
2. Do turn signals operate?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See [5.3 TURN SIGNALS.](#)

2. Turn Signal Indicator Circuit Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
4. Turn IGN ON.
5. Jump BOB terminal 10 (left) or terminal 12 (right) to ground.
6. Does turn signal indicator illuminate?
 - a. **Yes.** Replace speedometer. **(6020)**
 - b. **No. FXS/B.** Replace indicator harness. **(5191)**
 - c. **No. Except FXS/B.** [Go to Test 3.](#)

3. Turn Signal Indicator Circuit Open Test

1. Turn IGN OFF.
2. Disconnect [21].
3. Test continuity between [21B] terminal 1 and BOB terminal 10 (left) or between [21B] terminal 4 and BOB terminal 12 (right).
4. Is continuity present?
 - a. **Yes.** Replace indicator harness. **(5191)**
 - b. **No.** Repair open in (BE/PK) (left) or (BE/O) (right) between [21B] and [39B]. **(5041)**

GAUGES

4.6

THEORY OF OPERATION

See [Figure 4-16](#). With IGN ON, the fuel gauge receives 12V through the running lamp circuit. Current flows through the gauge and variable resistor in the fuel gauge sending unit to ground. The sending unit float controls the amount of resistance in the variable resistor.

Inoperative gauges occur if:

- Sender or fuel gauge not grounded.
- Malfunction in sender or fuel gauge.
- Inoperative or disconnected wire to fuel gauge.
- Corroded connections at fuel gauge.

Use the [4.6 GAUGES, Fuel Gauge Inaccurate, No DTCs](#) to test suspected components.

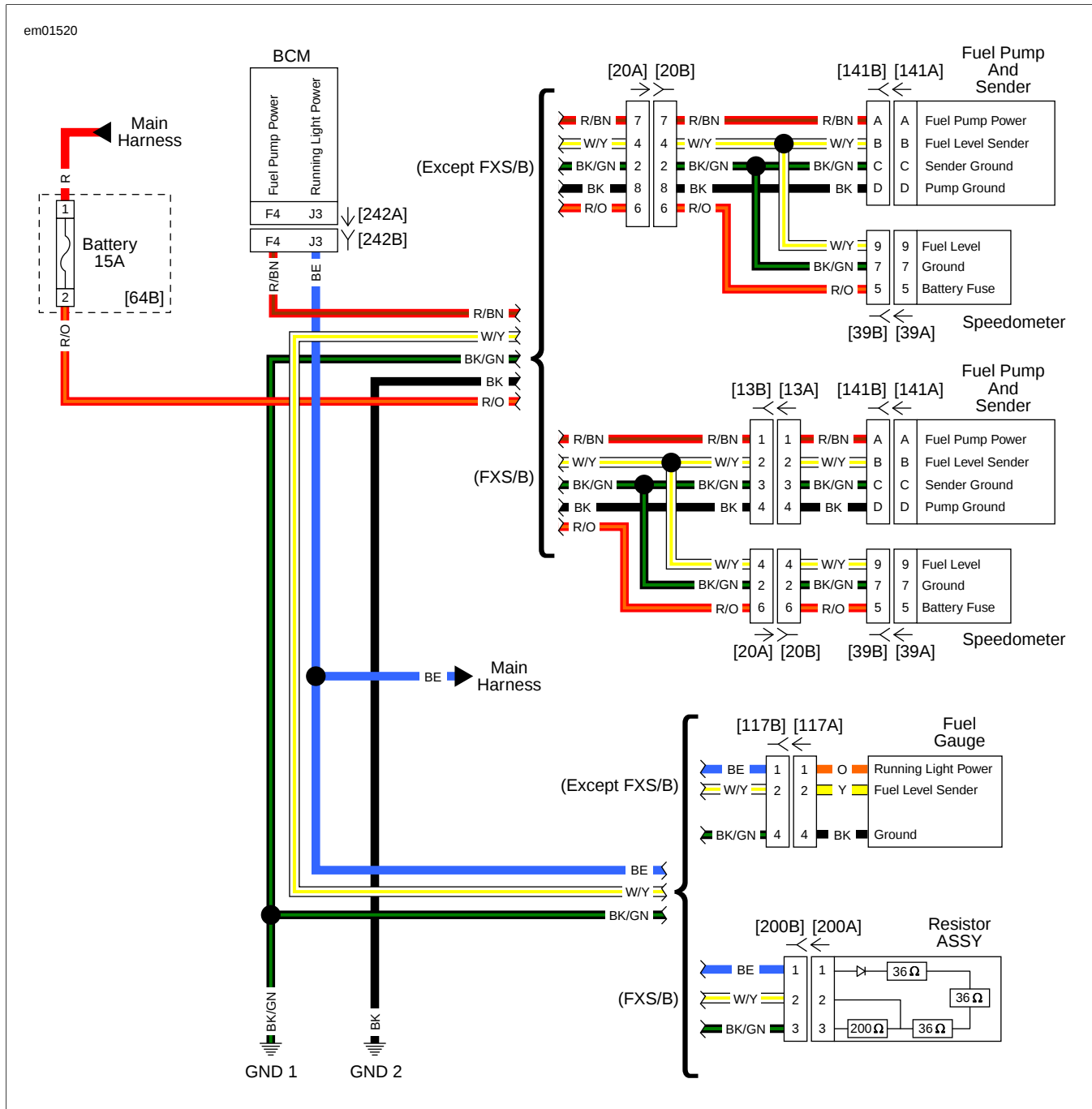


Figure 4-16. Fuel Sensor Circuit

FUEL GAUGE INACCURATE, NO DTCS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 4-21. Fuel Gauge Inaccurate, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Open in fuel gauge power circuit
Open in fuel gauge ground circuit
Fuel sender malfunction
Fuel gauge malfunction

1. Fuel Gauge Test

1. Turn IGN OFF.
2. Disconnect fuel pump and sender [141].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [141B] terminal B to ground.
4. Turn IGN ON.
5. Does fuel gauge indicate full?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 3.](#)

2. Sending Unit Test

1. Test resistance between [141A] terminals B and C.
2. Is resistance within the specified range? Refer to [Table 4-22](#).
 - a. **Yes.** System operating properly.
 - b. **No.** Replace fuel sender.

Table 4-22. Fuel Sender Resistance Values

FUEL LEVEL	RESISTANCE
Full	27-40 Ohms
Half-full	97-118 Ohms
Empty	240-264 Ohms

3. Fuel Gauge Circuit Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Test voltage between [117B] terminals 1 and 4.
5. Is battery voltage present?
 - a. **Yes.** Replace fuel gauge.
 - b. **No.** Repair open in (BE) or (BK/GN) wire.

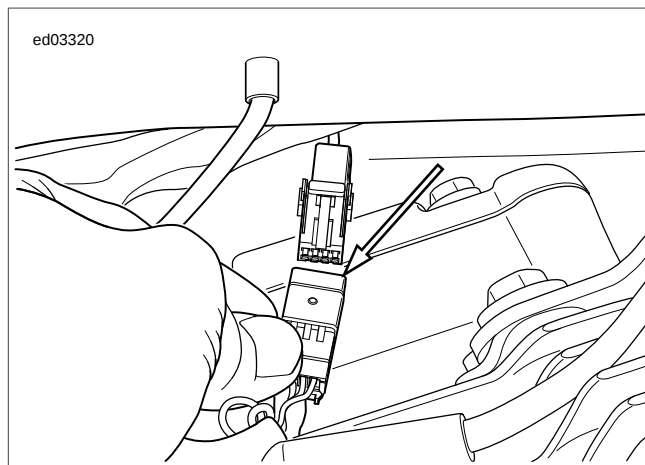


Figure 4-17. Fuel Gauge Connector

FUEL GAUGE INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 4-23. Fuel Gauge Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open in power circuit
Open in ground circuit
Fuel gauge malfunction

1. Ignition Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [117B] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (BE) wire. **(5041)**

2. Ground Circuit Test

1. Test voltage between [117B] terminals 1 and 4.
2. Is battery voltage present?
 - a. **Yes.** Replace fuel gauge. **(6047)**
 - b. **No.** Repair open in the ground circuit. **(5041)**

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NOTES

ACCESSORIES: DTC B2112, B2113, B2114

5.1

DESCRIPTION AND OPERATION

The P&A battery circuit is connected to battery power through the P&A fuse. This circuit supplies power to additional systems on the vehicle. The P&A circuit runs from the fuse to the DLC connector terminal 6.

There is also an accessory power circuit from the BCM terminal M2 that runs to the rear lighting and DLC connectors. This circuit is energized by the BCM when the IGN is in the ACC or ON position.

Table 5-1. Code Description

DTC	DESCRIPTION
B2112	Accessory output shorted high
B2113	Accessory output shorted low
B2114	Accessory output overloaded

Conditions for Setting

The accessory circuit normally has power when the IGN is ON or in the ACC positions. If the accessory circuit has power when the IGN is OFF, then DTC B2112 will set.

DTC B2114 will set if the accessory circuit draws more than 15 Amps.

The other accessory circuit DTCs will set if the BCM identifies them with the IGN ON or in the ACC position.

Diagnostic Tips

This circuit may be used for aftermarket accessories or systems for the vehicle. If a code is set and cannot be duplicated, verify that an aftermarket device did not cause the concern.

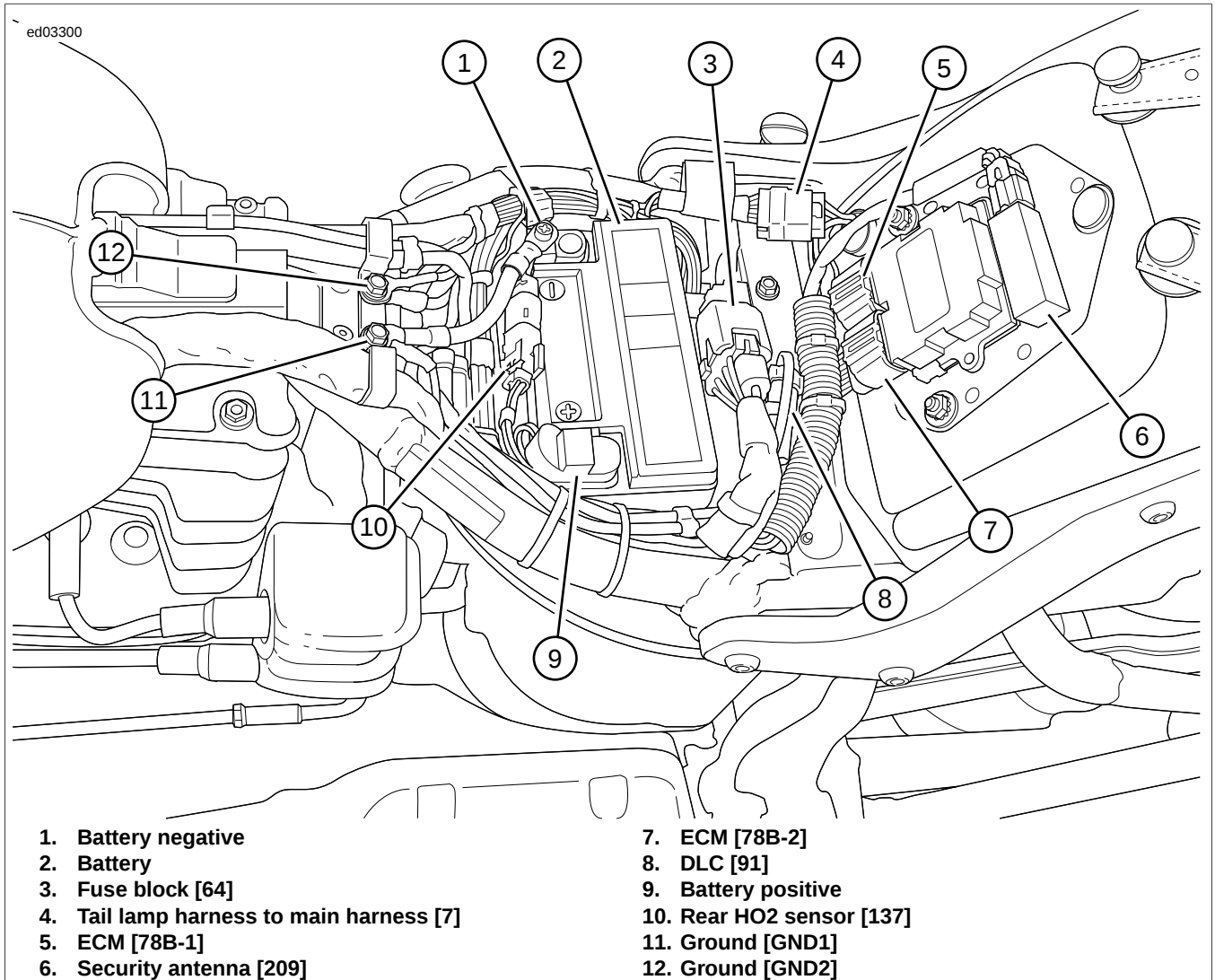


Figure 5-1. Under Seat: Except FXS/B and FLS

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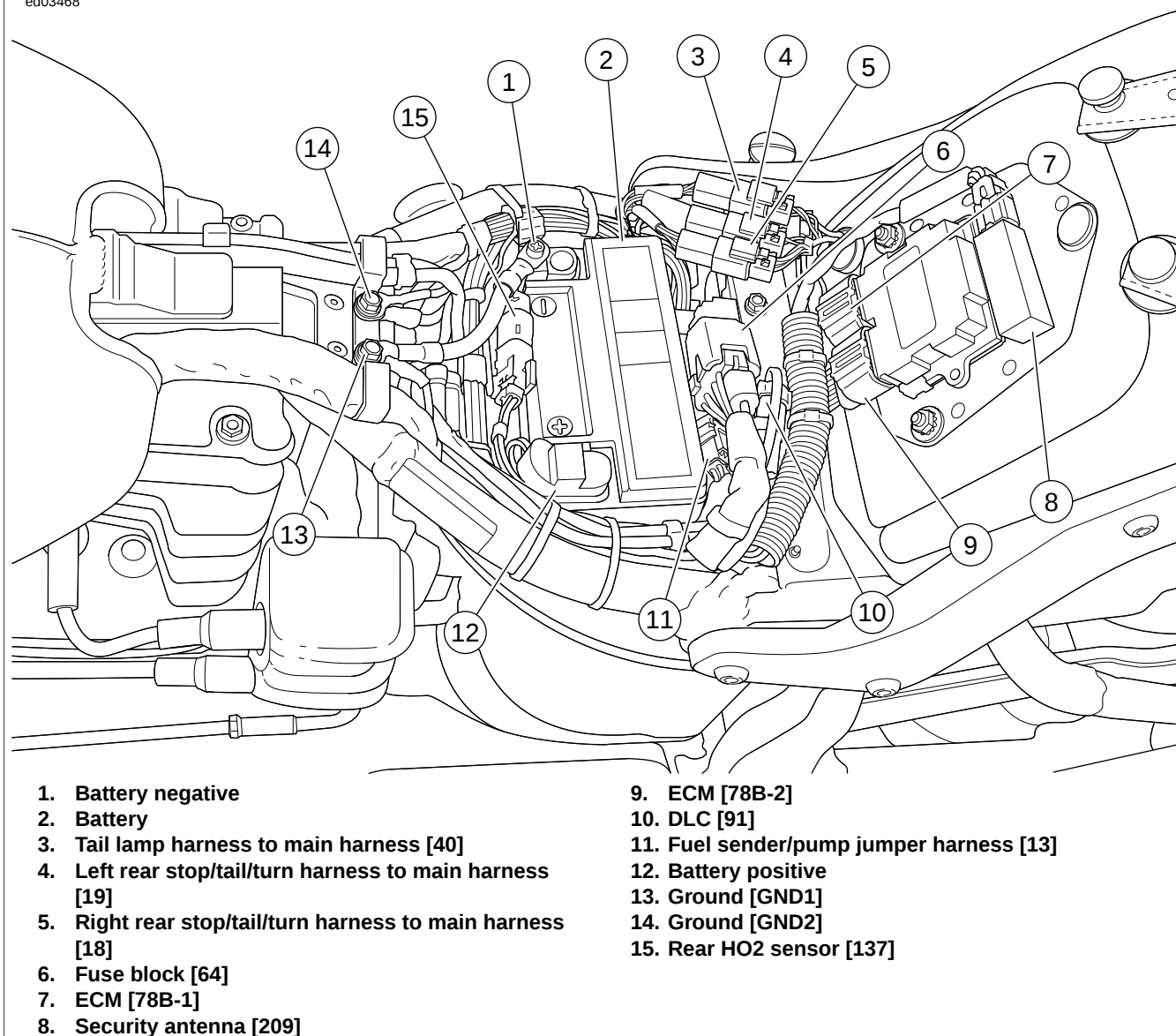


Figure 5-2. Under Seat: FXS and FLS

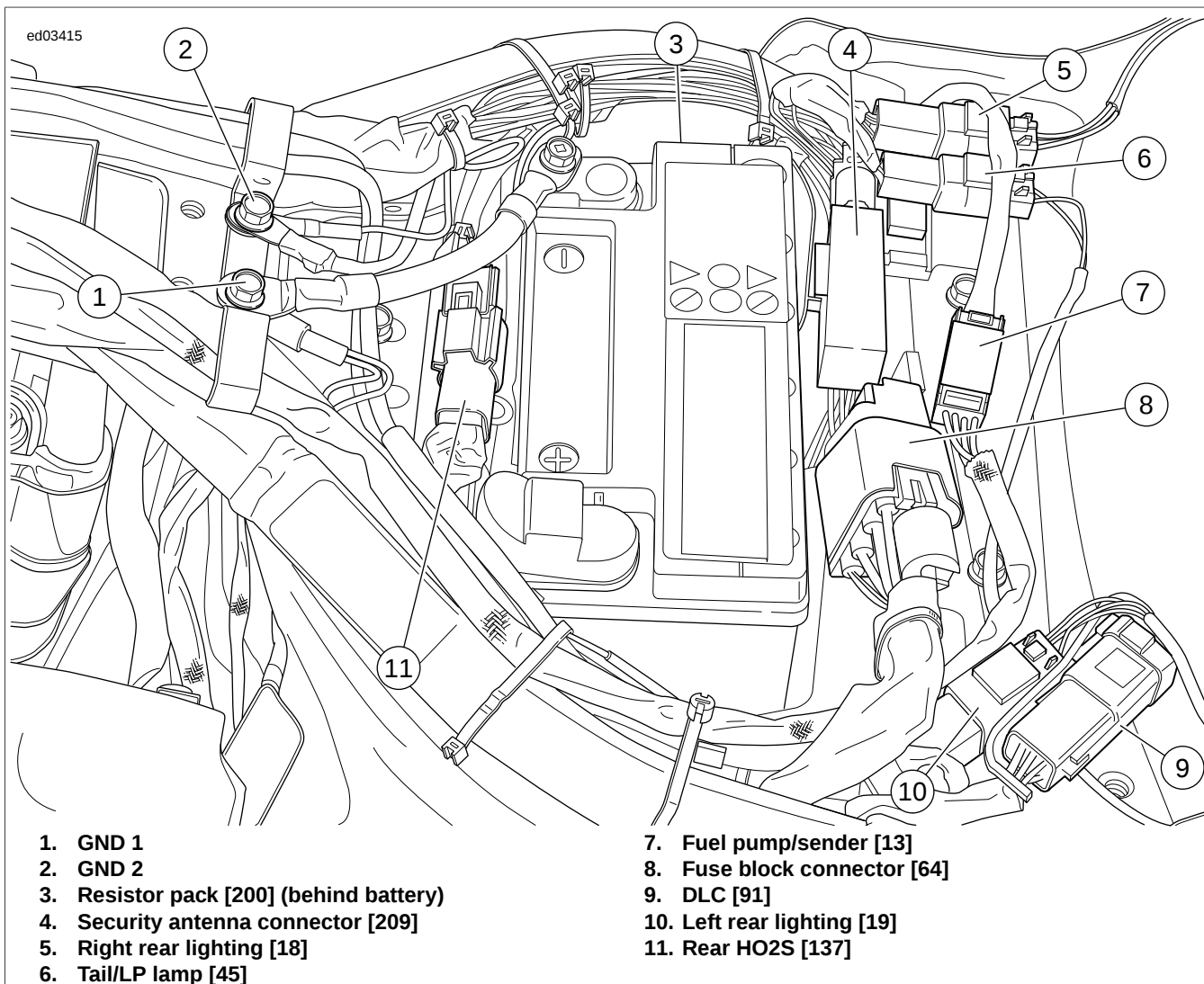


Figure 5-3. Under Seat: FXSB

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](#).

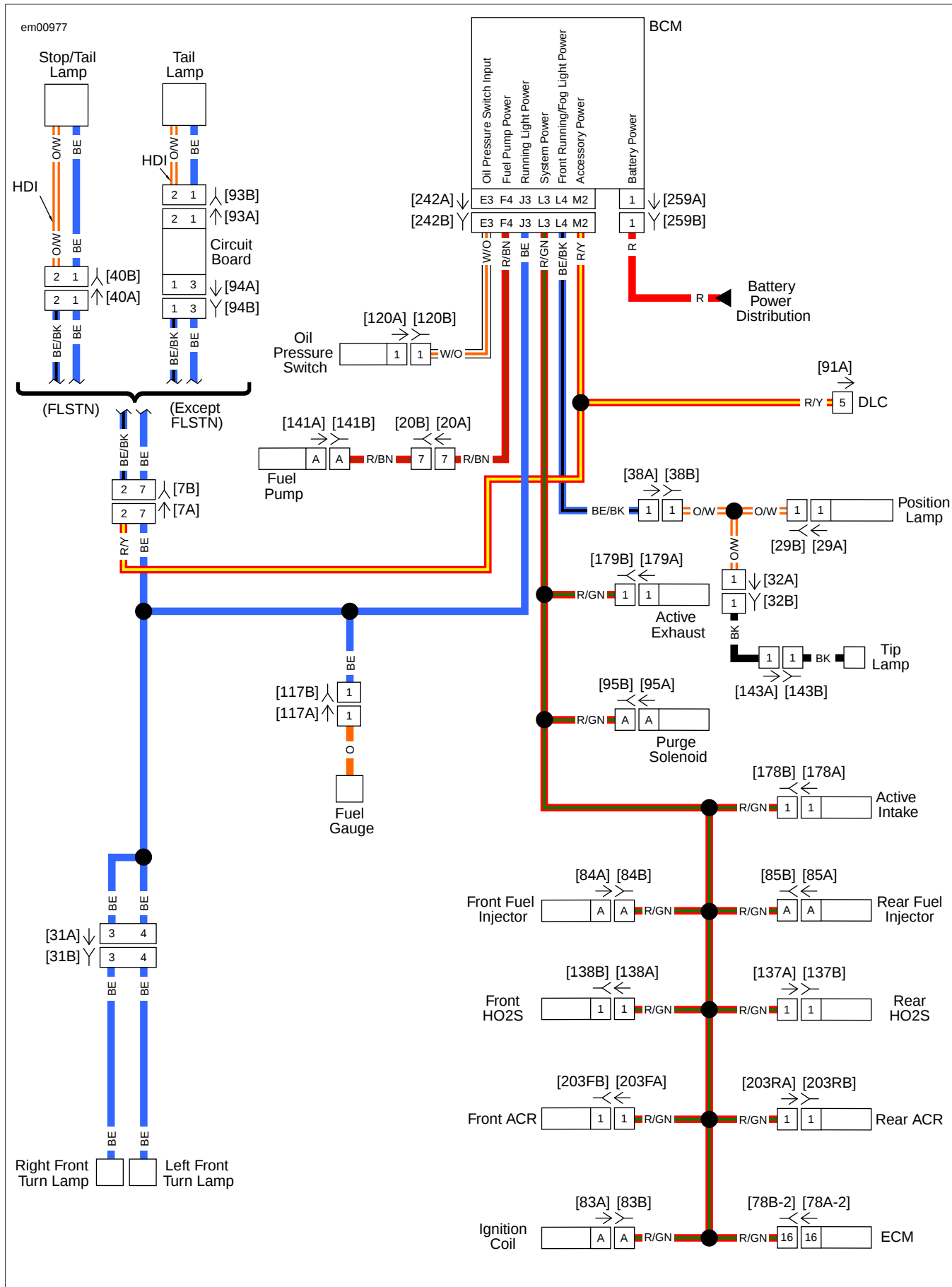


Figure 5-4. Ignition and Accessory Power Distribution: Except FXS/B and FLS

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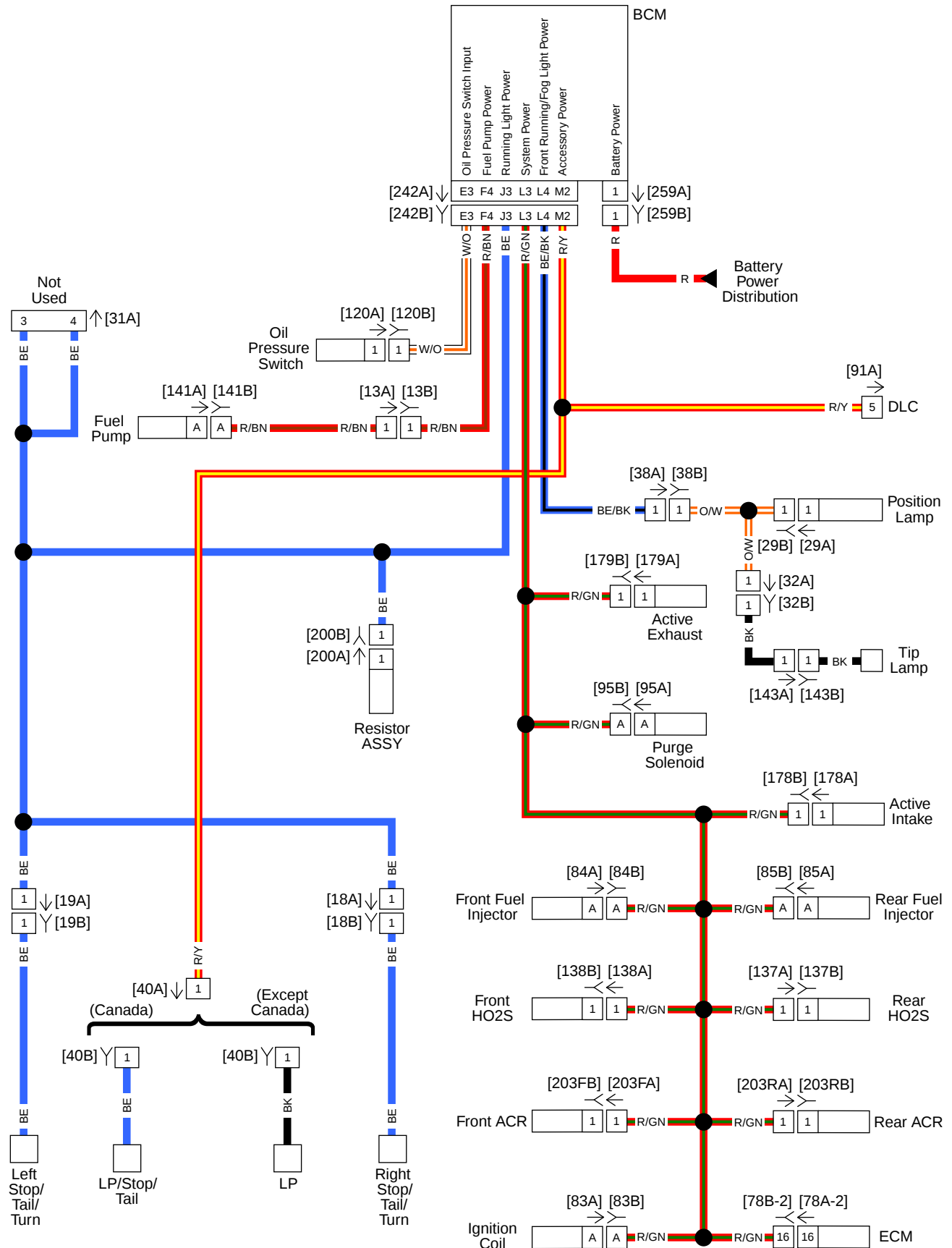


Figure 5-5. Ignition and Accessory Power Distribution: FXS/B

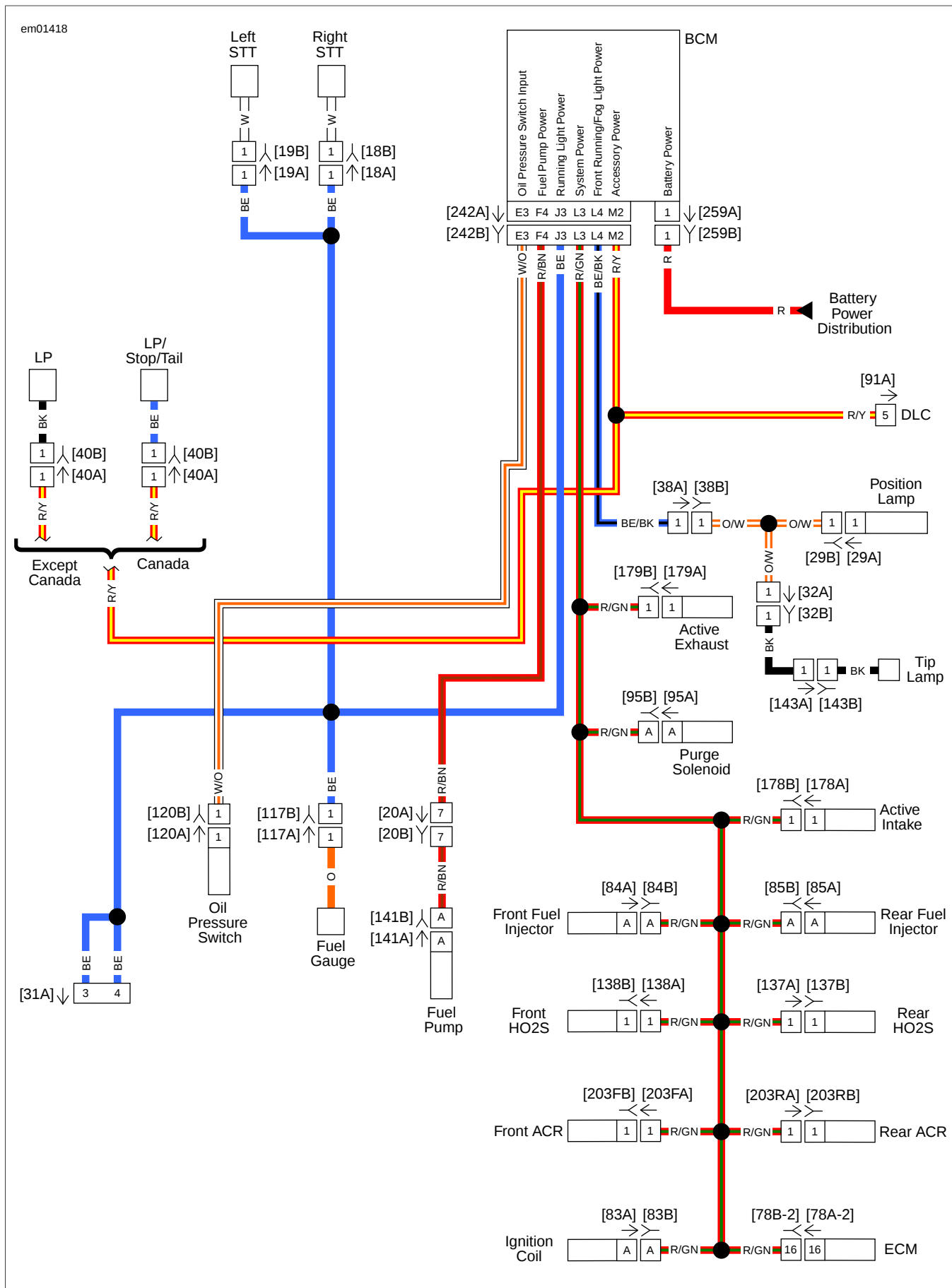


Figure 5-6. Ignition and Accessory Power Distribution: FLS

DTC B2112

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-2. DTC B2112 Diagnostic Faults

POSSIBLE CAUSES
Short to battery in the accessory power circuit

1. Accessory Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between DLC [91A] terminal 5 and ground.
3. Is battery voltage present?
 - a. **Yes.** Repair short to voltage on (R/Y) wire.
 - b. **No.** [Go to Test 2.](#)

2. BCM Test

1. Clear DTC.
2. Turn IGN ON-OFF.
3. Check for DTCs.
4. Did DTC return?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. Accessory devices may have caused DTC to set. Inspect and repair as needed.

DTC B2113, B2114

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-3. DTC B2113, B2114 Diagnostic Faults

POSSIBLE CAUSES
Excessive current draw in accessory power circuit
Short to ground in the accessory power circuit

1. Accessory Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B] leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal M2 and ground.
5. Is resistance less than 2 Ohms?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

2. Accessory Circuit Test

1. Inspect for any accessories connected to the accessory circuit.
2. Disconnect any accessories on the circuit.
3. Test resistance between BOB terminal M2 and ground.
4. Is resistance less than 2 Ohms?
 - a. **Yes.** Repair short to ground in (R/Y) wire.
 - b. **No.** [Go to Test 3.](#)

3. BCM Test

1. Leave all aftermarket accessories disconnected.
2. Connect BCM [242A].
3. Clear DTC.
4. Turn IGN ON.
5. Did DTC return?
 - a. **Yes.** Replace BCM.
 - b. **No.** Accessory devices may have caused DTC to set. Inspect and repair as needed.

HORN: DTC B2126, B2127, B2128, B2129

5.2

DESCRIPTION AND OPERATION

The horn is powered by the BCM from terminal E4 and grounded through GND 2. When the horn switch is pressed, a CAN signal is sent to the BCM. The BCM then supplies power to the horn over the (R/V) wire.

The horn switch is a push button switch on the left handlebar controls. The LHCM sends a signal to the BCM over the CAN bus when the horn switch is pressed. The horn switch is diagnosed with the other switches in the hand controls. See [5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270](#).

NOTE

If the horn button is pressed for more than 10 seconds, the BCM deactivates the horn to protect it from damage. Checking horn output from the BCM has to be done within 10 seconds of pressing the horn button.

See [Figure 5-7](#) and [Figure 5-8](#). The horn is located on the left side of the vehicle between the cylinders (except FXS/B) or between the front frame tubes (FXS/B).

Table 5-4. Code Description

DTC	DESCRIPTION
B2126	Horn output open
B2127	Horn output shorted high
B2128	Horn output shorted low
B2129	Horn output overloaded

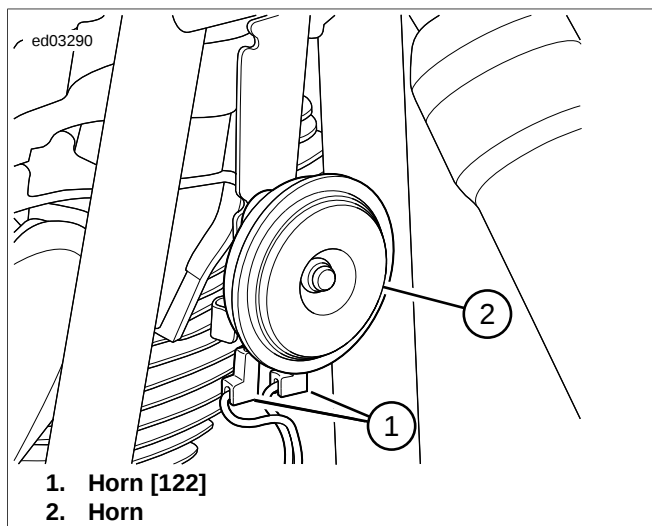


Figure 5-7. Horn: FXS/B

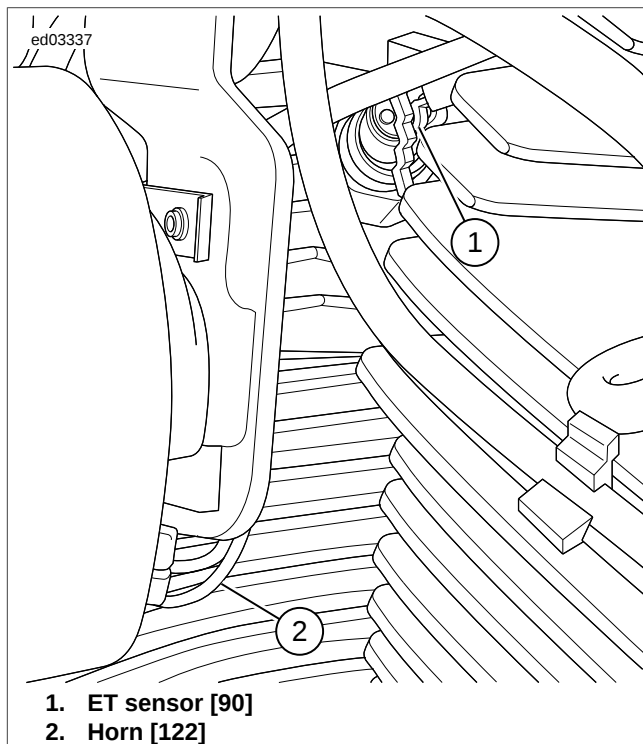


Figure 5-8. Horn and ET Sensor: Except FXS/B

Conditions for Setting

Press the horn switch to activate the horn in order to set these DTCs.

- DTC B2126 will set if the horn circuit draws less than 350 milliamps.
- DTC B2129 will set if the horn circuit draws more than 5 Amps.

Diagnostic Tips

There will not be a code set if the horn switch is always open. If the horn will not function when the switch is pressed but the other switches on the LHCM work normally, see [5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270](#).

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](#).

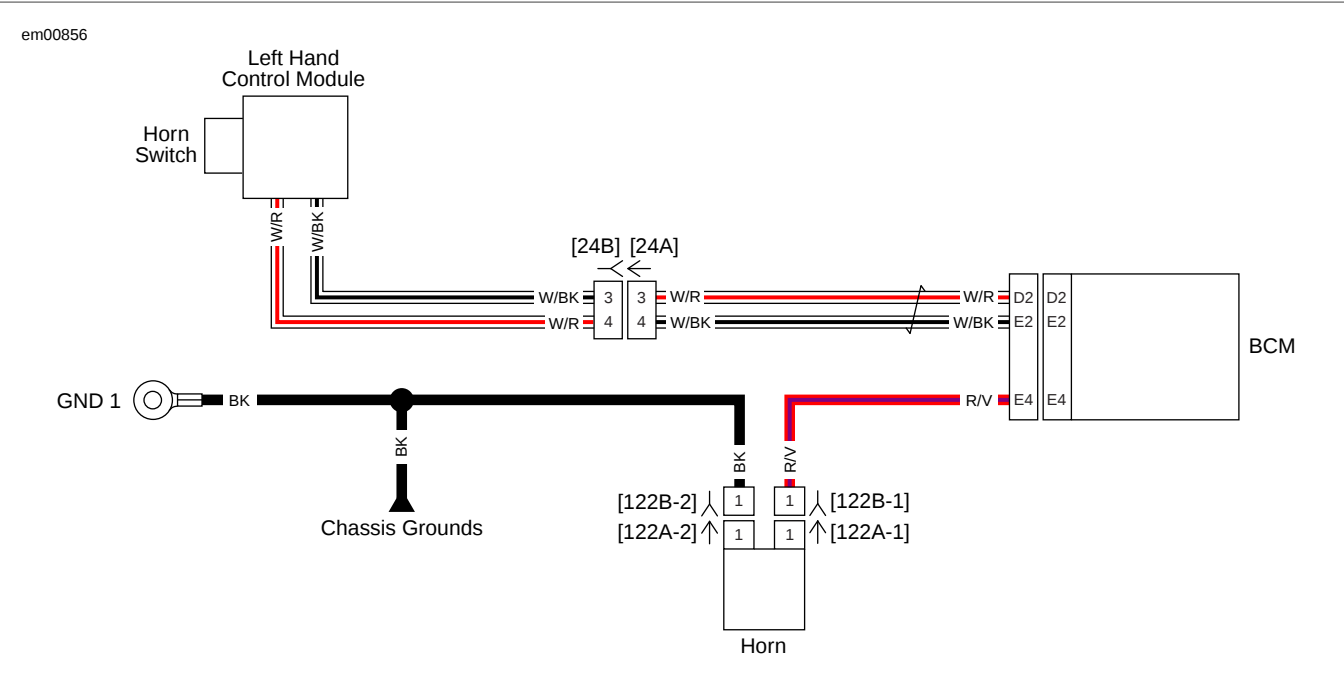


Figure 5-9. Horn

DTC B2126

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-5. DTC B2126 Diagnostic Faults

POSSIBLE CAUSES
Open in horn ground circuit
Open in horn power circuit
Horn malfunction

1. Horn Test

1. Turn IGN OFF.
2. Disconnect horn [122].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [122B-1] and [122B-2] while pressing the horn switch.
5. Is battery voltage present?
 - a. **Yes.** Replace horn.
 - b. **No.** [Go to Test 2.](#)

2. Ground Circuit Open Test

1. While pressing the horn switch, test voltage between [122B-1] terminal 1 and ground.

NOTE

If the horn button is pressed for more than 10 seconds, the BCM deactivates the horn to protect it from damage. Checking horn output from the BCM has to be done within 10 seconds of pressing the horn button.

2. Is battery voltage present?
 - a. **Yes.** Repair open in the (BK) ground circuit.
 - b. **No.** [Go to Test 3.](#)

3. Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. While pressing the horn switch, test voltage between BOB terminal E4 and ground.
5. Is battery voltage present?
 - a. **Yes.** Repair open in (R/V) wire.
 - b. **No.** Replace BCM.

DTC B2127

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL

Table 5-6. DTC B2127 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in horn power circuit

1. Horn Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Using 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423), remove terminal E4 (R/V) wire from BCM harness connector [242B].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between extracted terminal E4 and ground.
7. Is voltage present?
 - a. **Yes.** Repair short to voltage in horn power circuit (R/V) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.

4. Did DTC B2127 set?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC B2128, B2129

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-7. DTC B2128, B2129 Diagnostic Faults

POSSIBLE CAUSES
Accessory horn overloading circuit
Short to ground in horn power circuit
Horn malfunction

1. Horn Circuit Test

1. Turn IGN OFF.
2. Disconnect horn [122].
3. Disconnect BCM [242].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [122B-1] terminal 1 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground in (R/V) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Connect [242].
2. Clear DTC.
3. Turn IGN ON.
4. Press horn switch.
5. Check DTCs.
6. Did the DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace horn.

TURN SIGNALS

5.3

DESCRIPTION AND OPERATION

The BCM controls the turn signal functions, including the hazard lamps and turn signal cancellation feature. The BCM has separate controls for each of the turn signals. This allows the BCM to set DTCs for each turn signal individually.

The front turn signals are controlled two different ways depending on the wire routing of the front turn signals. If the front turn signals are wired to the LHCM and RHCM, then the power and ground for the turn signal comes from the LHCM or RHCM. The BCM only controls the rate of the flash of the turn signal by sending a message over the CAN bus to the hand control modules.

See [Figure 5-10](#). If the front turn signals are not wired to the LHCM and RHCM, then the BCM controls the front turn signals, as well as the rear turn signals. In this configuration, the BCM sends power to the turn signals directly over the specific wire for each signal. The BCM has different turn signal DTCs depending on vehicle configuration.

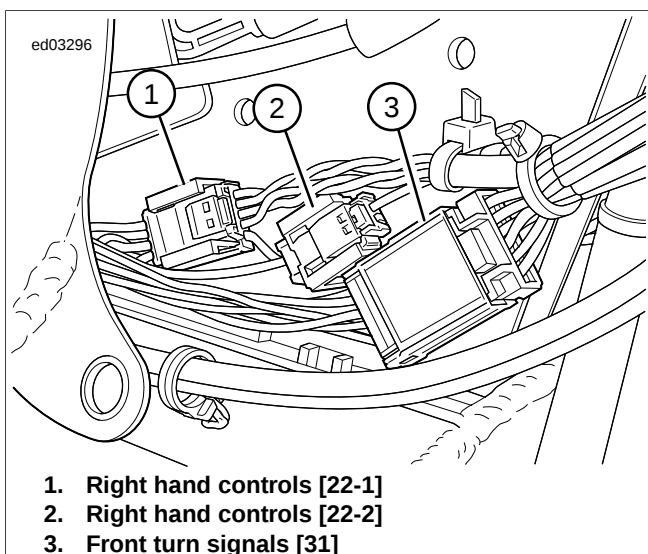


Figure 5-10. Under Fuel Tank Right Side

In either configuration, the LHCM and RHCM send messages to the BCM over the CAN bus when either of the turn signal switches or hazard warning switch are pressed. The BCM will also set codes if it determines a switch is stuck in the pressed position for longer than two minutes. The switch DTCs are diagnosed with the other hand control module switches. See [5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270](#).

Manual Cancellation

To stop the turn signals from flashing, briefly press the turn signal switch a second time.

If signaling to turn in one direction, pressing the switch for the opposite turn signal will cause the first signal to cancel and the opposite side to begin.

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 BCM will not cancel the signal before the turn is actually completed.

- When the turn signal switch is released, the system starts a 20 count. As long as the vehicle is traveling above 8 mph (13 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 8 mph (13 km/h) or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 mph (13 km/h) and will automatically cancel when the count total equals 20 as stated above.
- The turn signals may cancel within two seconds upon turn completion depending on vehicle lean angle during turn. An accelerometer inside the BCM 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. This calibration process optimizes the performance of the bank angle function. This automatic calibration is performed automatically every time the vehicle is started and ridden.

Four-Way Flashing

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

1. With the ignition switch ON or in ACC, press the hazard warning switch.

NOTE

To activate or deactivate hazards on vehicle equipped with security system, the fob must be within range of the vehicle.

2. Turn the ignition switch OFF (the security system will arm if equipped). The four-way flashers will continue for two hours.
3. To cancel four-way flashing, disarm the security system if equipped, turn the ignition switch ON or to ACC and press the hazard warning switch.

NOTE

To activate or deactivate hazards on vehicle equipped with security system, the fob must be within range of the vehicle.

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

Tip Over Detection Operation

The BCM uses an internal accelerometer to monitor vehicle position. Under normal driving conditions, the BCM uses the accelerometer along with speed input provided from the ECM to know when to automatically cancel the turn signals after a turn. The BCM will disable turn signal lamps, accessory power and starter activation and will 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.

Tip Over Reset

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

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](#).

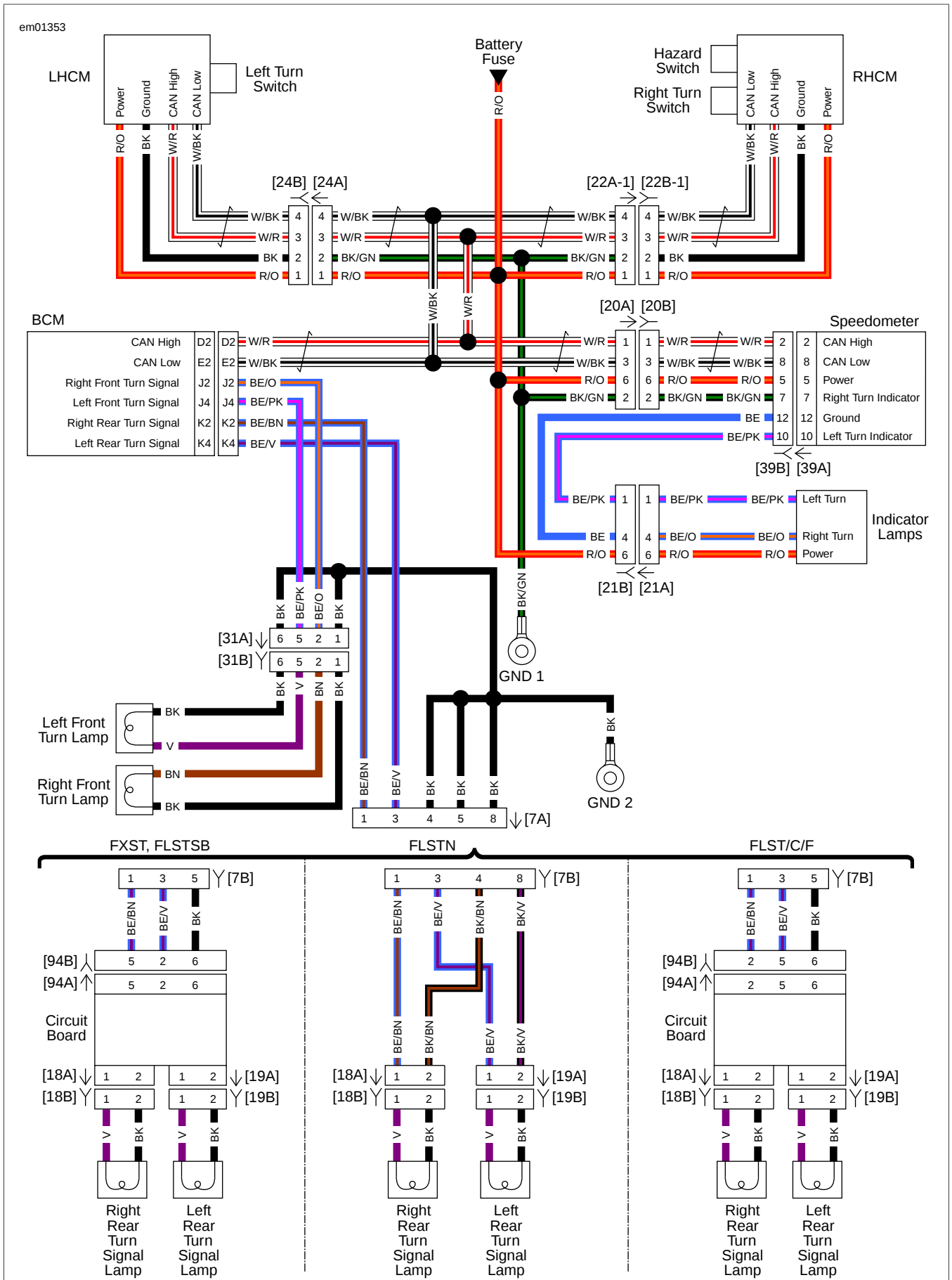
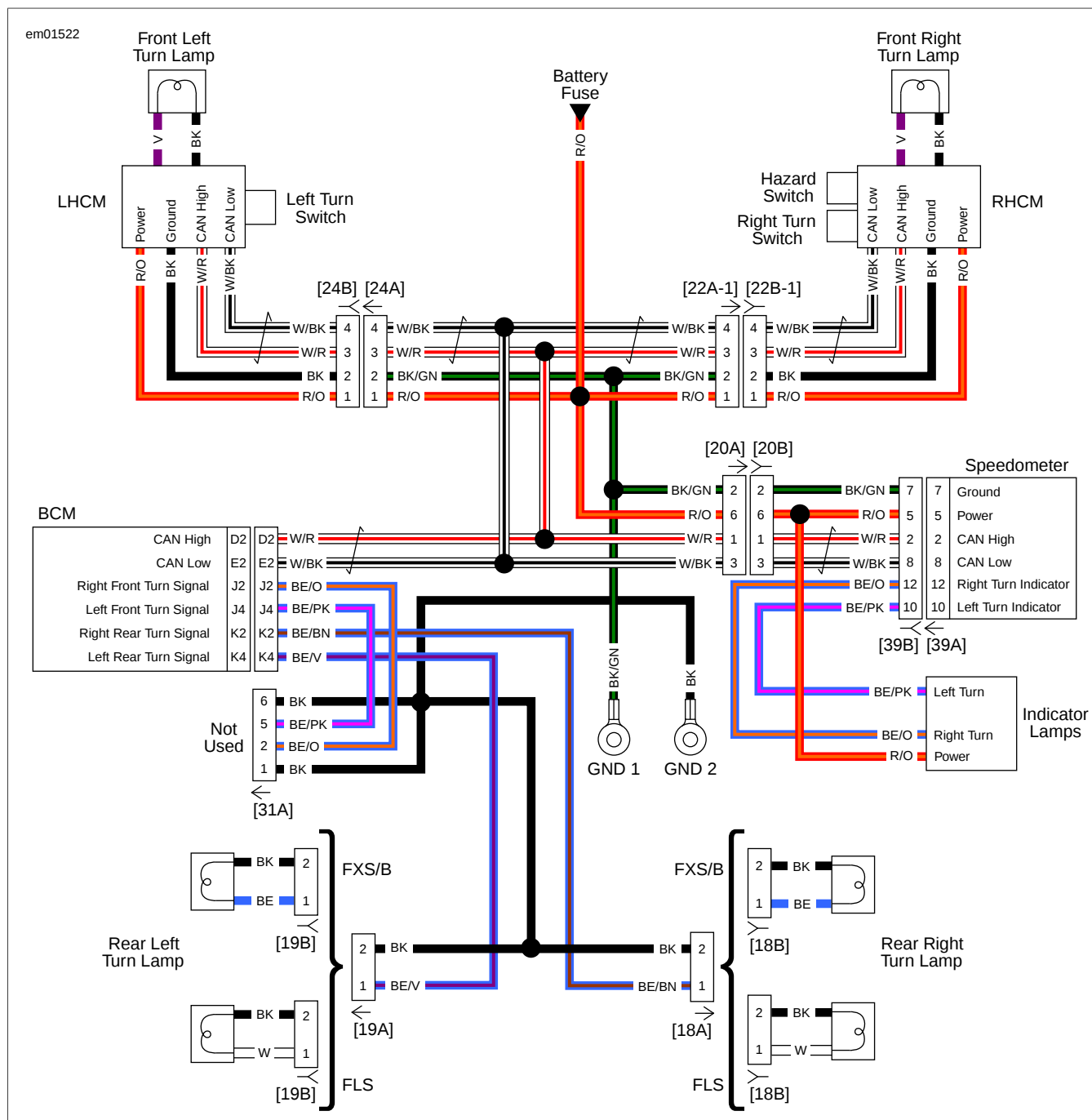


Figure 5-11. Turn Signal Circuit: Except FXS/B and FLS



WILL NOT CANCEL UPON TURN COMPLETION, NO DTCS

Table 5-8. Will Not Cancel Upon Turn Completion, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Conditions to self cancel not met
Improper configuration

1. BCM Mounting Test

1. Verify BCM is mounted correctly.

2. Is BCM mounted correctly?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Mount correctly.

2. Correct Configuration Test

1. Check if BCM is configured correctly. See [5.14 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS](#).
2. Is BCM configured correctly?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Select proper vehicle configuration.

3. Turn Signals Cancel Test

1. Operate vehicle at a speed greater than 8 mph (13 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 4.](#)

4. Speedometer Test

1. Does speedometer register vehicle speed?
 - a. **Yes.** Replace BCM. **(6773)**
 - b. **No.** See [2.1 INITIAL DIAGNOSTICS](#).

DTC B1101, B1151

DESCRIPTION AND OPERATION

These DTCs are specific for vehicles with the front turn signals wired to the LHCM and RHCM. If the turn signals are not wired in this configuration, a different set of codes are used to determine turn signal circuit malfunction. The LHCM and RHCM control the turn signals, but any DTCs related to the turn signals are reported by the BCM.

Before troubleshooting errors after relocating front turn signals, perform following steps:

1. Turn IGN ON.
2. Activate hazard lights for 10 flashes.
3. Deactivate hazards.
4. Activate hazard lights for 10 flashes.
5. Deactivate hazards.
6. Clear DTCs.
7. Turn IGN OFF, ON, activate hazard lights.
8. Verify DTCs.

NOTE

This is necessary for the BCM to validate the proper front lighting configuration and which module is actually controlling them.

Table 5-9. Code Description

DTC	DESCRIPTION
B1101	LHCM turn signal bulb out
B1151	RHCM turn signal bulb out

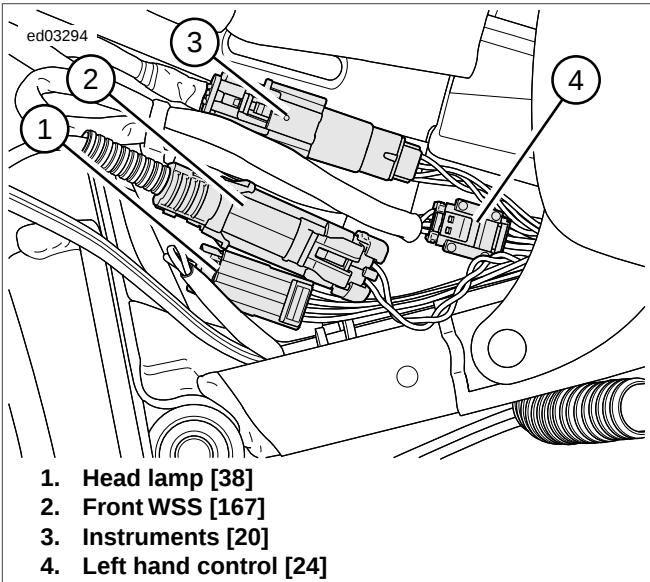


Figure 5-13. Under Fuel Tank Left Side

Conditions for Setting

After clearing DTCs, test inoperative turn signal. Verify DTC does not return.

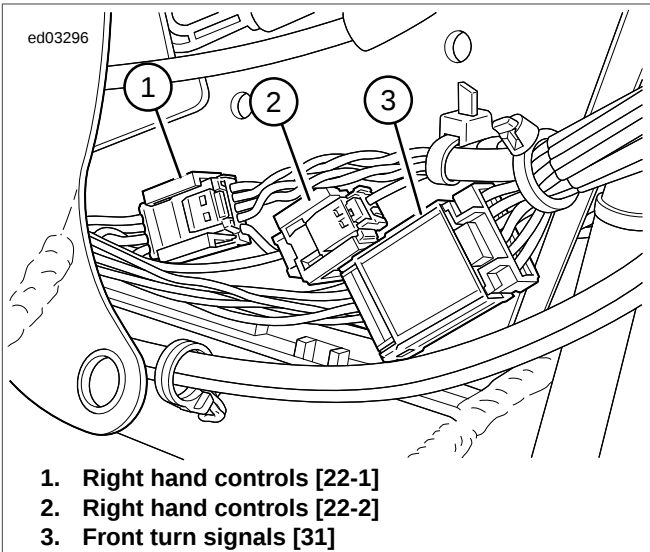


Figure 5-14. Under Fuel Tank Right Side

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](#).

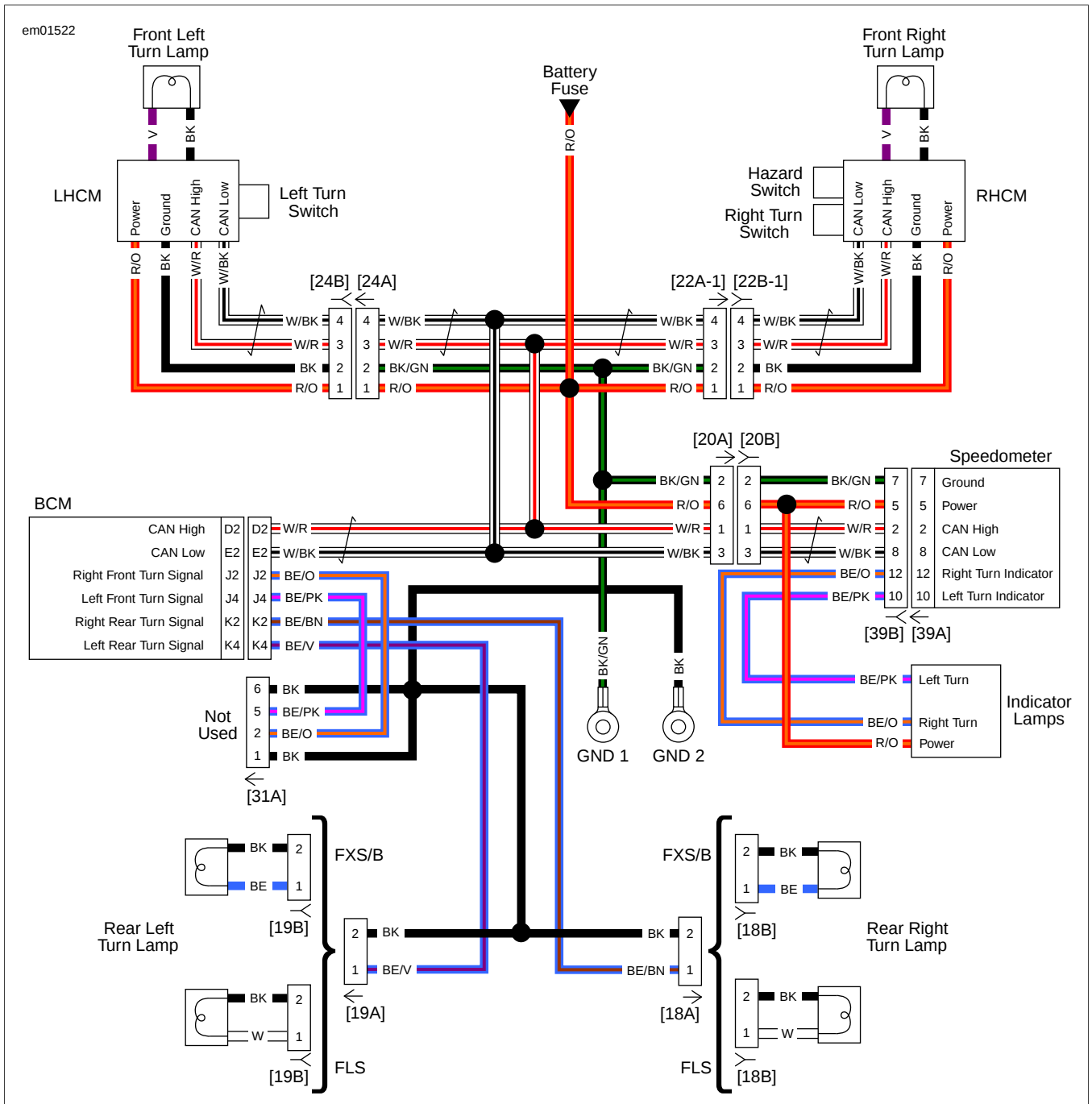


Figure 5-15. Turn Signal Circuit: FXS/B and FLS

DTC B1101, B1151

Table 5-10. DTC B1101, B1151 Diagnostic Faults

POSSIBLE CAUSES
Bulb malfunction

1. Bulb Test

1. Inspect inoperative turn signal bulb.

2. Is the bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Socket and Wiring Inspection Test

1. Inspect bulb socket and wiring to the turn signal for damage or poor connections.
2. Were any issues found?
 - a. **Yes.** Repair as needed.
 - b. **No.** Replace the inoperative side module (LHCM or RHCM).

DTC B2141, B2143, B2144, B2146, B2148, B2149

5.5

DESCRIPTION AND OPERATION

See [Figure 5-16](#). These DTCs only apply to vehicles where the turn signals are not wired directly to the hand control modules.

The turn signals are controlled by the BCM. The BCM supplies power to the turn signals and controls the flash rate of the turn signals through the turn signals individual power circuit.

When the turn signal or hazard warning lamp switch is pressed, the hand control module sends a message over the CAN bus to the BCM. The BCM then controls the power to the turn signal. The turn signals have a constant ground.

Before troubleshooting errors after relocating front turn signals, perform following steps:

1. Turn IGN ON.
2. Activate hazard lights for 10 flashes.
3. Deactivate hazards.
4. Activate hazard lights for 10 flashes.
5. Deactivate hazards.
6. Clear DTCs.
7. Turn IGN OFF, ON, activate hazard lights.
8. Verify DTCs.

NOTE

This is necessary for the BCM to validate the proper front lighting configuration and which module is actually controlling them.

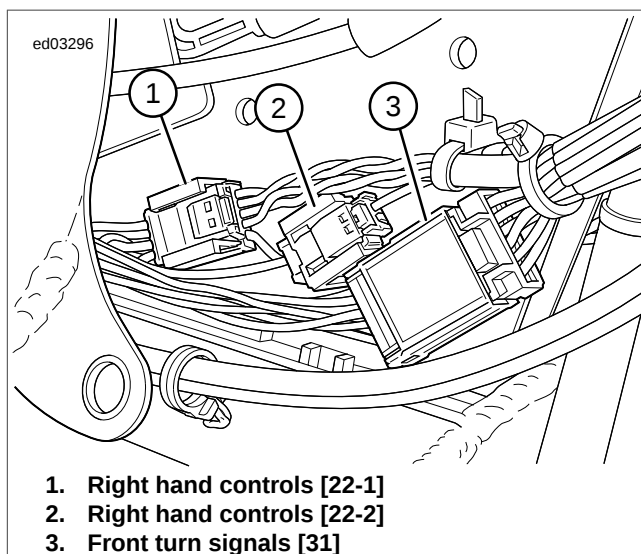


Figure 5-16. Under Fuel Tank Right Side

Table 5-11. Code Description

DTC	DESCRIPTION
B2141	Left front turn signal output open
B2143	Left front turn signal output shorted low
B2144	Left front turn signal output overloaded
B2146	Right front turn signal output open
B2148	Right front turn signal output shorted low
B2149	Right front turn signal output overloaded

Conditions for Setting

After clearing DTCs, test inoperative turn signal. Verify DTC does not return.

- DTC B2141 or B2146 will set if the corresponding front turn signal circuit draws less than 120 milliamps.
- DTC B2144 or B2149 will set if the corresponding front turn signal circuit draws more than 3 Amps.

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](#).

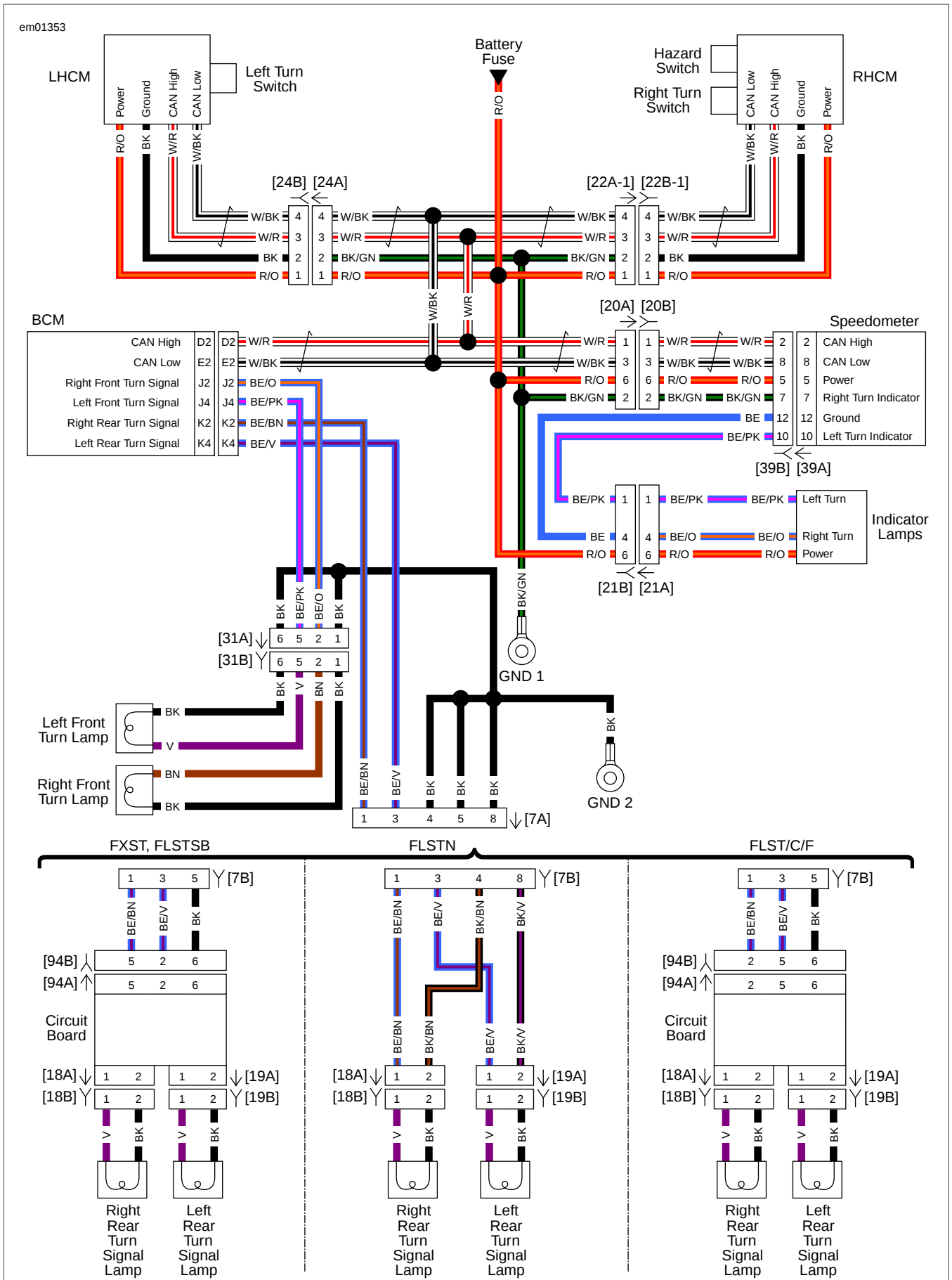


Figure 5-17. Turn Signal Circuit: Except FXS/B and FLS

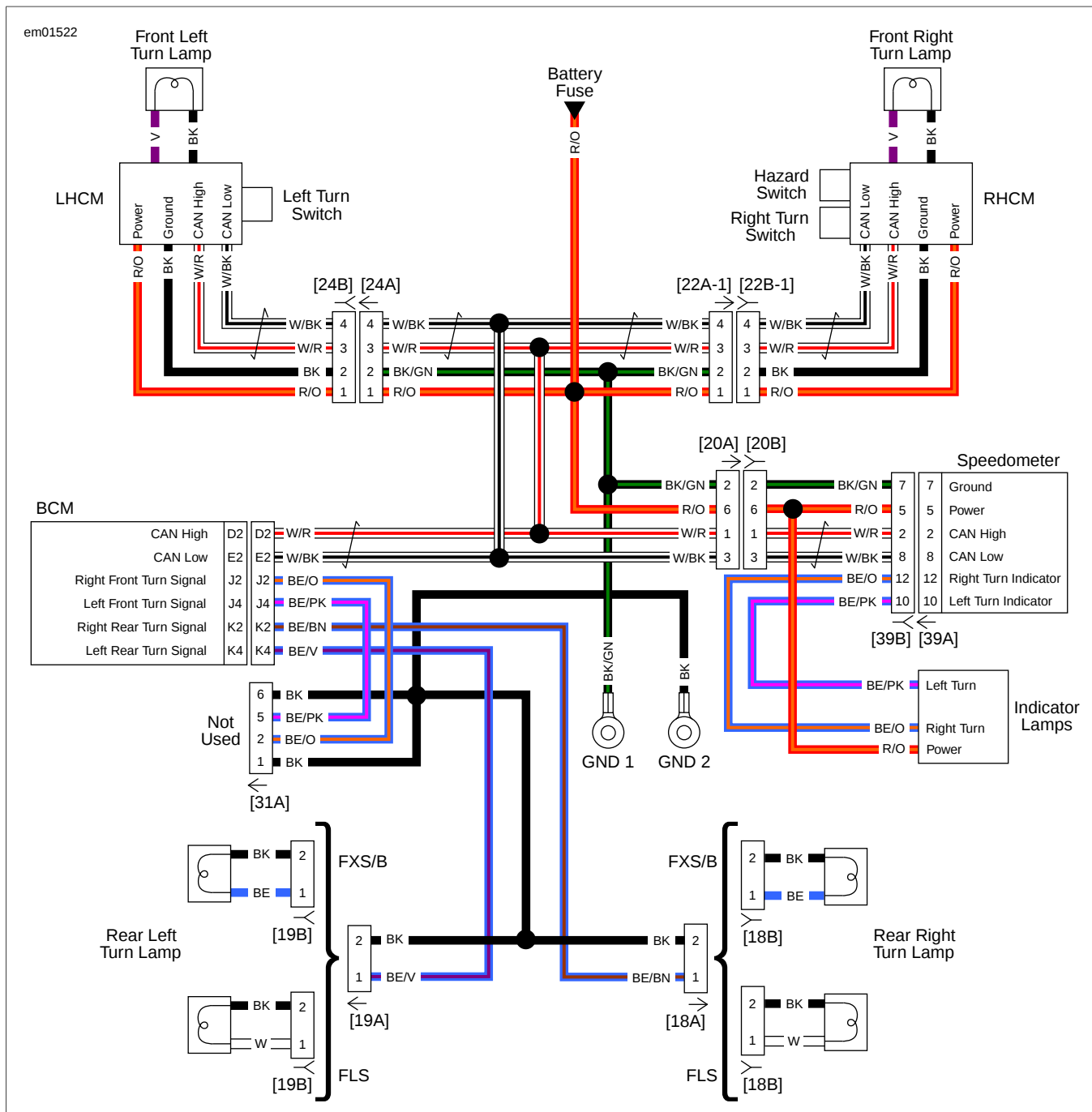


Figure 5-18. Turn Signal Circuit: FXS/B and FLS

DTC B2141

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-12. DTC B2141 Diagnostic Faults

POSSIBLE CAUSES
Open in left front turn signal ground circuit
Open in left front turn signal power circuit
Short to voltage in left front turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect left front turn signal bulb.
3. Is the bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between bulb socket ground and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal J4 and left front turn signal bulb socket terminal.
4. Is continuity present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in left front turn signal power circuit (BE/PK) or (V).

DTC B2143, B2144

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-13. DTC B2143, B2144 Diagnostic Faults

POSSIBLE CAUSES
Left front turn signal bulb current exceeds 3.0A
Accessory lighting overloading circuit
Short to ground in left front turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Inspect the left front turn signal bulb.
3. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with bulb out, test continuity between BOB terminal J4 and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground in left front turn signal power circuit (BE/PK) or (V) wire.
 - b. **No.** [Go to Test 3.](#)

3. DTC Test

1. Connect [242A].
2. Clear DTC.
3. Turn IGN ON.
4. Turn on left turn signal.
5. With bulb out, check DTCs.
6. Did the DTC B2143 or B2144 reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace turn signal bulb.

DTC B2146

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-14. DTC B2146 Diagnostic Faults

POSSIBLE CAUSES
Open in right front turn signal ground circuit
Open in right front turn signal power circuit
Short to voltage in right front turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect the right front turn signal bulb.
3. Is the bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between bulb socket ground and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal J2 and right front turn signal bulb socket terminal.
4. Is continuity present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in right front turn signal power circuit (BE/O) or (V).

DTC B2148, B2149

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-15. DTC B2148, B2149 Diagnostic Faults

POSSIBLE CAUSES
Right front turn signal bulb current exceeds 3.0A
Accessory lighting overloading circuit
Short to ground in right front turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Inspect right front turn signal bulb.
3. Is the bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with bulb out, test continuity between BOB terminal J2 and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground in right front turn signal power circuit (BE/O) or (V) wire.
 - b. **No.** [Go to Test 3.](#)

3. DTC Test

1. Connect [242A].
2. Clear DTC.
3. Turn IGN ON.
4. Turn on right turn signal.
5. With bulb removed, check DTCs.
6. Did DTC B2148 or B2149 reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace turn signal bulb.

DTC B2151, B2153, B2154, B2156, B2158, B2159

5.6

DESCRIPTION AND OPERATION

The rear turn signals are controlled by the BCM. The BCM supplies power to the rear turn signals and controls the flash rate of the turn signals through the power circuit.

Table 5-16. Code Description

DTC	DESCRIPTION
B2151	Left rear turn signal output open
B2153	Left rear turn signal output shorted low
B2154	Left rear turn signal output overloaded
B2156	Right rear turn signal output open
B2158	Right rear turn signal output shorted low
B2159	Right rear turn signal output overloaded

Conditions for Setting

After clearing the DTCs, operate the inoperative turn signal to verify if the DTC has returned.

DTC B2151 or B2156 will set if the corresponding rear turn signal circuit draws less than 120 milliamps. DTC B2154 or B2159 will set if the corresponding rear turn signal circuit draws more than 3 Amps.

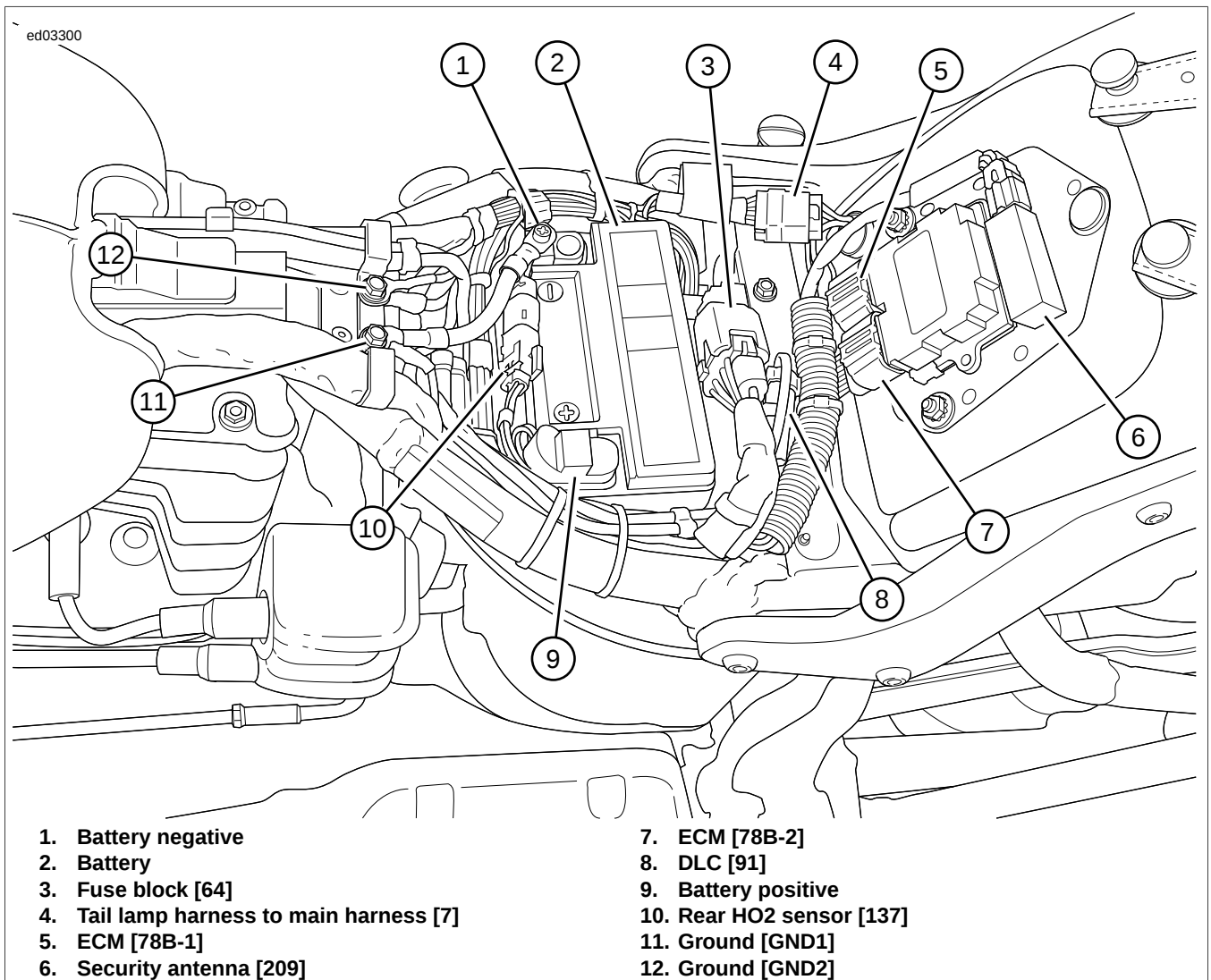


Figure 5-19. Under Seat: Except FXS/B and FLS

ed03468

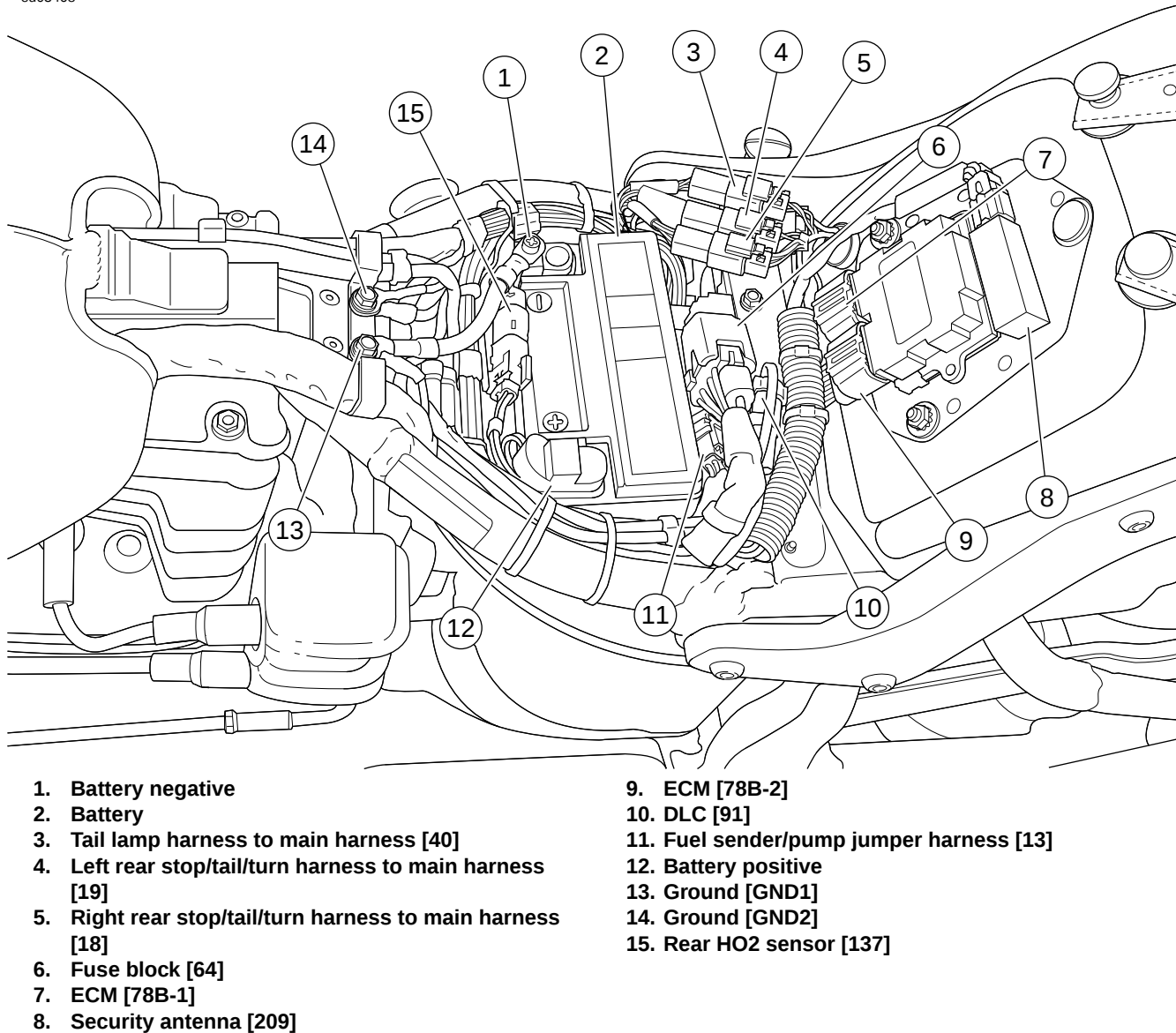


Figure 5-20. Under Seat: FXS and FLS

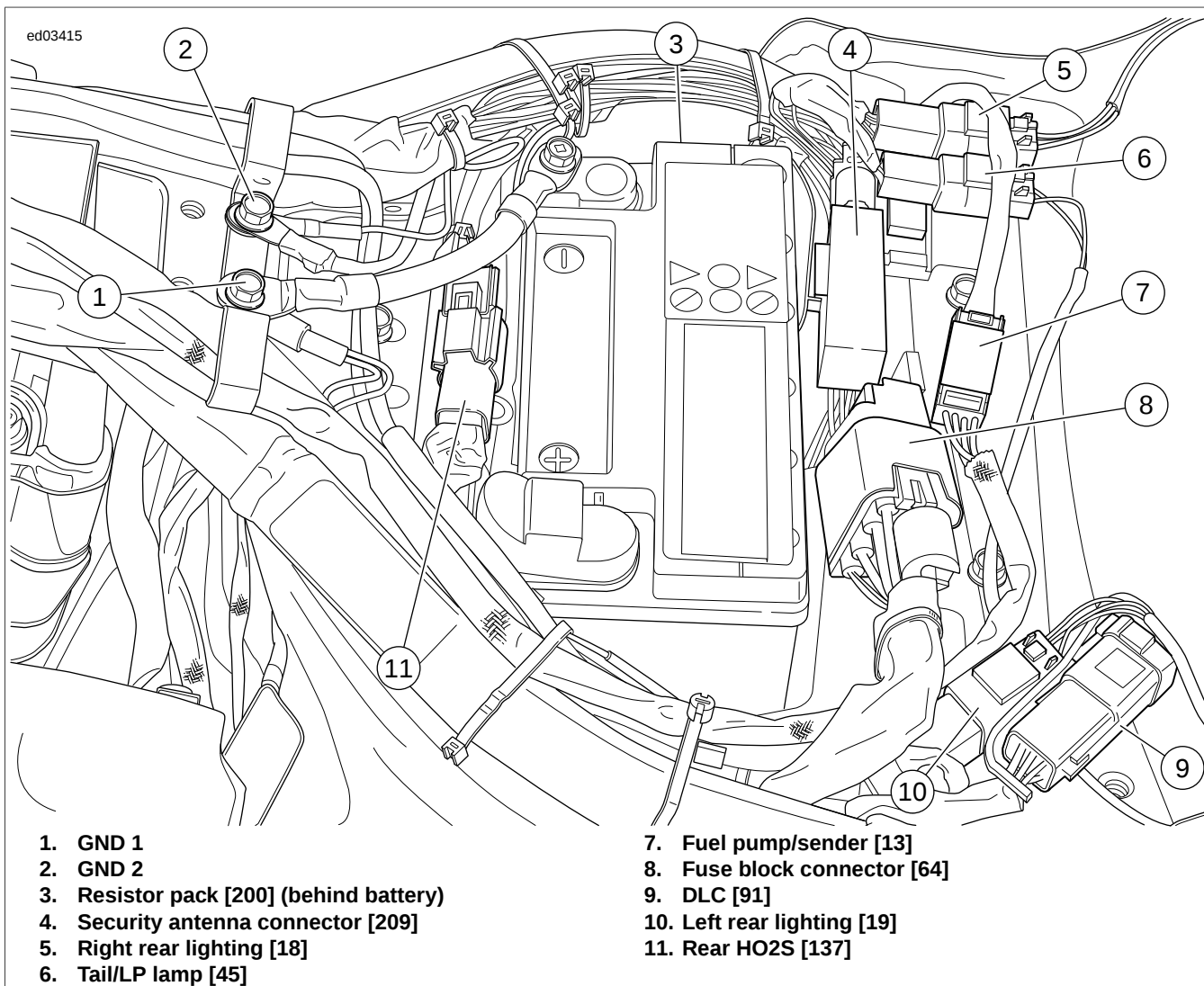


Figure 5-21. Under Seat: FXSB

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](#).

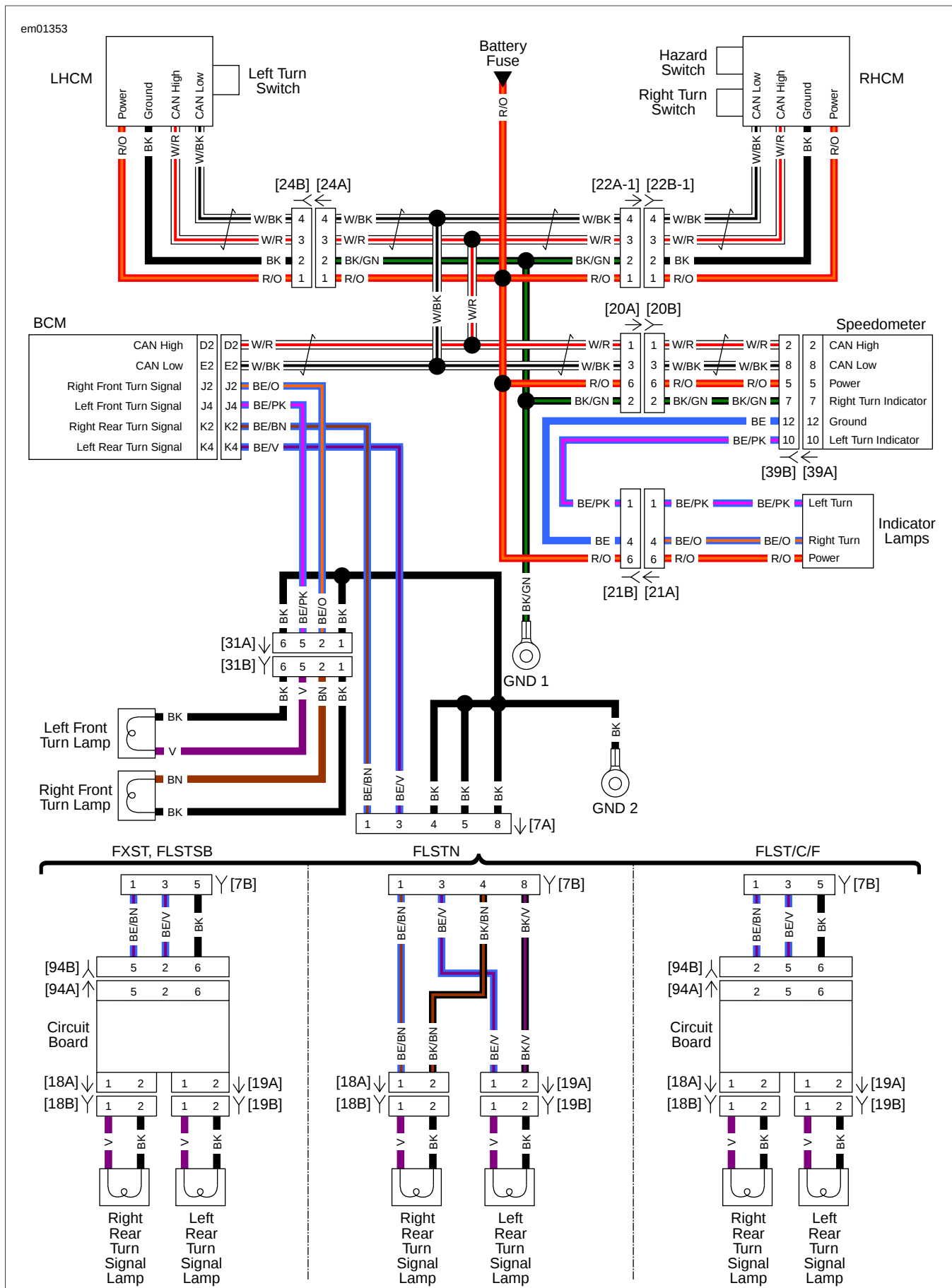


Figure 5-22. Turn Signal Circuit: Except FXS/B and FLS

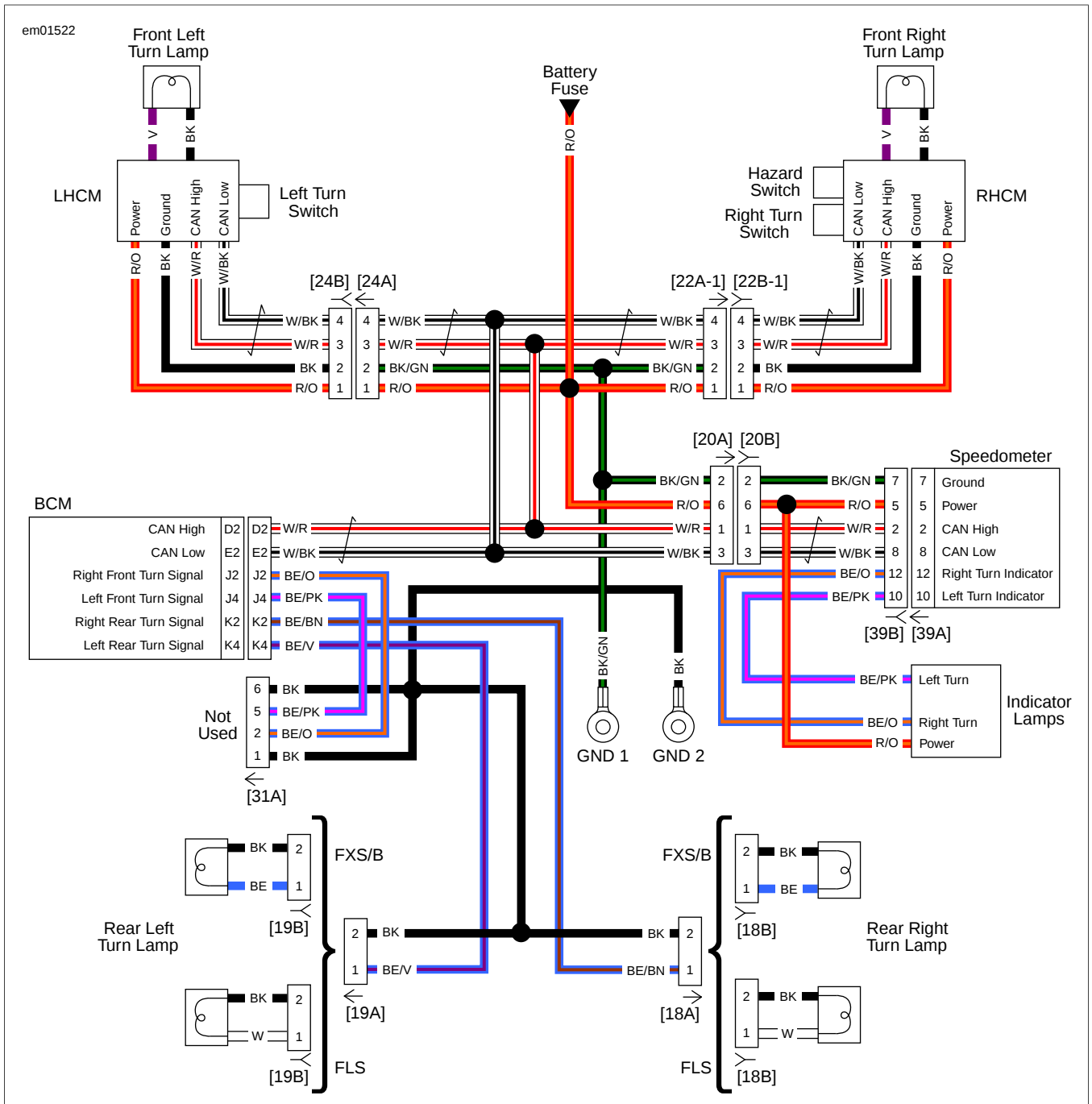


Figure 5-23. Turn Signal Circuit: FXS/B and FLS

DTC B2151

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-17. DTC B2151 Diagnostic Faults

POSSIBLE CAUSES
Open in left rear turn signal ground circuit
Open in left rear turn signal power circuit
Short to voltage in left rear turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Remove left rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between bulb socket ground and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K4 and left rear turn signal bulb power circuit socket terminal.
5. Is continuity present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in left rear turn signal power circuit (BE/V).

DTC B2153, B2154

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-18. DTC B2153, B2154 Diagnostic Faults

POSSIBLE CAUSES
Left rear turn signal bulb current too high
Accessory lighting overloading circuit
Short to ground in left rear turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Remove left rear turn signal bulb.
3. Clear DTCs.
4. Activate left turn signal.
5. Did DTC return?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K4 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground in left rear turn signal power circuit (BE/V) wire.
 - b. **No.** Replace BCM.

DTC B2156

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-19. DTC B2156 Diagnostic Faults

POSSIBLE CAUSES
Open in right rear turn signal ground circuit
Open in right rear turn signal power circuit
Short to voltage in right rear turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Remove right rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between bulb socket ground and ground.
3. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K2 and right rear turn signal bulb power circuit socket terminal.

4. Is continuity present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in right rear turn signal power circuit (BE/BN).

DTC B2158, B2159

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-20. DTC B2158, B2159 Diagnostic Faults

POSSIBLE CAUSES
Right rear turn signal bulb current too high
Accessory lighting overloading circuit
Short to ground in right rear turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Remove right rear turn signal bulb.
3. Clear DTCs.
4. Activate right turn signal.
5. Did DTC return?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity between BOB terminal K2 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground in right rear turn signal power circuit (BE/BN) wire.
 - b. **No.** Replace BCM.

HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139

DESCRIPTION AND OPERATION

The headlamp switch activates either the high beam or the low beam headlamps. When the ignition is turned ON, the BCM defaults to the low beam position. Pressing the upper part of the switch toggles to the high beam headlamp and the lower part of the switch toggles to the low beam headlamp.

- In the low position, the BCM supplies power to illuminate the low beam headlamp.
- Push the low position again, the BCM supplies power to the high beam headlamp to provide a flash to pass feature.
- In the high position, BCM supplies power to the high beam headlamp and sends a message to the speedometer over the CAN bus to illuminate the high beam indicator.

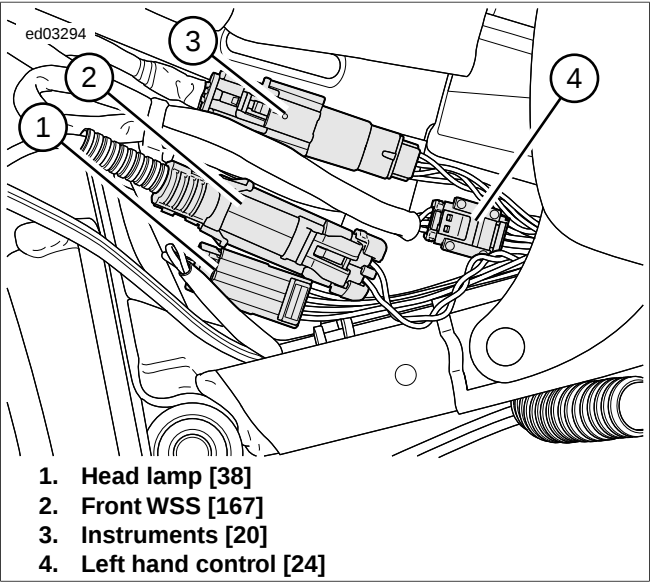


Figure 5-24. Under Fuel Tank Left Side

Table 5-21. Code Description

DTC	DESCRIPTION
B2131	High beam output open
B2132	High beam output shorted high
B2133	High beam output shorted low
B2134	High beam output overloaded
B2136	Low beam output open
B2137	Low beam output shorted high
B2138	Low beam output shorted low
B2139	Low beam output overloaded

Conditions for Setting

The headlamp DTCs may require either the high or low beam headlamp be requested on in order to set the DTC. Toggle back and forth between the high and low beam headlamp positions to check DTCs on both circuits.

The auxiliary lamps (if equipped) should be turned off when checking the low beam headlamp circuit. If not, an open DTC may not show up due to the auxiliary lamps still providing a load on the circuit.

- DTC B2131 or B2136 will set if the corresponding headlamp circuit draws less than 1.2 Amps.
- DTC B2134 or B2139 will set if the corresponding headlamp circuit draws more than 12 Amps.

Diagnostic Tips

If the vehicle is equipped with auxiliary lamps, an open to the low beam headlamp will not set a code unless the auxiliary lamps are turned off. If the headlamp cannot be switched from one position to the other with no codes it could be an open switch causing the problem. See [5.9 DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270](#).

Turn IGN to ACC. If low beam illuminates, this circuit is shorted to voltage. If the high beam illuminates, this circuit is shorted to voltage.

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](#).

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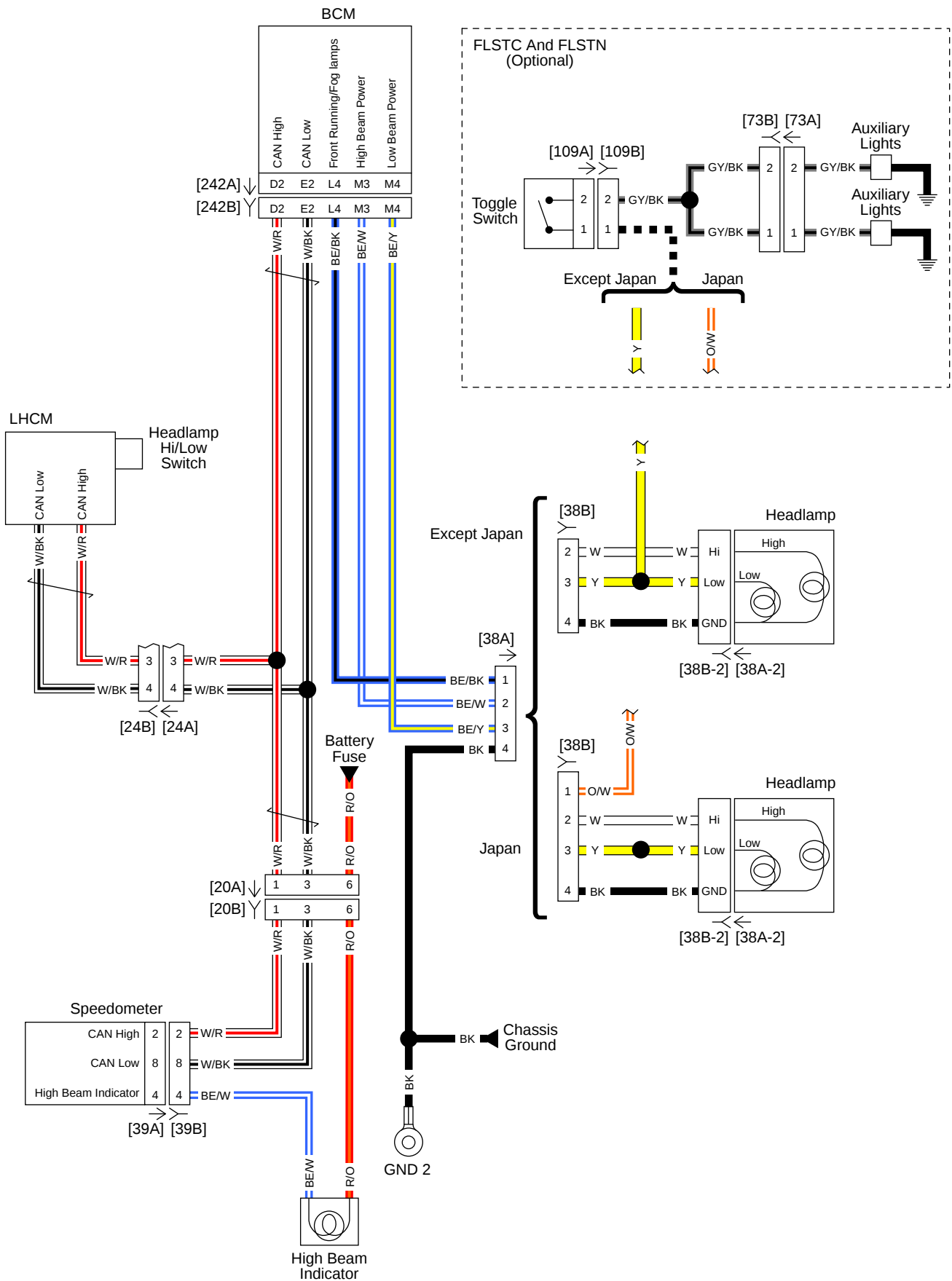


Figure 5-25. Headlamp and Auxiliary Lamps

AUXILIARY LAMPS INOPERATIVE: EXCEPT JAPAN

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-22. Auxiliary Lamps Inoperative Diagnostic Faults

POSSIBLE CAUSES
Auxiliary lamp malfunction
Toggle switch malfunction
Open in auxiliary power circuit
Open in auxiliary ground circuit

1. Auxiliary Lamps Operation Test

- With IGN ON, place headlamp switch in the low position.
- Turn on auxiliary lamps.
- Do auxiliary lamps illuminate?
 - Yes.** System operating properly. Intermittent perform wiggle test. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).
 - No. Auxiliary lamps and headlamps inoperative.** DTC will be present. Refer to [Table 2-1](#).
 - No. Only one auxiliary lamp is operative.** [Go to Test 2](#).
 - No. Both auxiliary lamps are inoperative.** [Go to Test 4](#).

2. Auxiliary Bulb Test

- Inspect bulb.
- Is bulb good?
 - Yes.** [Go to Test 3](#).
 - No.** Replace bulb. **(5227)**

3. Auxiliary Lamp Circuit Test

- Turn IGN OFF.
- Disconnect auxiliary lamps [73].
- Turn IGN ON.
- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between inoperative circuit at [73B] terminal 1 or 2 and ground.
- Is battery voltage present?
 - Yes.** Replace inoperative auxiliary lamp. **(5227)**
 - No.** Repair open in the (GY/BK) wire between the toggle switch and [73]. **(5041)**

4. Auxiliary Lamp Switch Test

- Turn IGN OFF.
- Disconnect auxiliary lamp switch [109].
- Turn IGN ON.

- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [109B] terminals 1 and 2 together.
- Do auxiliary lamps illuminate?
 - Yes.** Replace auxiliary lamp toggle switch. **(5167)**
 - No.** [Go to Test 5](#).

5. Auxiliary Lamp Power Circuit Test

- Test voltage between [109B] terminal 1 (Y) wire to ground.
- Is battery voltage present?
 - Yes.** Repair open in (GY/BK) wire between [109B] and [73B]. **(5041)**
 - No.** Repair open in (Y) wire between [109B] and headlamp switch. **(5041)**

AUXILIARY LAMPS INOPERATIVE: JAPAN

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-23. Auxiliary Lamps Inoperative Diagnostic Faults: Japan

POSSIBLE CAUSES
Auxiliary lamp malfunction
Toggle switch malfunction
Open in auxiliary power circuit
Open in auxiliary ground circuit

1. Auxiliary Lamps Operation Test

- Turn IGN ON.
- Turn on auxiliary lamps.
- Do auxiliary lamps illuminate?
 - Yes.** System operating properly. Intermittent perform wiggle test. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).
 - No. Auxiliary lamps inoperative.** DTC will be present. Refer to [Table 2-1](#).
 - No. Only one auxiliary lamp is operative.** [Go to Test 2](#).
 - No. Both auxiliary lamps are inoperative.** [Go to Test 4](#).

2. Auxiliary Bulb Test

- Inspect bulb.
- Is bulb good?
 - Yes.** [Go to Test 3](#).
 - No.** Replace bulb. **(5227)**

3. Auxiliary Lamp Circuit Test

- Turn IGN OFF.
- Disconnect auxiliary lamps [73].

3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between inoperative circuit at [73B] terminal 1 or 2 and ground.
5. Is battery voltage present?
 - a. **Yes.** Replace inoperative auxiliary lamp. **(5227)**
 - b. **No.** Repair open in the (GY/BK) wire between the toggle switch and [73]. **(5041)**

4. Auxiliary Lamp Switch Test

1. Turn IGN OFF.
2. Disconnect auxiliary lamp switch [109].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [109B] terminals 1 and 2 together.
5. Do auxiliary lamps illuminate?
 - a. **Yes.** Replace auxiliary lamp toggle switch. **(5167)**
 - b. **No.** [Go to Test 5.](#)

5. Auxiliary Lamp Power Circuit Test

1. With IGN ON, test voltage between [109B] terminal 1 (O/W) wire to ground.
2. Is battery voltage present?
 - a. **Yes.** Repair open in (GY/BK) wire between [109B] and [73B]. **(5041)**
 - b. **No.** Repair open in (O/W) wire between [109B] terminal 1 and BCM [242B] terminal L4 (BE/BK) wire. **(5041)**

DTC B2131

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-24. DTC B2131 Diagnostic Faults

POSSIBLE CAUSES
Open in high beam ground circuit
Open in high beam power circuit
Headlamp malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect headlamp.
3. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace headlamp.

2. Headlamp Test

1. Turn IGN ON.
2. Observe headlamp in high and low beam positions.
3. Is headlamp only inoperative in high beam position?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** [Go to Test 3.](#)

3. Ground Circuit Open Test

1. Disconnect headlamp [38-2].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [38B-2] terminal GND and ground.
3. Is continuity present?
 - a. **Yes.** Replace headlamp.
 - b. **No.** Repair open in (BK) ground wire.

4. Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Disconnect headlamp [38-2].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal M3 and [38-2] high beam terminal (W) wire.
6. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (W) or (BE/W) wire between BCM and headlamp.

5. BCM Test

1. Connect [38-2].
2. With IGN ON, jumper BOB terminal M2 to M3.
3. Does high beam headlamp illuminate?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace headlamp.

DTC B2132

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-25. DTC B2132 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in headlamp high beam circuit

1. Headlamp Test

1. Turn IGN OFF.
2. Using 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal M3 from [242B].
3. Connect [242].
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between extracted terminal M3 and ground.
6. Is voltage present?
 - a. **Yes.** Repair short to voltage in (BE/W) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Install terminal M3 from [242B]
2. Connect [242].
3. Clear DTCs.
4. Turn IGN ON.
5. Observe headlamp in high and low beam positions.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Condition is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)

DTC B2133, B2134

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-26. DTC B2133, B2134 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in high beam headlamp circuit
Accessory lighting overloading circuit
Headlamp malfunction

1. High Beam Headlamp Circuit Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS.](#)
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal M3 and ground.
6. Is continuity present?
 - a. **Yes.** Repair short to ground in (W) or (BE/W) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace headlamp.

DTC B2136

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-27. DTC B2136 Diagnostic Faults

POSSIBLE CAUSES
Open in low beam ground circuit
Open in low beam power circuit
Headlamp malfunction

1. Headlamp Test

1. Observe headlamp in high and low beam positions.
2. Is headlamp only inoperative in low beam position?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 2.](#)

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [38B-2] terminal GND and ground.
4. Is continuity present?
 - a. **Yes.** Replace headlamp.
 - b. **No.** Repair open in (BK) ground wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Disconnect the headlamp [38-2].
4. Test continuity between BOB terminal M4 and [38-2] low beam terminal (Y) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (Y) or (BE/Y) wire between BCM and headlamp.

4. BCM Test

1. Connect headlamp [38-2].
2. Turn IGN ON.
3. Jumper breakout box terminal M2 to M4.

4. Does low beam headlamp illuminate?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace headlamp.

DTC B2137

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-28. DTC B2137 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in headlamp low beam circuit

1. Headlamp Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Using the 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal (M4) from [242B].
4. Connect BCM [242].
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between removed terminal (M4) and ground.
7. Is voltage present?
 - a. **Yes.** Repair short to voltage in (BE/Y) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Install terminal M4 from [242B].
2. Connect [242].
3. Clear DTCs.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Condition is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC B2138, B2139

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-29. DTC B2138, B2139 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in low beam headlamp circuit
Accessory lighting overloading circuit
Headlamp malfunction

1. Low Beam Headlamp Circuit Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness

[242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).

4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal (M4) and ground.
6. Is continuity present?
 - a. **Yes.** Repair short to ground in (Y) or (BE/Y) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace headlamp.

STOP LAMPS: DTC B2161, B2163, B2164, B2223

5.8

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

See [Figure 5-26](#). The BCM controls the stop lamp based off inputs from the front and rear stop lamp switches. The front stop lamp switch is a mechanical switch. When the front brake lever is applied, the lever presses a mechanical switch and closes the contacts on the switch. The front stop lamp switch is part of the RHCM. When the switch is pressed, the RHCM sends a message to the BCM over the CAN bus and the BCM supplies power to the stop lamp.

The rear stop lamp switch is a pressure switch. When the rear brake is applied, it generates pressure in the brake fluid. This pressure in the fluid closes the contacts for the rear stop lamp switch. The BCM supplies power to the rear stop lamp switch. When the rear stop lamp switch is closed, it grounds the circuit from the BCM. This signals the BCM to supply power to the stop lamp.

Some models have no center brake lamp. Instead the turn signals are used for stop, turn and tail lamp functions. If DTCs B2161, B2163, B2164 set on a model with no center brake lamp, it means the vehicle is improperly configured. Use DIGITAL TECHNICIAN II (Part No. HD-48650) to configure properly.

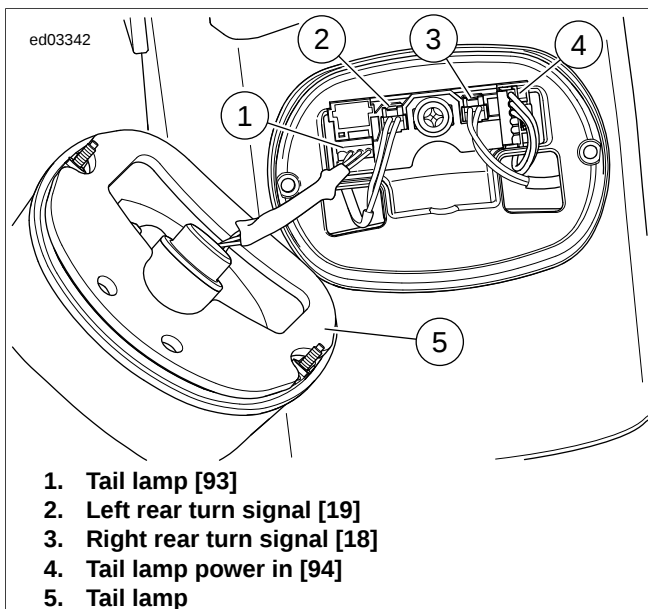


Figure 5-26. Tail Lamp: With Circuit Board: Typical

Table 5-30. Code Description

DTC	DESCRIPTION
B2161	Brake lamp output open
B2163	Brake lamp output shorted low
B2164	Brake lamp output overloaded
B2223	Rear brake switch shorted low

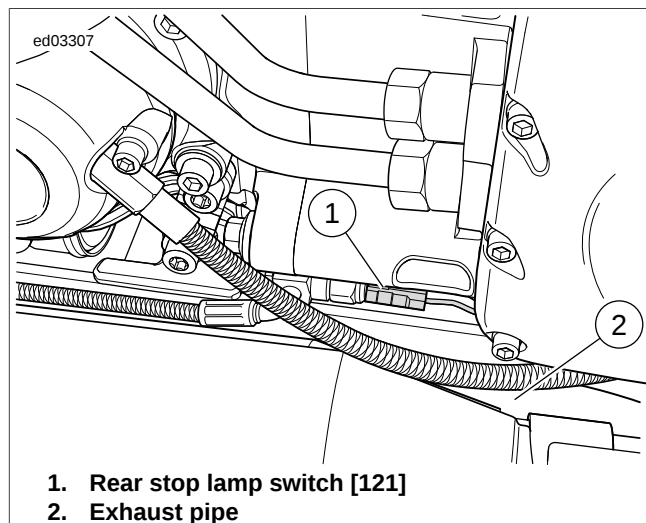


Figure 5-27. Rear Stop Lamp Switch [121]

Conditions for Setting

The brake lamp circuit needs to see activation to set DTCs. Apply the front and rear brakes to verify brake lamp DTCs do not return.

- DTC B2161 is set when the stop lamp circuit current draw is less than 120 milliamps.
- DTC B2164 is set when the stop lamp circuit current draw is above 4 Amps.
- DTC B2223 is set when the brake switch input circuit is grounded for 120 seconds and the vehicle speed is above 45 mph (72 km/h).

The brake switch is normally open and supplies a path to ground when closed. In order to set a shorted brake switch code, the vehicle needs to be operated over 30 mph (48 km/h) for at least two minutes. DTC B2161 will only set when all loads on the circuit are inoperable.

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](#).

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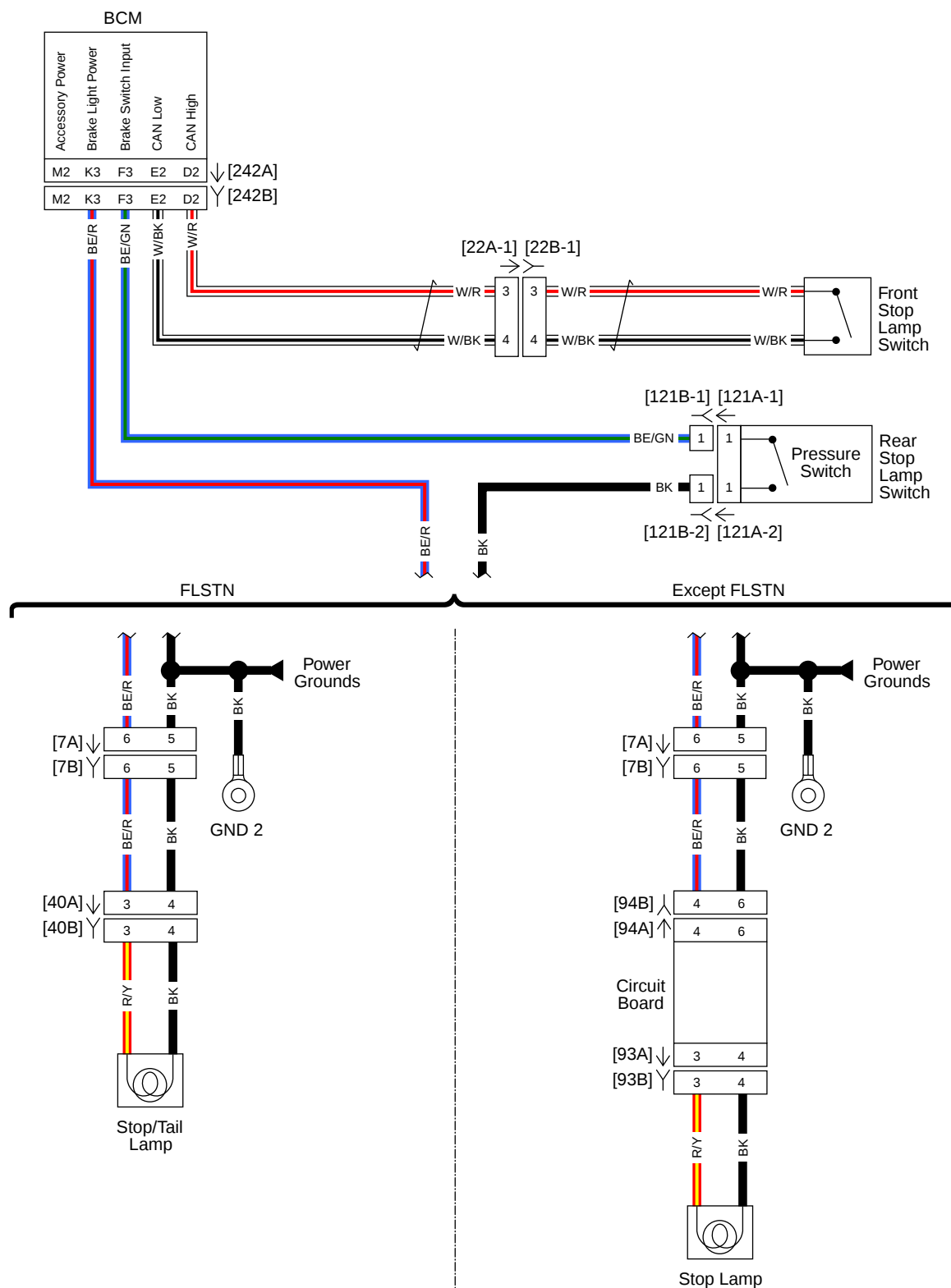


Figure 5-28. Stop/Tail Lamps: Except FXS/B and FLS

em00919

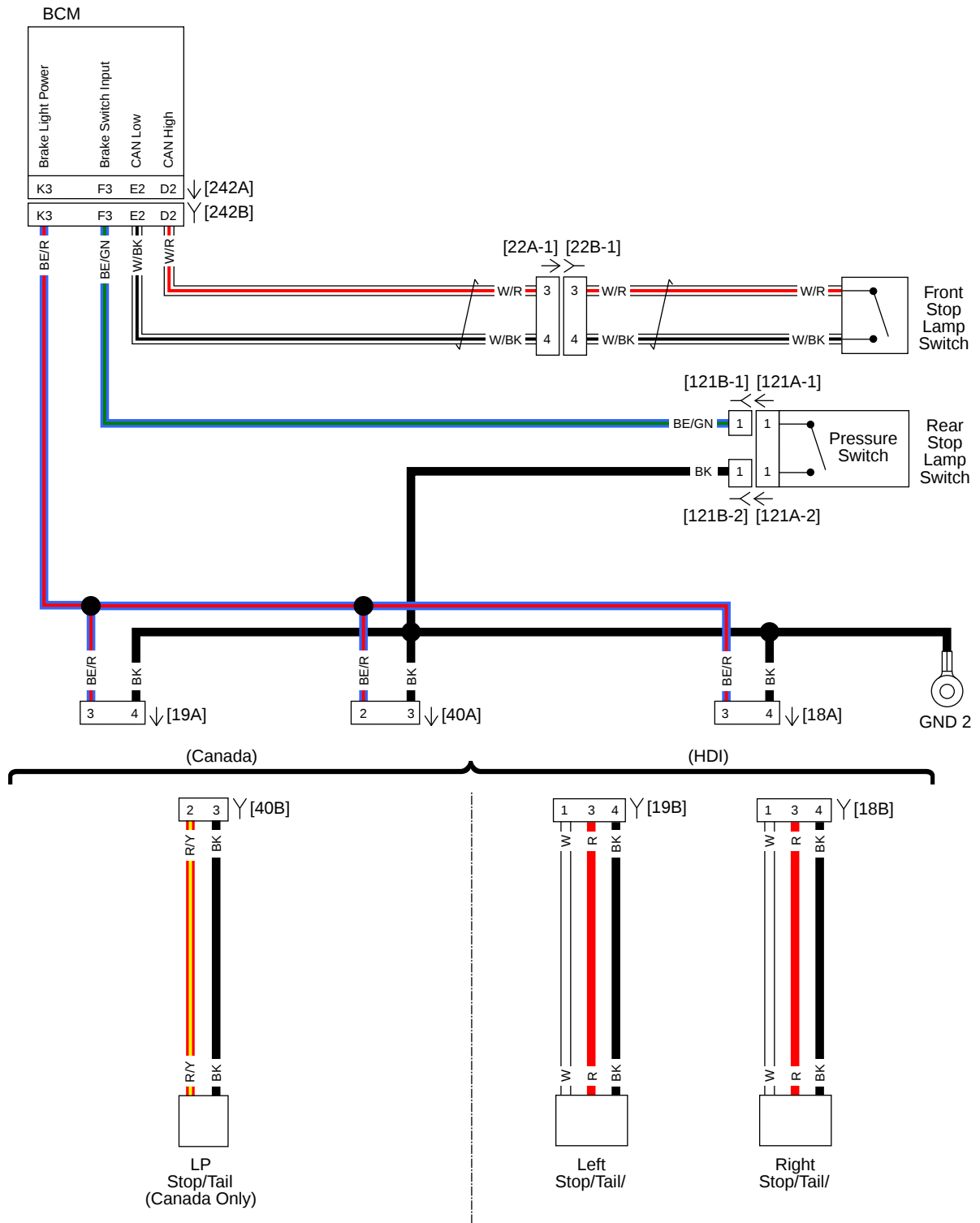


Figure 5-29. Stop/Tail Lamps: FXS/B and FLS

STOP LAMP ALWAYS ON, DTC B2223

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL

Table 5-31. Stop Lamp Always On, DTC B2223 Diagnostic Faults

POSSIBLE CAUSES
Brake switch malfunction
Short to voltage on brake lamp output circuit

1. Brake Switch Test

1. Turn IGN OFF.
2. Disconnect rear brake switch [121-1] (BE/GN) wire.
3. Turn IGN ON.
4. Does stop lamp go out?
 - a. **Yes.** Replace rear brake switch.
 - b. **No.** [Go to Test 2.](#)

2. Brake Switch Input Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal F3 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground between [242B] and [121B-1] (BE/GN) wire.
 - b. **No.** [Go to Test 3.](#)

3. Brake Light Power Test

1. Using 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423), remove terminal K3 from [242B] (BE/R) wire.
2. Connect [242A].
3. Turn IGN ON.
4. Is brake lamp on?
 - a. **Yes.** Repair short to voltage on brake lamp power circuit. **(5041)**
 - b. **No.** [Go to Test 4.](#)

4. DTC Test

1. Remove BOB.
2. Insert terminal K3 into [242B] (BE/R) wire.
3. Connect [242].
4. Clear DTCs.
5. Operate system in the conditions for setting the DTCs.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)

DTC B2161

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-32. DTC B2161 Diagnostic Faults

POSSIBLE CAUSES
Open in brake lamp ground circuit
Open in brake lamp power circuit
Bulb malfunction

1. Stop Lamp Test

1. Turn IGN OFF.
2. Inspect the stop lamp bulb.
3. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between stop lamp socket ground and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) ground circuit.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Install stop lamp bulb.

4. Jumper BOB terminals (M2) and (K3).
5. Turn IGN ON.
6. Does stop lamp illuminate?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in stop lamp power circuit.

DTC B2163, B2164

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-33. DTC B2163, B2164 Diagnostic Faults

POSSIBLE CAUSES
Accessory tail lamp overloading circuit
Short to ground in stop lamp power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect bulb.
3. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb.

2. Stop Lamp Power Circuit Short to Ground Test

1. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal (K3) and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground in stop lamp power circuit.
 - b. **No.** Replace BCM.

DTC B2223

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-34. DTC B2223 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in stop lamp switch power circuit (stop lamp always illuminated)
Brake switch malfunction

1. Stop Lamp Switch Test

1. Turn IGN ON.
2. Disconnect rear stop lamp switch.
3. Does the stop lamp go out?
 - a. **Yes.** Replace the rear brake switch.
 - b. **No.** [Go to Test 2.](#)

2. Brake Switch Short to Ground Test

1. Disconnect rear stop lamp switch [121-1].
2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on breakout box.
4. Test for continuity to ground between breakout box terminal (F3) and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on brake switch power circuit.
 - b. **No.** [Go to Test 3.](#)

3. DTC Test

1. Connect [242].
2. Clear the DTCs. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).
3. Operate the system in the conditions for setting the DTCs.
4. Check DTCs. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).
5. Did the DTC reset?
 - a. **Yes.** Replace the BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC B1103, B1153, B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263, B2270

5.9

DESCRIPTION AND OPERATION

All of these DTCs pertain to stuck switches or an internal fault in the LHCM, RHCM or BCM. If the switches are open they will not set DTCs. In most cases, there will be symptoms depending on which switch is malfunctioning.

Table 5-35. Switch Symptoms

OPEN SWITCH	SYMPTOM
High beam	Headlamp will not toggle to high beam
Low beam	Headlamp will not toggle to low beam
Left turn signal	Left turn signals will not function/PIN cannot be entered
Right turn signal	Right turn signals will not function/PIN cannot be entered
Trip	Odometer will not cycle through different settings
Front brake	Brake lamp will not function with brake lever pulled in
Clutch	Vehicle will not start unless in neutral
Horn	Horn will not sound
Hazard	Hazard lamps will not function
Start switch	Vehicle will not start (nothing clicks)
Engine stop switch	Vehicle will not start (nothing clicks)

Table 5-36. Code Description

DTC	DESCRIPTION
B1103	LHCM internal fault
B1153	RHCM internal fault
B2210	Engine stop switch inputs both open
B2212	Engine stop switch inputs both closed
B2250	Clutch switch stuck
B2251	Horn switch stuck
B2252	High beam switch stuck
B2253	Low beam switch stuck
B2254	Left turn switch stuck
B2260	Start switch stuck
B2261	Right turn switch stuck
B2262	Front brake switch stuck
B2263	Hazard switch stuck
B2270	BCM internal fault

Conditions for Setting

If any of the switches are held or stuck for over two minutes with the IGN ON, the stuck switch code will set for that switch.

The engine stop is either in the run or the stop position. If the RHCM does not see either input or both inputs at the same time, DTC B2210 or B2212 will set.

For DTC B2262 and B2250 to be set, the vehicle has to be in operation for more than two minutes at speed above 30 mph (48 km/h). Historic codes may indicate the rider continually applies the brake to clutch. For example, coasting downhill with the clutch lever pulled in for more than two minutes will set codes.

Diagnostic Tips

Clear the DTCs and operate the vehicle to verify the DTCs are current. Stuck switch codes will take over two minutes to set.

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](#).

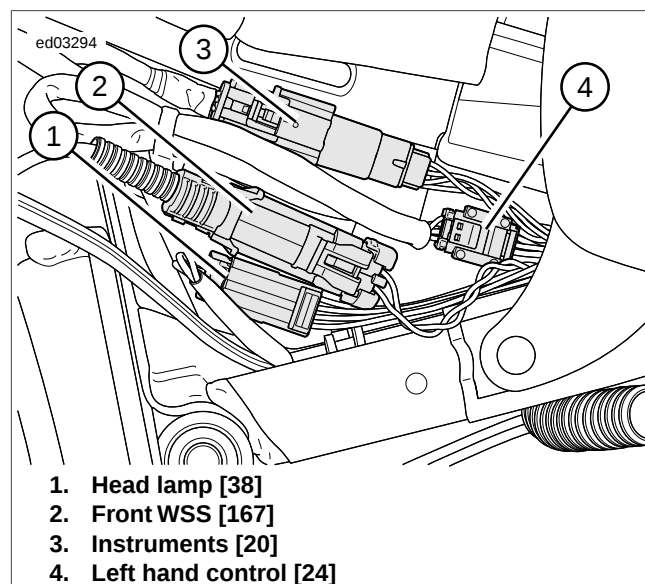


Figure 5-30. Under Fuel Tank Left Side

DTC B1103, B1153

Table 5-37. DTC B1103, B1153 Diagnostic Faults

POSSIBLE CAUSES
Open in hand control module ground circuit
Open in hand control module power circuit

1. Switch Test

1. Clear DTC.
2. Turn IGN ON and wait three minutes.
3. Check for DTCs.

4. Did DTC reset?
 - a. **Yes.** Replace LHCM or RHCM.
 - b. **No.** Condition not currently present.

DTC B2210, B2212, B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263

Table 5-38. DTC B2250, B2251, B2252, B2253, B2254, B2260, B2261, B2262, B2263 Diagnostic Faults

POSSIBLE CAUSES
Clutch switch malfunction
Front brake switch malfunction

1. Switch Test

1. Clear the DTC. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).
2. Turn IGN ON and wait three minutes.
3. Operate the vehicle to meet the conditions for setting the DTC.
4. Check for DTCs. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).
5. Did the DTC reset?
 - a. **Yes, except DTC B2250 or B2262.** Replace the LHCM or RHCM.
 - b. **Yes, DTC B2250 or B2262.** Replace the clutch or brake switch.
 - c. **Yes, DTC B2210 or B2212.** Replace the run/stop key cap.
 - d. **No.** Concern is intermittent. Switch may have been pressed for an extended period of time.

DTC B2270

Table 5-39. DTC B2270 Diagnostic Faults

POSSIBLE CAUSES
Open in BCM battery circuit
Open in BCM ground circuit

1. DTC Test

1. Clear DTC.
2. Turn IGN ON.
3. Check for DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Condition not currently present.

ANY HAND CONTROL SWITCH INOPERATIVE

Table 5-40. Any Hand Control Switch Inoperative Diagnostic Faults

POSSIBLE CAUSES
Clutch switch malfunction
Brake switch malfunction

1. Switch Operation Test

1. Operate the inoperative switch.
2. Does switch operate correctly?
 - a. **Yes.** Condition not currently present.
 - b. **No.** Replace LHCM or RHCM.

RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169

5.10

DESCRIPTION AND OPERATION

The running lamps consist of the front position lamp (HDI), located in the headlamp housing, the front running lamps, the license plate lamp and the tail lamp. The running lamps are powered by the BCM through terminal J3 and L4 (if equipped).

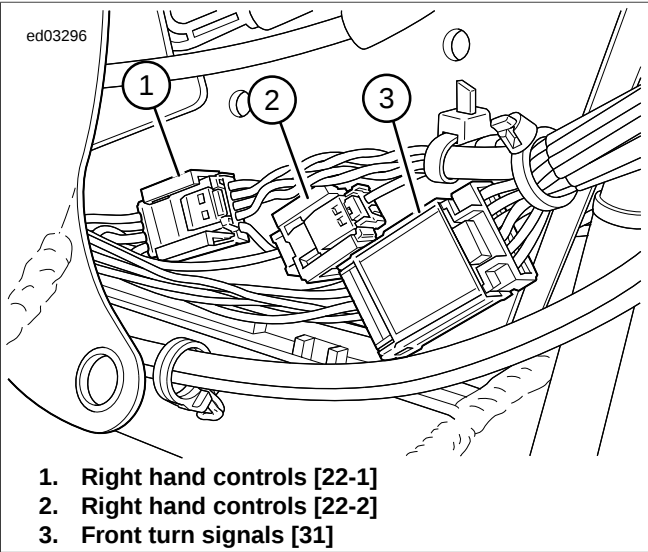


Figure 5-31. Under Fuel Tank Right Side

Table 5-41. Code Description

DTC	DESCRIPTION
B2107	Front position/running power output shorted high
B2108	Front position/running power output shorted low
B2109	Front position/running power output overloaded
B2166	Running lights output open
B2168	Running lights output shorted low
B2169	Running lights output overloaded

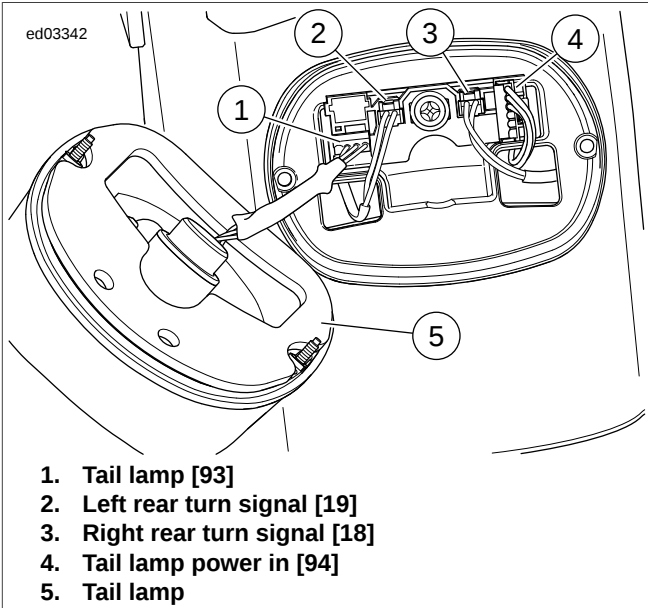


Figure 5-32. Tail Lamp: With Circuit Board: Typical

Conditions for Setting

The running lamps circuit powers up when the ignition is turned on. On HDI models, the running lamp circuit is also powered in the ACC position. Any running lamp related DTCs will set shortly after the ignition is turned on.

- DTC B2166 will only set if all lights are open on the circuit.
- DTC B2166 will set if the running lights circuit is below 120 milliamps.
- DTC B2169 will set if the running lights circuit is above 3 Amps.
- DTC B2109 will set if the switched power output circuit is above 10 Amps.

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](#).

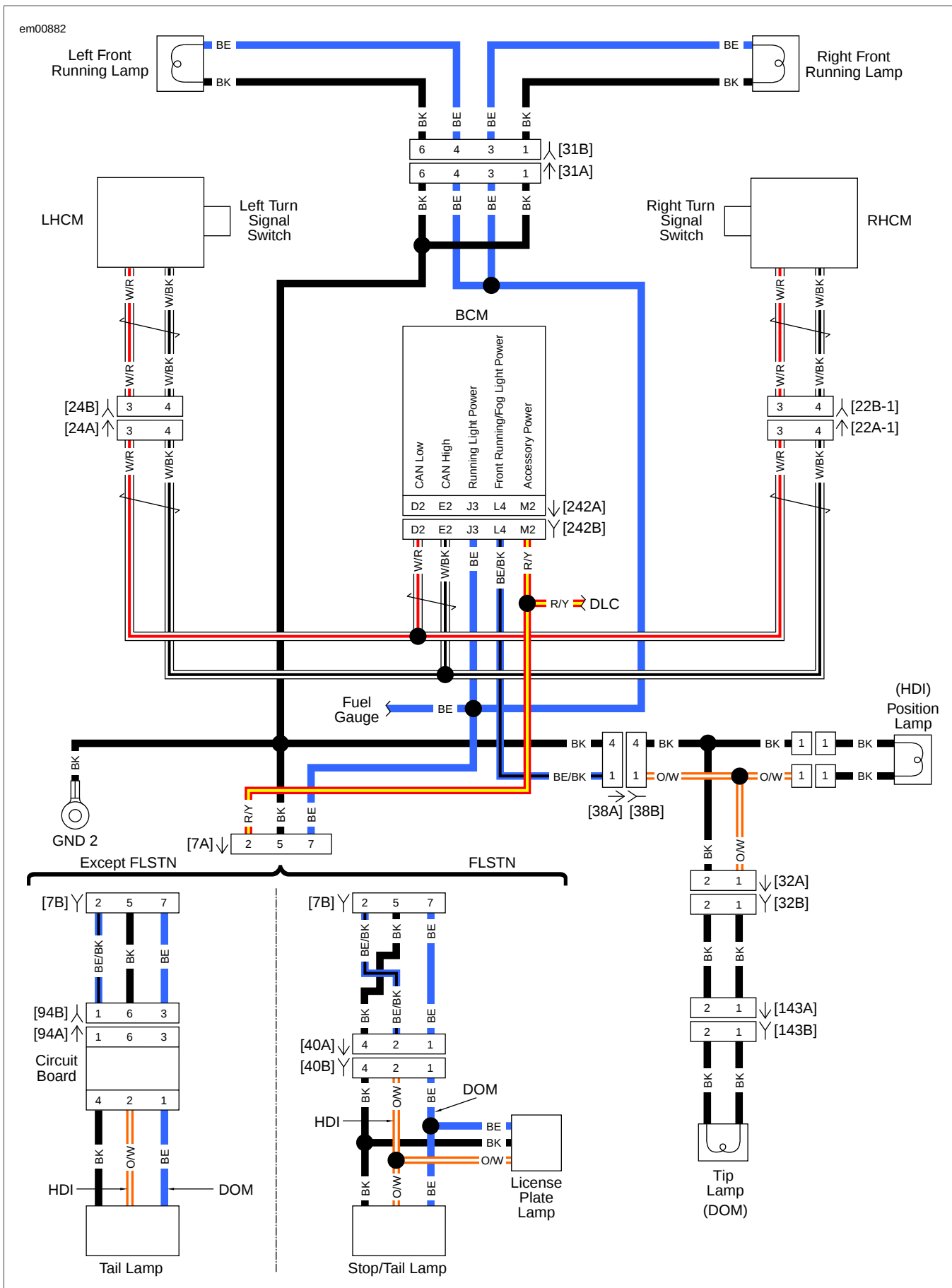


Figure 5-33. Running Lamps: Except FXS/B and FLS

em01523

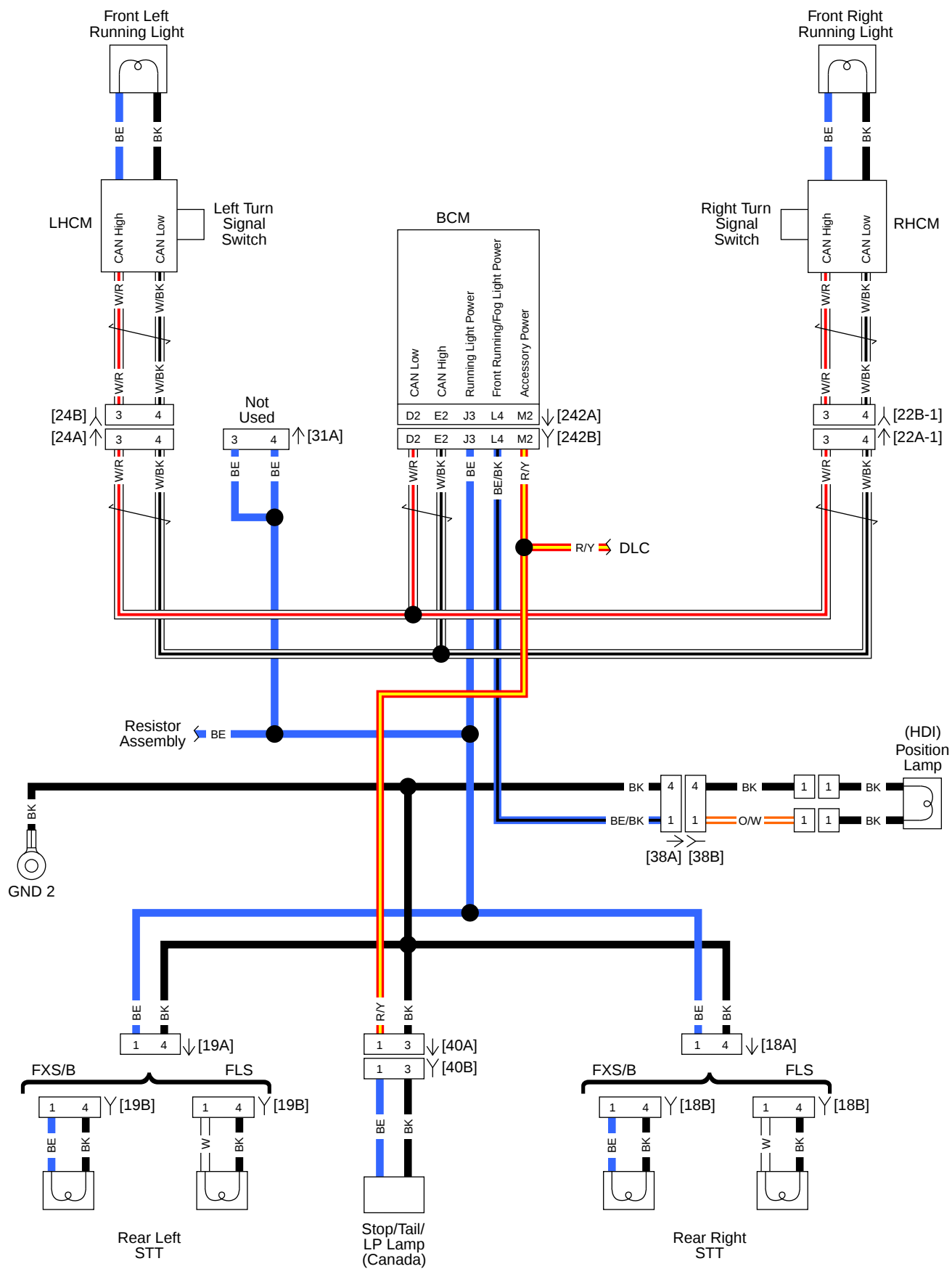


Figure 5-34. Running Lamps: FXS/B and FLS

FRONT RUNNING LAMPS INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-42. Front Running Lamps Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

NOTE

This test refers to domestic running lamps integrated with the front turn signals.

1. Domestic Running Lamp Configuration Test

1. Inspect front running lamps.
2. Are running lamps wired directly to the LHCM and RHCM?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 3.](#)

2. Bulb Test

1. Inspect inoperative bulb and socket.
2. Is bulb and socket good?
 - a. **Yes.** Replace LHCM or RHCM for the inoperative lamp. **(6165) or (6166)**
 - b. **No.** Replace bulb. **(6796)**

3. Running Lamp Test

1. Inspect inoperative bulb.
2. Is bulb good?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace bulb. **(6796)**

4. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between running lamp bulb socket ground and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in running lamp power circuit (BE) wire. **(5041)**
 - b. **No.** Repair open in (BK) ground circuit. **(5041)**

REAR RUNNING LAMPS INOPERATIVE: EXCEPT FXS/B AND FLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-43. Rear Running Lamps Inoperative Diagnostic Faults: Except FXS/B and FLS

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Running Lamps Configuration Test

1. Inspect rear running lamps.
2. Do rear turn signals also function as the brake lamps?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** [Go to Test 2.](#)

2. Bulb Test

1. Inspect inoperative bulb and socket.
2. Is bulb and socket good?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace bulb. **(6796)**

3. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between tail lamp bulb socket terminal ground and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in running lamp power circuit. **(5041)**
 - b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

4. Running Lamps Power Test

1. Disconnect rear lighting harness [7].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [7A] terminal 7 and ground.
4. Is voltage present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (BE) wire. **(5041)**

5. Rear Running Lamps Ground Circuit Test

1. Turn IGN OFF.
2. Test continuity between ground and [7A] terminal 4, terminal 5 and terminal 8.

3. Is continuity present on all three terminals?
 - a. **Yes.** Replace rear lighting harness. **(6823)**
 - b. **No.** Repair open in (BK) ground circuit. **(5041)**

REAR RUNNING LAMPS INOPERATIVE: FXS/B AND FLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

**Table 5-44. Rear Running Lamps Inoperative Diagnostic
Faults: FXS/B and FLS**

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Bulb Test

1. Inspect inoperative bulb.
2. Is bulb good?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace bulb. **(6796)**

2. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between tail lamp bulb socket terminal ground and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in running lamp power circuit. **(5041)**
 - b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

LICENSE PLATE LAMP INOPERATIVE: EXCEPT FXS/B AND FLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

**Table 5-45. License Plate Lamp Inoperative Diagnostic
Faults: Except FXS/B and FLS**

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Running Lamps Configuration Test

1. Inspect rear running lamps.

2. Do rear turn signals function as brake lamps?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** [Go to Test 2.](#)

2. Bulb Test

1. Inspect inoperative bulb.
2. Is bulb good?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace bulb. **(6796)**

3. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between tail lamp bulb socket terminal ground and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in running lamp power circuit. **(5041)**
 - b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

4. License Plate Lamps Power Test

1. Turn IGN OFF.
2. Disconnect rear lighting harness [7].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [7A] terminal 2 (R/Y) wire to ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (R/Y) wire. **(5041)**

5. License Plate Lamp Ground Circuit Test

1. Test for continuity between ground and [7A] terminal 5 (BK) wire.
2. Is continuity present?
 - a. **Yes.** Replace rear lighting harness. **(6823)**
 - b. **No.** Repair open in (BK) ground circuit. **(5041)**

LICENSE PLATE LAMP INOPERATIVE: FXS/B AND FLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-46. License Plate Lamp Inoperative Diagnostic Faults: FXS/B and FLS

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit
LED malfunction

1. Verify Test

1. Verify LP lamp is a LED.
2. Is LP lamp a LED?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** [Go to Test 2.](#)

2. Bulb Test

1. Inspect license plate lamp.
2. Is bulb good?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace bulb. **(6796)**

3. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between license plate lamp bulb socket terminal ground and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in running lamp power circuit. **(5041)**
 - b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

4. LED + [40] Test

1. Turn IGN OFF.
2. Disconnect rear lighting [40].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [40A] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (R/Y) wire. **(5041)**

5. LED - [40] Test

1. Turn IGN OFF.
2. Test continuity between [40A] terminal 3 and ground.

3. Is continuity present?
 - a. **Yes.** Replace LP LED light assembly.
 - b. **No.** Repair open in (BK) wire. **(5041)**

DTC B2107

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-47. DTC B2107 Diagnostic Faults

POSSIBLE CAUSES
Short to power in front position/running circuit

1. Position Lamp Circuit Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Using 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal L4 from [242B].
4. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Turn IGN ON.
7. Test voltage between extracted terminal L4 and ground.
8. Is voltage present?
 - a. **Yes.** Repair short to voltage in the front position/running circuit.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Connect [242].
2. Clear DTC.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is not currently present.

DTC B2108, B2109

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-48. DTC B2108, B2109 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in front position/running circuit
High current in front position/running circuit
Accessory lighting overloading circuit

1. Position Lamp Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Disconnect position lamp and fender tip lamp (if equipped).
4. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Test for continuity between BOB terminal L4 and ground.
7. Is continuity present?
 - a. **Yes.** Repair short to ground in (BE/BK) wire.
 - b. **No.** [Go to Test 2.](#)

2. Excessive Draw Test

1. Remove accessory lighting (if equipped). Unplug one lamp at a time on circuit and cycle IGN ON-OFF-ON.
2. Check DTCs after each lamp is removed.
3. Does code clear?
 - a. **Yes.** Replace lamp that was causing issue.
 - b. **No.** [Go to Test 3.](#)

3. DTC Test

1. Turn IGN OFF.
2. Connect [242].
3. Clear DTC.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Condition not currently present.

DTC B2166 (DOMESTIC ONLY)

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-49. DTC B2166 Diagnostic Faults (Domestic Only)

POSSIBLE CAUSES
Open in running lights ground circuit
Open in running lights power circuit
Incorrect configuration (HDI only)

1. Running Lamp Operation Test

1. Verify tail lamp/license plate lamp, fuel gauge and fork mounted front running lamps are operational.
2. Are all lights on?
 - a. **Yes.** Replace BCM.
 - b. **No, some of the lights are on.** [Go to Test 3.](#)
 - c. **No, all lights are inoperative: except FXS/B.** [Go to Test 4.](#)
 - d. **No, all lights are inoperative: FXS/B.** [Go to Test 5.](#)

2. Running Lamps Circuit Test

1. Turn IGN OFF.
2. Disconnect rear lighting harness [7].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [7A] terminal 7 and ground.
5. Is battery voltage present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in (BE) wire.

3. Bulb Test

1. Inspect inoperative bulb.
2. Is bulb good and the correct bulb?
 - a. **Yes.**
 - b. **No.** Replace bulb.

4. Running Lamp Open Circuit Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.

5. Test continuity between BOB terminal J3 and inoperative running lamp power circuit.
6. Is continuity present?
 - a. **Yes.** Replace bulb and socket.
 - b. **No.** Repair open in running lamp circuit between inoperative lamp and BCM.

5. Running Lamps Circuit Test

1. Turn IGN OFF.
2. Disconnect left rear stop/tail/turn harness [19].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [19A] terminal 1 and ground.
5. Is battery voltage present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in (BE) wire.

DTC B2168, B2169

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-50. DTC B2168, B2169 Diagnostic Faults

POSSIBLE CAUSES
Running lights circuit resistance too low
Short to ground in running lights power circuit
Accessory lighting overloading circuit

1. Rear Running Lamps Circuit Test

1. Turn IGN OFF.
2. Disconnect rear lighting [7].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair short to ground or high current draw in rear lighting harness in the running lamp power circuits.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Clear DTC.
4. Cycle IGN OFF-ON.

5. Did DTC return?
 - a. **Yes, the front running lamps are wired to hand control modules.** [Go to Test 4.](#)
 - b. **Yes, the front running lamps are not wired to hand control modules.** [Go to Test 3.](#)
 - c. **No.** Replace fuel gauge.

3. Front Running Lamp Circuit Test

1. Turn IGN OFF.
2. Disconnect front turn signal [31].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair short to ground in front running lamps harness.

4. BCM Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal J3 and ground.
6. Is continuity present?
 - a. **Yes.** Repair short to ground in (BE) wire.
 - b. **No.** Replace BCM.

DTC B2168, B2169: FXS/B AND FLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-51. DTC B2168, B2169 Diagnostic Faults: FXS/B and FLS

POSSIBLE CAUSES
Running lights circuit resistance too low
Short to ground in running lights power circuit
Accessory lighting overloading circuit

1. Right Rear Turn Lamp Circuit Test

1. Turn IGN OFF.

2. Disconnect right rear turn lamp [18].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair short to ground or high current draw in right rear turn signal harness in the running lamp power circuits.

2. Left Rear Turn Lamp Circuit Test

1. Turn IGN OFF.
2. Disconnect left rear turn lamp [19].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair short to ground or high current draw in left rear turn signal harness in the running lamp power circuits.

3. Tail Lamp Circuit Test

1. Turn IGN OFF.
2. Disconnect tail lamp [40].
3. Clear DTC.
4. Cycle IGN OFF-ON.

5. Did DTC return?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair short to ground or high current draw in tail lamp harness in the running lamp power circuits.

4. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect the resistor assembly [200].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace the resistor assembly.

5. BCM Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal J3 and ground.
6. Is continuity present?
 - a. **Yes.** Repair short to ground in (BE) wire.
 - b. **No.** Replace BCM.

SECURITY SYSTEM

5.11

SECURITY LAMP

See [Figure 5-35](#). The security lamp indicates system status. Refer to [Table 5-52](#).

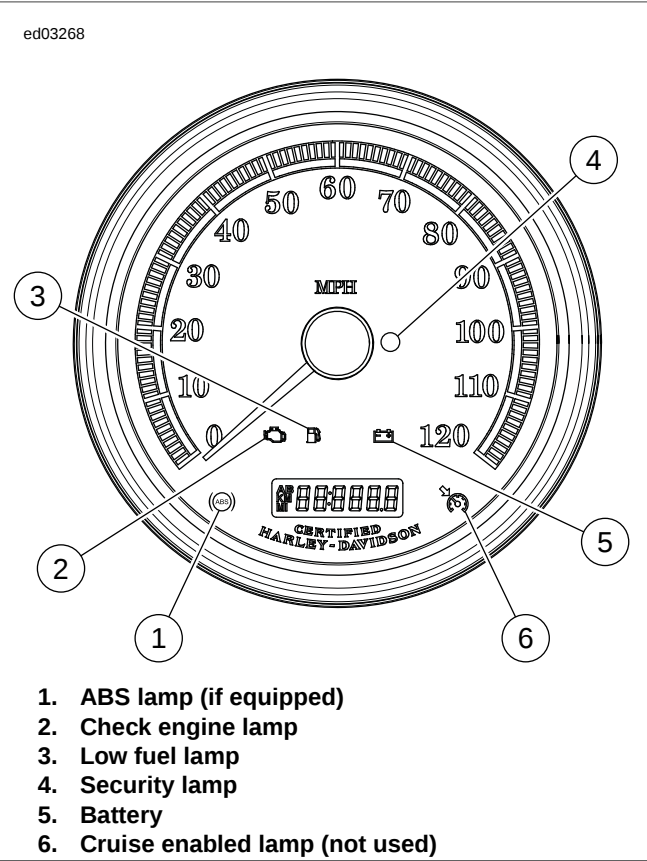


Figure 5-35. Indicator Lamps

Table 5-52. Security Lamp Status

LAMP	MODE
Does not flash.	Security system not armed.
Flashes every second.	Two minute 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 five seconds before system is armed.
Stays on solid with IGN ON.	If solid for more than four seconds after IGN ON, a current DTC is present.

SECURITY IMMOBILIZATION

If the vehicle is equipped with the security system, the functionality is provided by a security BCM. The BCM 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 [5.13 SIREN, Siren Chirp Mode Confirmation](#).

Conditions that trigger a security event 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. The system will remain armed and the vehicle will be immobilized.
- **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 vehicle by turning the IGN ON with the fob present before removing or disconnecting the battery. This prevents the siren (if installed) from activating.

SECURITY SYSTEM FEATURES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The following information applies only to vehicles equipped with the security.

- **Personal code disarming:** If the fob is not available or inoperative, the BCM allows the rider to disable the security alarm and immobilization functions with a five-digit personal code.
- **Arming confirmation:** When the security system 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.
- **Disarming confirmation:** When the security system 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 [5.13 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:** This mode allows the dealer to disable security system via DIGITAL TECHNICIAN II (Part No. HD-48650). Dealer service mode is exited when the IGN is turned ON with the assigned fob in range.

SECURITY SYSTEM 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 security system 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

The H-DSSS automatically arms within five seconds when the vehicle is parked and the ignition switch is turned to **OFF** or **ACC** and motion is not detected.

On arming, the turn signals flash twice and the smart siren will "chirp" twice if chirp function is activated. While armed, the security lamp will flash once every 2.5 seconds. Refer to [Table 5-52](#).

DISARMING

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 vehicle can be moved in an armed state with the fob present without triggering the alarm. 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 will turn ON solid for four seconds then go out. Refer to [Table 5-52](#).

Disarming with a PIN

See [5.14 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS](#) to enter an initial PIN to enable the system.

If you make an error while disarming the security system 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 two minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to [Table 5-53](#).

Table 5-53. Entering a PIN to Disarm Harley-Davidson Smart Security System

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	If necessary, verify the current 5-digit PIN.		Should be recorded on wallet card.
2	Turn ignition to IGN .	If armed, the odometer window display will read: ENTER PIN and the security lamp will be flashing at a fast rate. The headlight will not be on.	
3	Press and release the left turn signal switch.	In the odometer window, a flashing 1 will appear.	
4	Increment the digit by tapping the left turn signal until the odometer window displays the first digit of the PIN.	The first digit in the odometer will be the first digit in the PIN.	
5	Press right turn switch 1 time .	The first digit is stored and the next digit will flash.	Serves as enter key.
6	Increment the second digit using the left turn switch until the digit reaches the second digit of the PIN.	The second digit in the odometer will be the second digit in the PIN.	
7	Press right turn switch 1 time.	The second digit is stored and the next dash will flash.	Serves as enter key.
8	Increment the third digit using the left turn switch until it reaches the third digit of the PIN.	The third digit in the odometer will be the third digit in the PIN.	

Table 5-53. Entering a PIN to Disarm Harley-Davidson Smart Security System

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
9	Press right turn switch 1 time .	The third digit is stored and the next dash will flash.	Serves as enter key.
10	Increment the fourth digit using the left turn switch until it reaches the fourth digit of the PIN.	The fourth digit in the odometer will be the fourth digit in the PIN.	
11	Press right turn switch 1 time .	The fourth digit is stored and the next dash will flash.	Serves as enter key.
12	Increment the fifth digit using the left turn switch until it reaches the fifth digit of the PIN.	The fifth digit in the odometer will be the fifth digit in the PIN.	
13	Press right turn switch 1 time .	The fifth digit is stored. The security system indicator lamp stops blinking.	Smart Security System is disarmed.

ALARM

Activation

When the alarm system is activated:

- Turn signals alternately flash.
- Smart siren, if equipped, sounds.

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 and continue for another 30 seconds.

The security system 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

Stop the alarm at any time by moving an assigned fob to the vehicle. The presence of the fob will terminate the alarm.

KEY FOB

5.12

DESCRIPTION AND OPERATION

See [Figure 5-36](#). The fob's reception range for the signal depends on a specific receiver pattern. The typical range will be an arm's length.

NOTES

- *Environmental and geographic conditions impact signal range.*
- *Always have the fob present whenever the vehicle is operated.*
- *Do not place fob in metal enclosure. 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 the fob battery every year.*

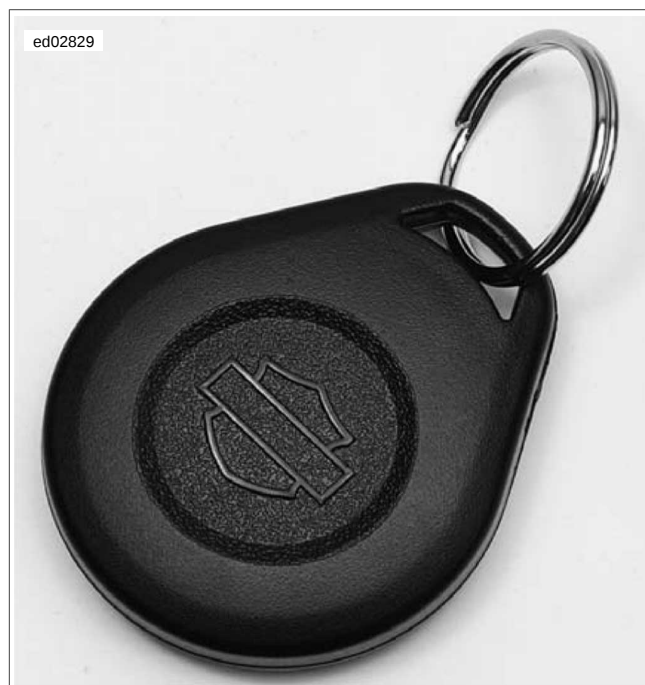


Figure 5-36. Hands-Free Fob

FOB ASSIGNMENT

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.

NOTE

Each fob has a unique serial number. Attach fob label to a blank NOTES page in the owner's manual for reference.

SIREN

5.13

DESCRIPTION AND OPERATION

See [Figure 5-37](#) and [Figure 5-38](#). If equipped, the siren is attached at [142] off the BCM. Through this connector it shares the battery circuit, the ground circuit and the alarm signal circuit with the BCM. The siren adds an audible warning to the visual warnings that are a standard function of the security system.

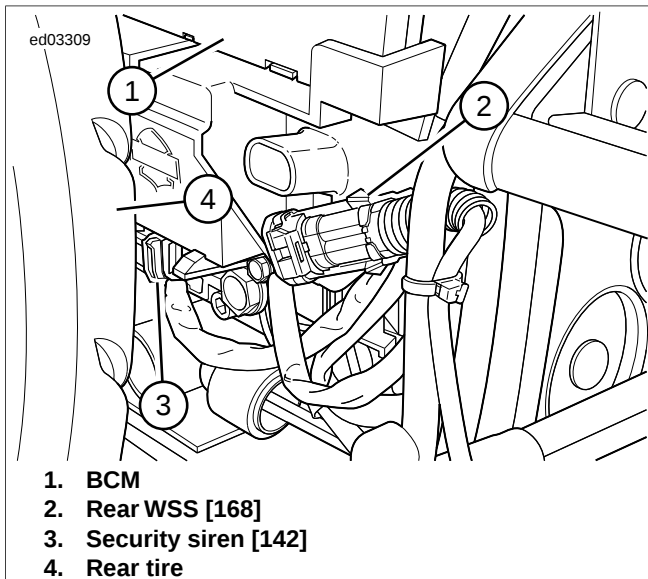


Figure 5-37. BCM: Except FXSB

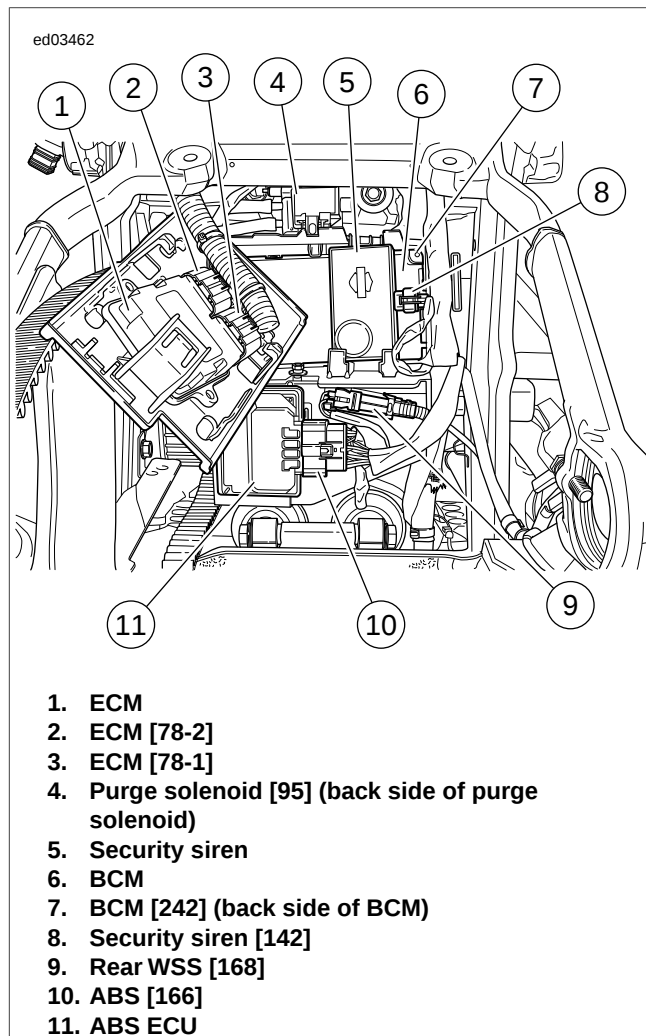


Figure 5-38. Electrical Panel: FXSB

SIREN CHIRP MODE CONFIRMATION

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 chirp mode.

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

5.14

GENERAL

Setting up a vehicle's security requires a BCM that is security equipped.

ACTUATION

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 vehicles by assigning **both** fobs to the vehicle.
2. Configure 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 wallet card. Instruct the customer to always carry this card when riding the motorcycle.

Once the system has been activated, it will always arm within five seconds of turning the ignition switch to **OFF** or **ACC** and no vehicle motion.

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

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The initial PIN entry should be performed using DIGITAL TECHNICIAN II (Part No. HD-48650) in conjunction with fob assignment.

CHANGING THE PIN

To change a PIN, refer to [Table 5-54](#).

If a PIN was previously entered, the odometer will display the equivalent digit. To increment the digits, press the left turn signal switch. The first press selects the same value and then each additional press of the left turn signal switch will increment the digit by one.

Examples:

- To advance from 5 to 6, press and release the left turn switch twice.
- To advance from 8 to 2, press and release the left turn switch four times.

Table 5-54. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Select a 5-digit (1 thru 9) PIN and record on the wallet card from Owner's Manual.		
2	With an assigned fob present, turn the OFF/RUN switch to OFF .		
3	Turn the ignition switch to IGN .		
4	Cycle the OFF/RUN switch twice: RUN - OFF - RUN - OFF - RUN .		
5	Press left turn signal switch 2 times .	ENTER PIN will scroll through the odometer window.	
6	Press right turn signal switch 1 time and release.	Turn signals will flash 3 times. Current PIN will appear in odometer. The first digit will be flashing.	
7	Enter first digit of new PIN by pressing and releasing the left turn signal switch until the selected digit appears.		
8	Press right turn signal switch 1 time and release.	The new digit will replace the current in odometer window.	
9	Enter second digit of selected PIN by pressing and releasing the left turn signal switch until the selected digit is present.		
10	Press right turn signal switch 1 time and release.	The new digit will replace the current in odometer window.	

Table 5-54. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
11	Enter third digit of the selected PIN by pressing and releasing the left turn signal switch until the selected digit is present.		
12	Press right turn switch 1 time and release.	The new digit will replace the current in odometer window.	
13	Enter fourth digit of new PIN by pressing and releasing the left turn signal switch until the selected digit is present.		
14	Press right turn switch 1 time and release.	The new digit will replace the current in odometer window.	
15	Enter fifth digit of the new PIN by pressing and releasing the left turn signal switch until the selected digit is present.		
16	Press right turn switch 1 time and release.	The new digit will replace the current in odometer window.	
17	Turn the OFF/RUN switch OFF , then turn the ignition switch to OFF .		Pushing the OFF/RUN switch to OFF stores the new PIN in the module.

TRANSPORT MODE

When transporting the motorcycle, place the system in the transport mode. Otherwise, the alarm activated by motion detection can discharge the battery.

In the transport mode, the security system is armed 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 when the fob is not within range will trigger the alarm.

To Enter Transport Mode

1. With an assigned fob within range, turn the ignition switch to IGN.
2. Before the security system lamp goes out, turn the ignition switch to OFF.
3. Within three seconds, simultaneously press both the left and the right turn signal switches.
4. After the turn signals flash once, the system enters the transport mode. With the fob removed, the motorcycle can be moved without setting off the alarm.

To Exit Transport Mode

With the fob present, turn the ignition switch to IGN to disarm the system.

SERVICE MODE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

With a fob present, the security system 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 Security System 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 or ACC.
2. Press the hazard warning switch. The four-way flashers will continue for two hours.
3. Turn IGN OFF to arm the smart security system.

To Disarm the Security System and Turn the Hazard Warning Flashers OFF

1. With a fob present, turn IGN to ON or ACC.
2. Press the hazard warning switch.

DTC B2172, B2173

DESCRIPTION AND OPERATION

NOTE

This section applies only to those vehicles equipped with the optional security system.

See [Figure 5-39](#) and [Figure 5-40](#). An alarm cycle is activated when the BCM is connected, the siren has been armed by the BCM and a security event occurs. See [5.11 SECURITY SYSTEM](#). Under normal armed operation, the siren input (terminal 2) is driven low by the BCM to trigger the audible alarm. When the siren input is driven high by the BCM the audible alarm stops.

Table 5-55. Code Description

DTC	DESCRIPTION
B2172	Security siren output shorted high
B2173	Security siren output shorted low

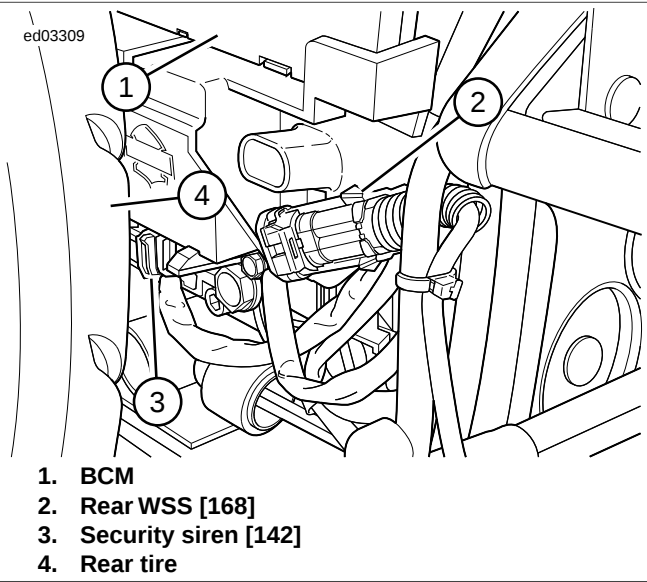


Figure 5-39. BCM: Except FXSB

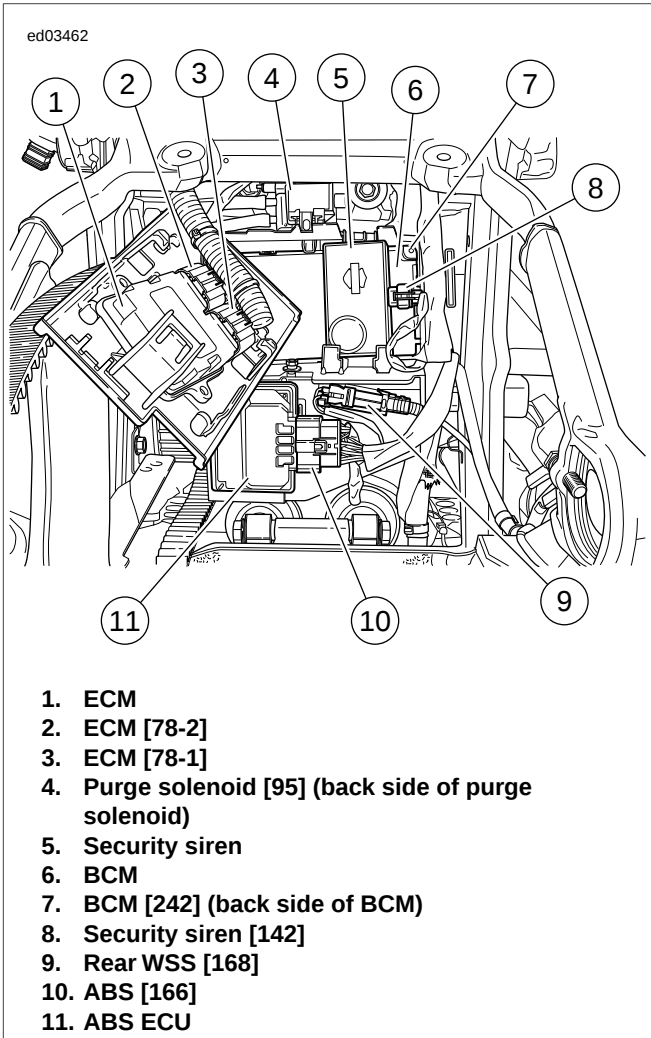


Figure 5-40. Electrical Panel: FXSB

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 BCM, 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 BCM 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 BCM output or siren input may be shorted to ground, the siren vehicle battery connection is open or the siren vehicle ground connection is open or a security

event has occurred. See [5.11 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](#).

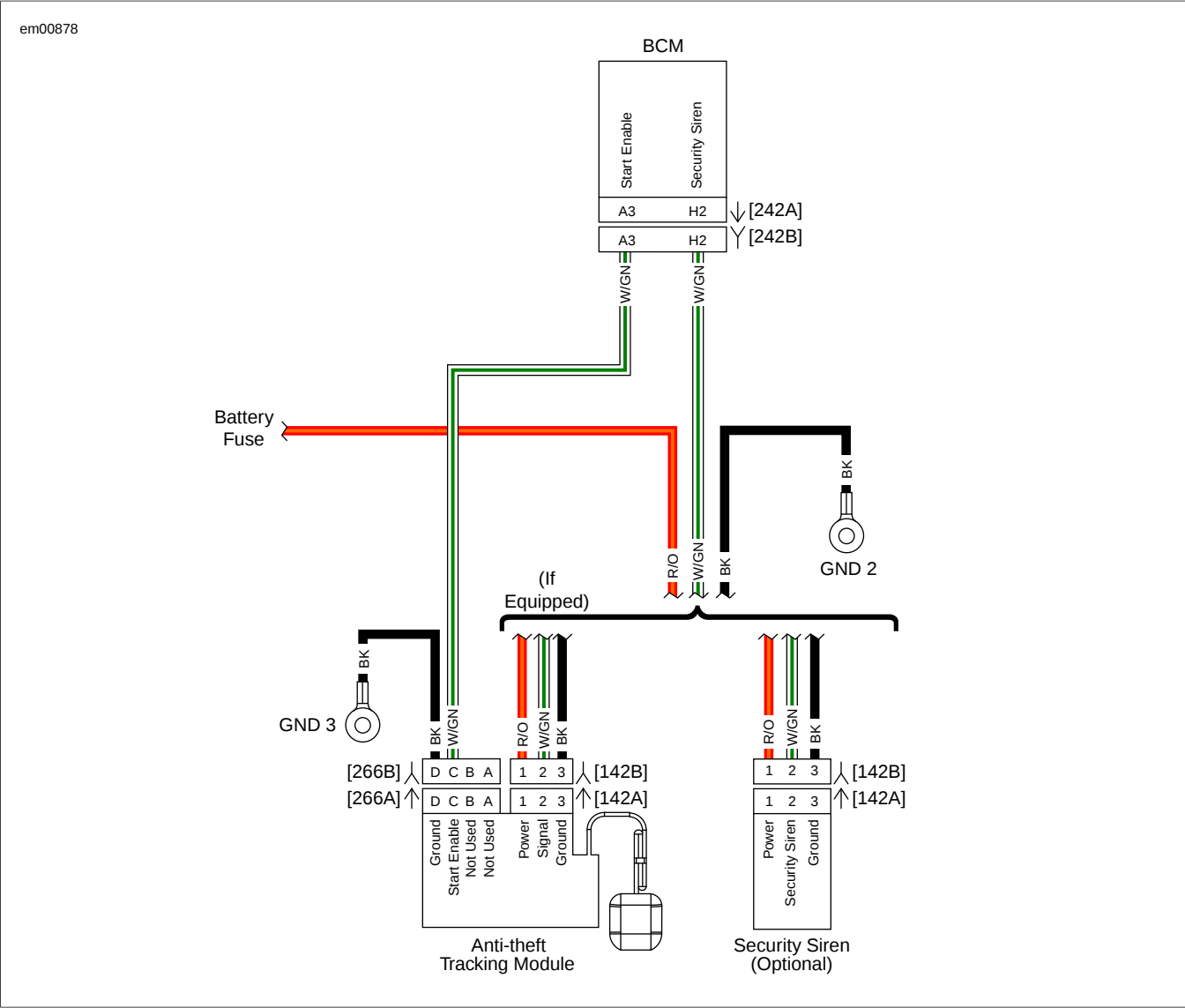


Figure 5-41. Smart Siren Circuit

DTC B2172

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-56. DTC B2172 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in alarm signal
Siren malfunction

1. Siren Circuit Short to Voltage Test

1. Disconnect siren [142] (if equipped).
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [142] terminal 2 and ground.

NOTE

With fully charged battery normal circuit voltage is 9.0-10.5V.

3. Is battery voltage present?
 - a. **Yes.** Repair short to voltage in (W/GN) wire.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Clear DTCs.
2. Turn IGN OFF. Verify security activates.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace siren.

DTC B2173

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-57. DTC B2173 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in alarm signal
Open ground circuit
Open alarm signal
Siren malfunction

1. Siren Signal Short to Ground Test

1. Disconnect security siren [142] (if equipped).
2. Turn IGN OFF.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal H2 and ground.
6. Is continuity present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (W/GN) wire between [142B] and [242B].

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Replace security siren.

FAILS TO DISARM: DTC B2176, B2177, B2178

5.16

DESCRIPTION AND OPERATION

DTC B2176, B2177 or B2178 will set when a fault occurs to the security antenna circuit used to transmit to the fob. Refer to [Table 5-58](#).

If the security system does not respond, responds with limited range or will not consistently disarm with fob within normal range, follow the fails to disarm diagnostic procedure.

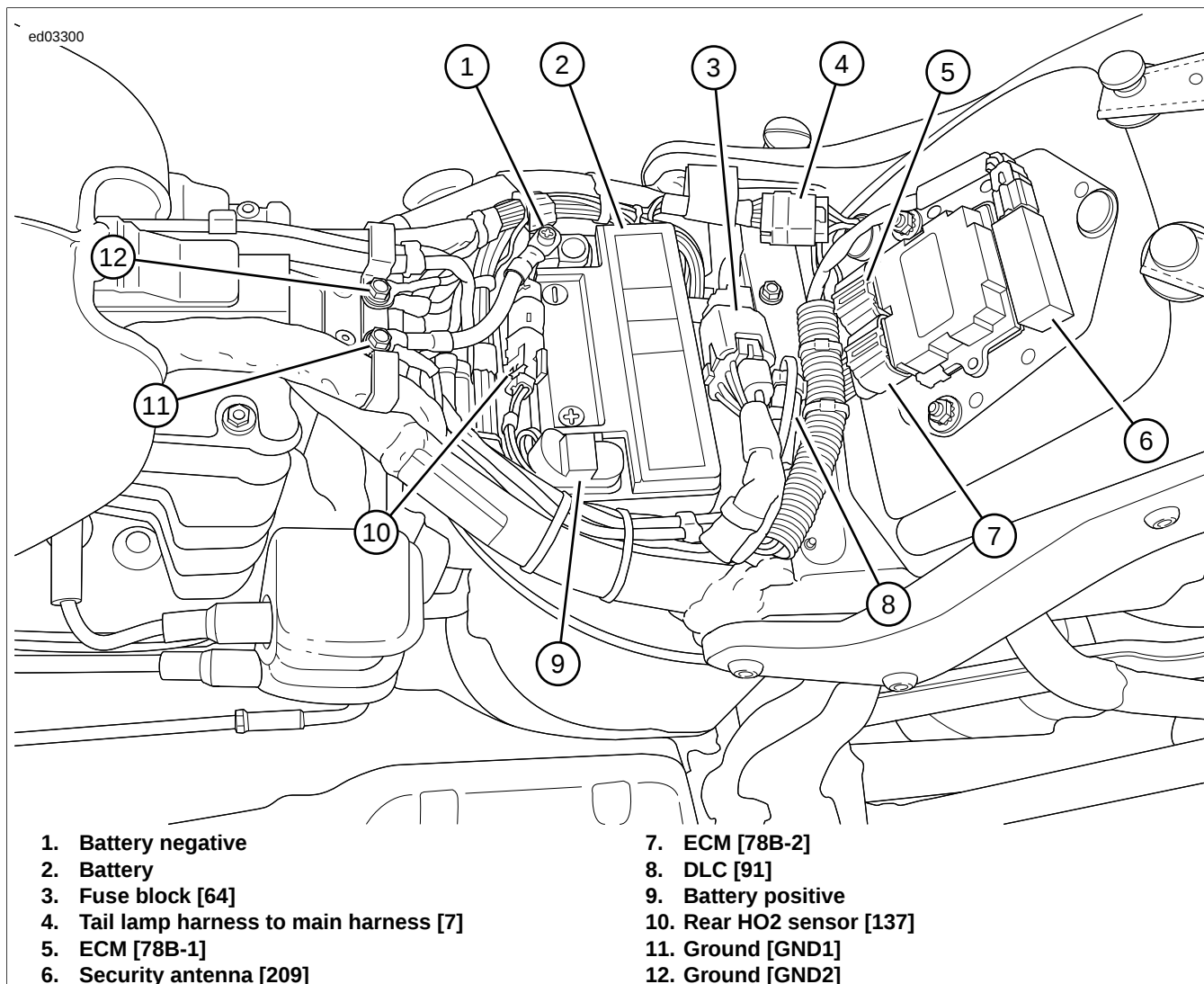


Figure 5-42. Under Seat: Except FXS/B and FLS

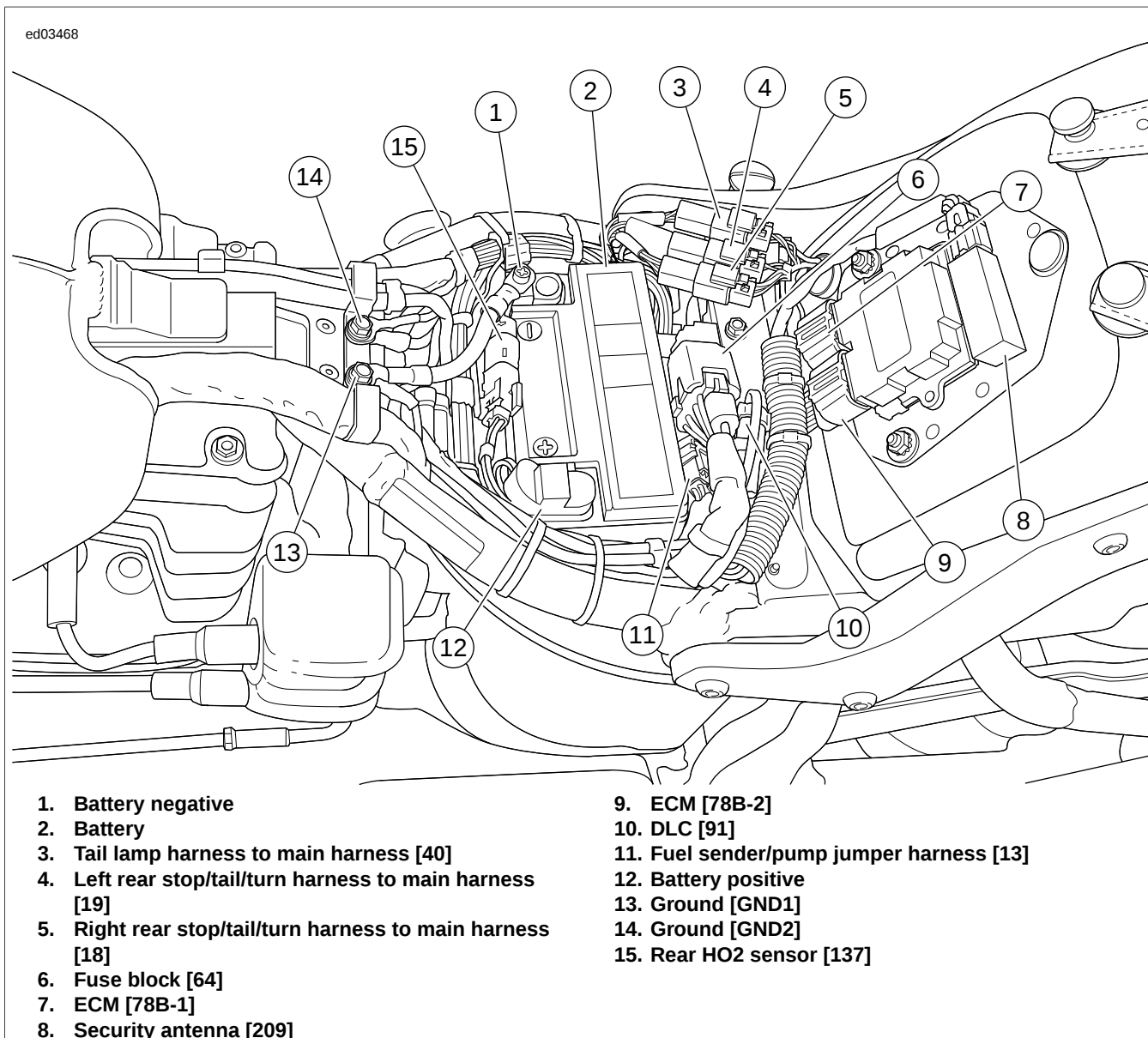


Figure 5-43. Under Seat: FXS and FLS

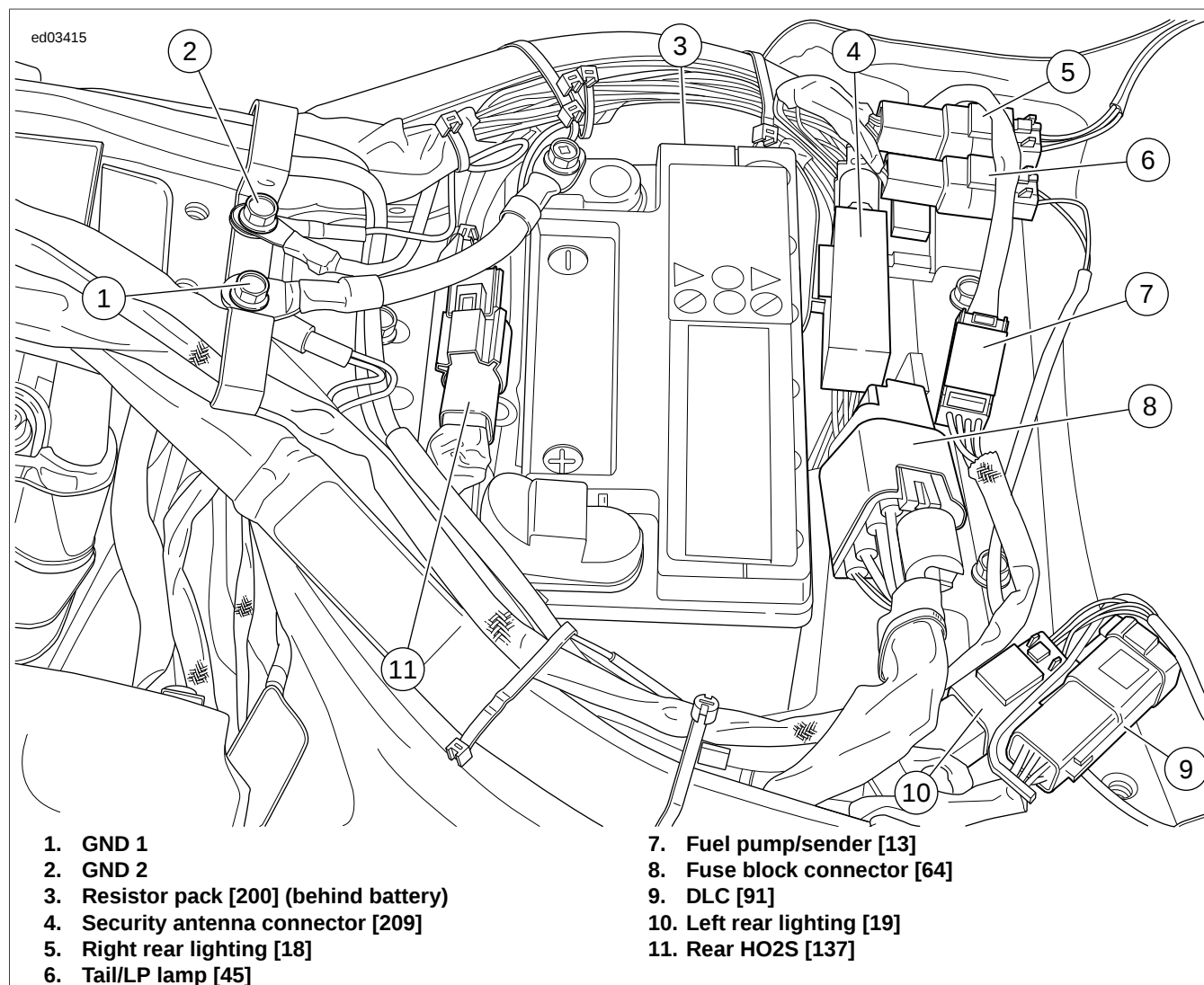


Figure 5-44. Under Seat: FXSB

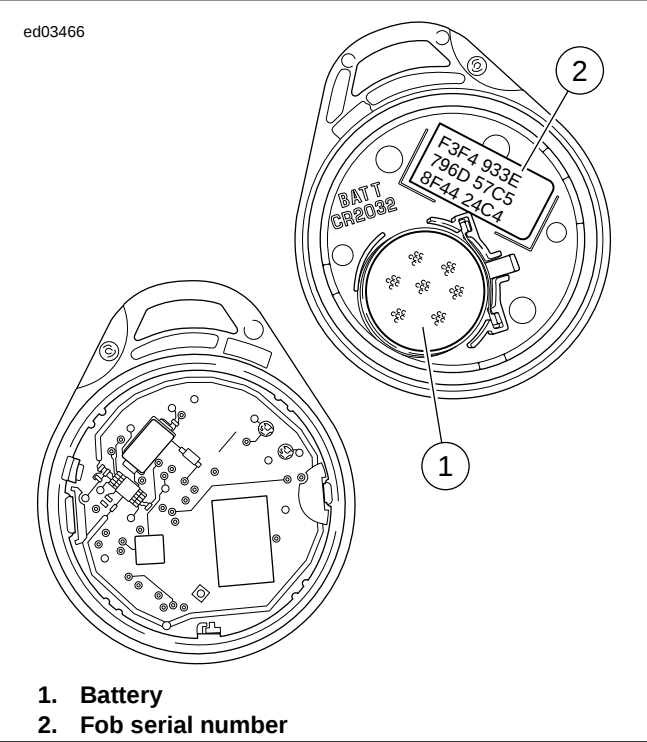


Figure 5-45. Open Fob

Table 5-58. Code Description

DTC	DESCRIPTION
B2176	Security antenna output open
B2177	Security antenna output shorted high
B2178	Security antenna output shorted low

Conditions for Setting

The BCM will recognize the faults with IGN ON.

Diagnostic Tips

- Verify that cell phone is not within 3.0 in (80.0 mm) of key fob.
- Interference from physical surroundings impacts RF transmission. Place fob next to vehicle or move vehicle to a new location and retest.
- See [Figure 5-42](#). Verify that antenna is in OE location. Make sure that seat has not been replaced with a metal base seat.
- Check for damage to antenna wire.
- See [Figure 5-45](#). Verify fob battery voltage is at least 2.9V.
- Fob serial number is located inside fob. Twist thin blade in thumbnail slot to 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](#).

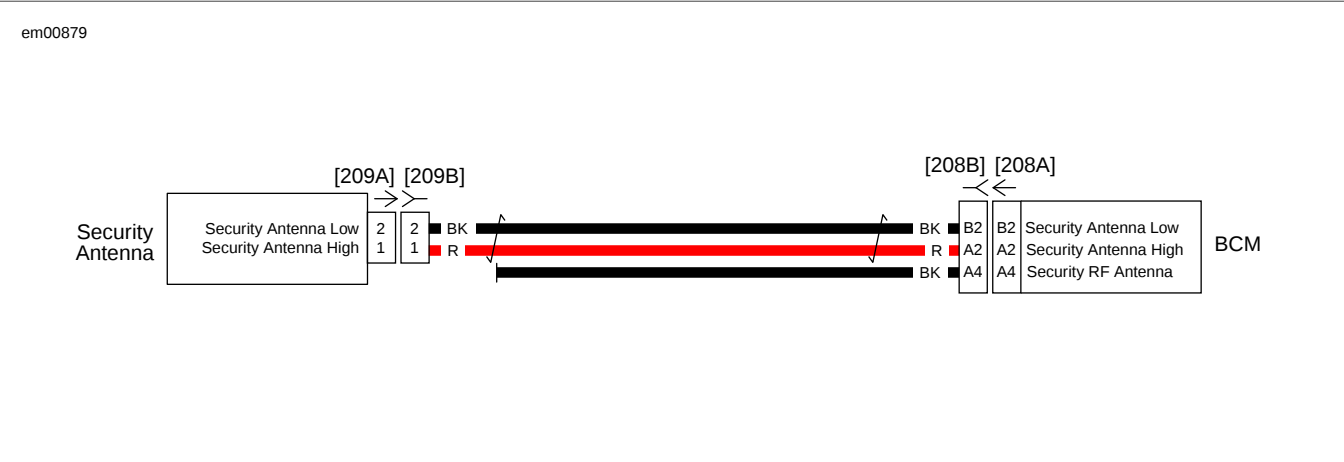


Figure 5-46. Antenna Circuit

DTC B2176

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-59. DTC B2176 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Open antenna circuit

1. Fob Test

1. Turn IGN OFF.
2. With fob present, turn IGN ON.
3. Does odometer read ENTER PIN?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 6.](#)

2. 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 3.](#)

3. Security Antenna Resistance Test

1. Turn IGN OFF.
2. Disconnect antenna [209].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between terminals 1 and 2 of [209A].
4. Is resistance greater than 5700 Ohms?
 - a. **Yes.** Replace security antenna.
 - b. **No.** [Go to Test 2.](#)

4. Antenna B Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal B2 and [209B] terminal 2.
4. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) wire.

5. Antenna A Circuit Open Test

1. Test continuity between BOB terminal A2 and [209B] terminal 1.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (R) wire.

6. DTC Test

1. Connect [242] and [209] (if needed).
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC B2177

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-60. DTC B2177 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Short to voltage in antenna circuit

1. Security Antenna Visual Test

1. Inspect 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 High Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal A2 and ground.

6. Is voltage greater than 0.6V?
 - a. **Yes.** Repair short to voltage in (R) wire.
 - b. **No.** [Go to Test 3.](#)

3. Security Antenna Low Circuit Short to Voltage Test

1. Test voltage between BOB terminal B2 and ground.
2. Is voltage greater than 0.6V?
 - a. **Yes.** Repair short to voltage on (BK) wire.
 - b. **No.** [Go to Test 4.](#)

4. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)

DTC B2178

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-61. DTC B2178 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Open antenna circuit

1. Security Antenna Visual Test

1. Inspect 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 High Short to Ground Test

1. Disconnect security antenna [209].
2. Turn IGN OFF.
3. Disconnect BCM [242].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [209B] terminal 1 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground in (R) wire.
 - b. **No.** [Go to Test 3.](#)

3. Security Antenna Low Short to Ground Test

1. Test continuity between [209B] terminal 2 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (BK) wire.
 - b. **No.** [Go to Test 4.](#)

4. DTC Test

1. Connect BCM [242] and [209].
2. Clear DTC.
3. Turn IGN ON.
4. Did the DTC return?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.](#)

FAILS TO DISARM

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-62. Fails to Disarm Diagnostic Faults

POSSIBLE CAUSES
Open antenna circuit
Short to ground in antenna circuit
RF interference
Antenna malfunction
Fob malfunction/dead battery

1. Non-Functional Fob Test

1. Check battery on non-functional fob.
2. Is battery voltage greater than 2.9V?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace battery. (6755)

2. Interference Test

1. Move vehicle away from any possible interference sources.
2. Place fob on seat.
3. Will the security system disarm?
 - a. **Yes.** Inspect for electrical accessories or an after-market seat that may be causing interference.
 - b. **No.** [Go to Test 3.](#)

3. Antenna Connection Test

1. Inspect antenna connection.

2. Is the antenna connection good?

- a. **Yes.** [Go to Test 4.](#)
- b. **No.** Repair connection.

4. Antenna Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal A4 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground. **(5041)**
 - b. **No.** [Go to Test 5.](#)

5. Antenna Circuits Shorted Together Test

1. Disconnect security antenna [209].

2. Test continuity between BOB terminals A2 and B2.
3. Is continuity present?
 - a. **Yes.** Repair short between antenna circuits. **(5041)**
 - b. **No.** [Go to Test 6.](#)

6. Antenna Circuit Open Test

1. Test continuity between BOB terminal A4 and end of (BK) wire. Pull back conduit to expose unterminated end of wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open on (BK) wire. **(5041)**

7. Security System Antenna Test

1. Replace security antenna with a known good security antenna.
2. Does security system now disarm?
 - a. **Yes.** Replace security antenna. **(6878)**
 - b. **No.** Replace BCM. **(6757)**

DTC B2183, B2188, B2193, B2198

5.17

DESCRIPTION AND OPERATION

These outputs are intended for future applications and are not used for this model.

Table 5-63. Code Description

DTC	DESCRIPTION
B2183	High side drive output #1 shorted low
B2188	High side drive output #2 shorted low
B2193	High side drive output #3 shorted low
B2198	High side drive output #4 shorted low

Conditions for Setting

This output is shorted to ground in one of three areas:

- Wire harness.
- Device the output is connected to.
- BCM.

Diagnostic Tips

This circuit may be used for aftermarket accessories or systems. If a code is set and cannot be duplicated, check for aftermarket devices.

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](#).

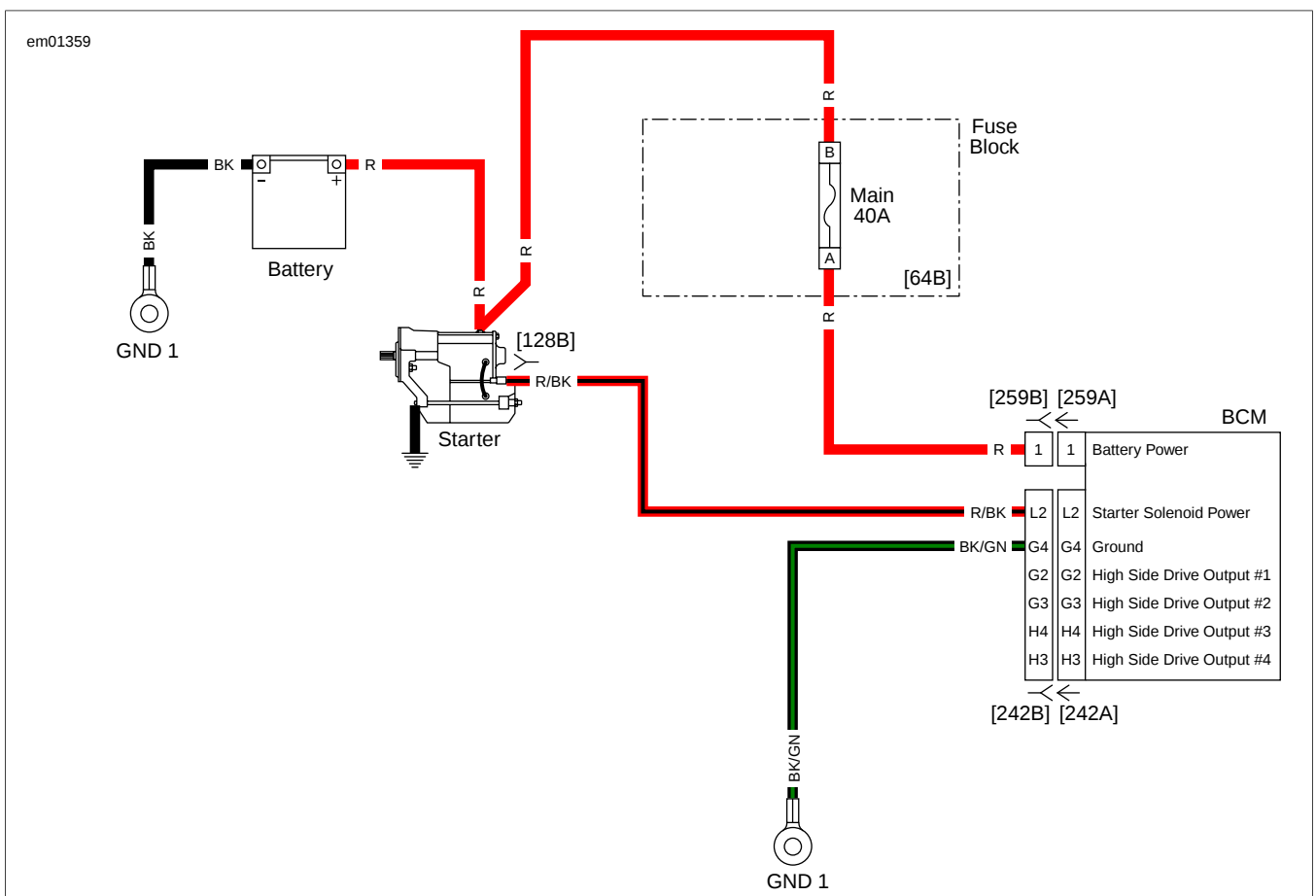


Figure 5-47. Spare Outputs

DTC B2183, B2188, B2193, B2198

Table 5-64. DTC B2183, B2188, B2193, B2198 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in spare output circuit

1. Circuit Inspection Test

1. Visually inspect BCM harness [242].

2. Are there wires plugged into any of the spare output terminals?
 - a. **Yes.** Problem may be caused by aftermarket devices. Refer to aftermarket manufacturer for repair.
 - b. **No.** [Go to Test 2.](#)

2. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent.

DTC B2218

5.18

DESCRIPTION AND OPERATION

The BCM monitors the clutch and neutral switch circuits to determine whether or not to let the vehicle start. No power will be supplied to the starter solenoid unless either:

- Clutch switch is closed (lever pulled in).
- Neutral switch is closed (shifted to neutral).

Conditions for Setting

DTC B2218 will set when the neutral switch circuit is shorted to ground at speeds greater than 5 mph (8 km/h) for more than 60 seconds.

Table 5-65. Code Description

DTC	DESCRIPTION
B2218	Neutral switch shorted low

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](#).

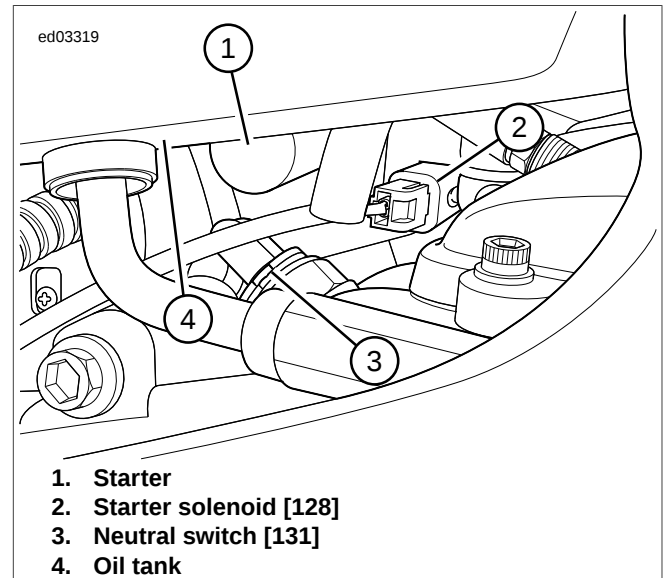


Figure 5-48. Under Oil Tank Right Side

em01524

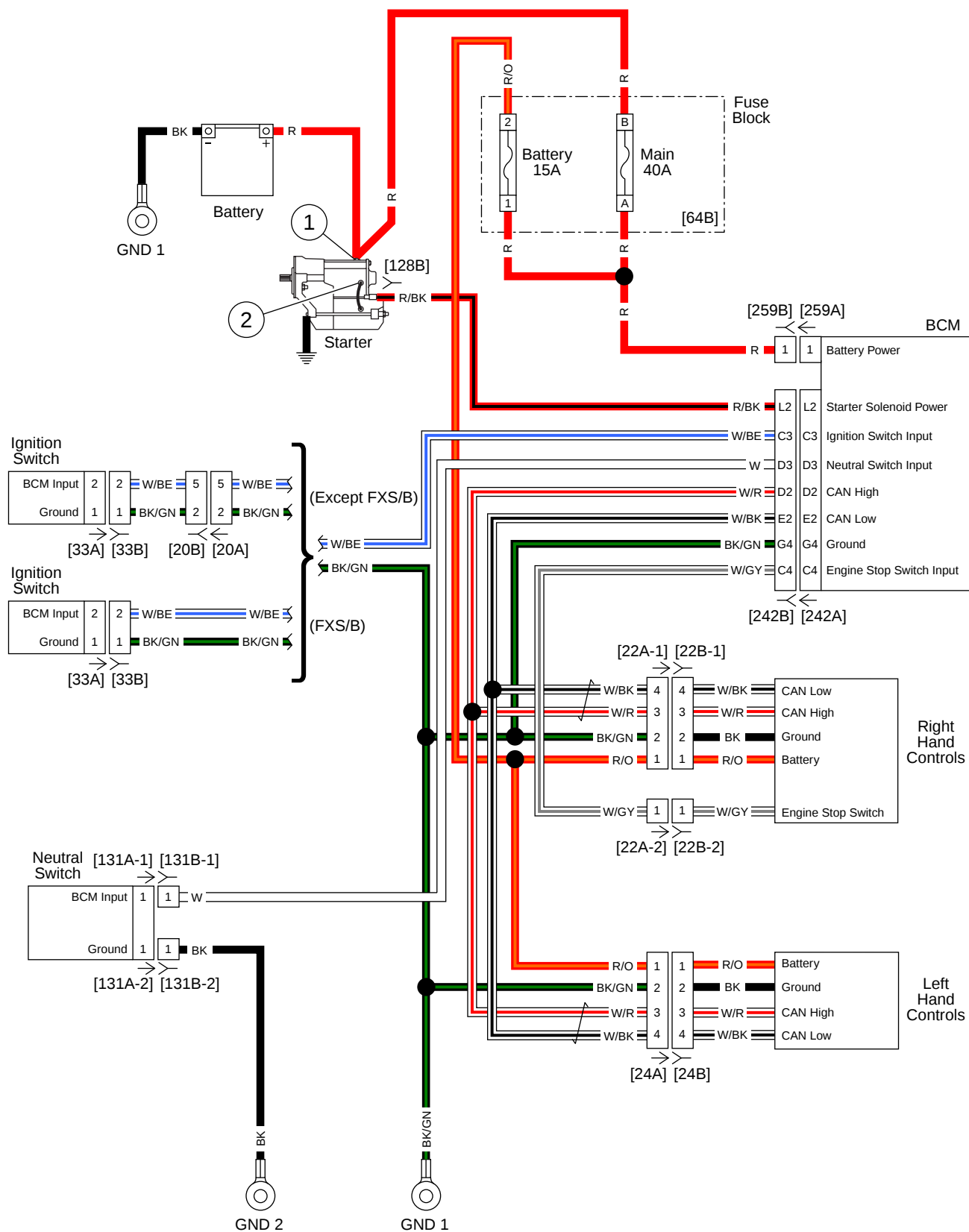


Figure 5-49. Starting Circuit

DTC B2218

PART NUMBER	TOOL NAME
HD-41404	HARNESSE CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-66. DTC B2218 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 5 mph (8 km/h) for more than 60 seconds. For example, if coasting down a long mountain road with the transmission in neutral.

1. Neutral Circuit Short to Ground Test

- Shift the transmission into 1st or 2nd gear.
- Turn IGN ON.
- Is the neutral indicator illuminated?
 - Yes.** [Go to Test 2.](#)
 - No.** Verify neutral switch torque.

2. Neutral Switch Test

- Disconnect the neutral switch [131-1].

- Is the neutral lamp illuminated?
 - Yes.** [Go to Test 3.](#)
 - No.** Replace the neutral switch.

3. Neutral Switch Short to Ground Test

- Turn IGN OFF.
- Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
- Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
- Using HARNESSE CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal D3 and ground.
- Is resistance less than 10 Ohms?
 - Yes.** Repair short to ground on (W) wire.
 - No.** [Go to Test 4.](#)

4. DTC Test

- Connect BCM [242] and neutral switch.
- Clear DTC.
- Turn IGN ON.
- Operate vehicle above 5 mph (8 km/h) for at least two minutes.
- Did DTC return?
 - Yes.** Replace BCM.
 - No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

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NOTES

GENERAL

This chapter describes the operation of the Harley-Davidson EFI system. A good working knowledge of motorcycle component is required for troubleshooting engine and EFI problems. [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 engine. 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 ECM makes decisions for enabling ignition, starting, spark and fuel delivery. Sensors include:

- CKP sensor
- TPS
- JSS
- BCM including an integrated accelerometer
- Clutch switch
- Neutral switch
- ET sensor
- VSS
- HO2 sensor
- MAP
- IAT sensor

EFI Operation

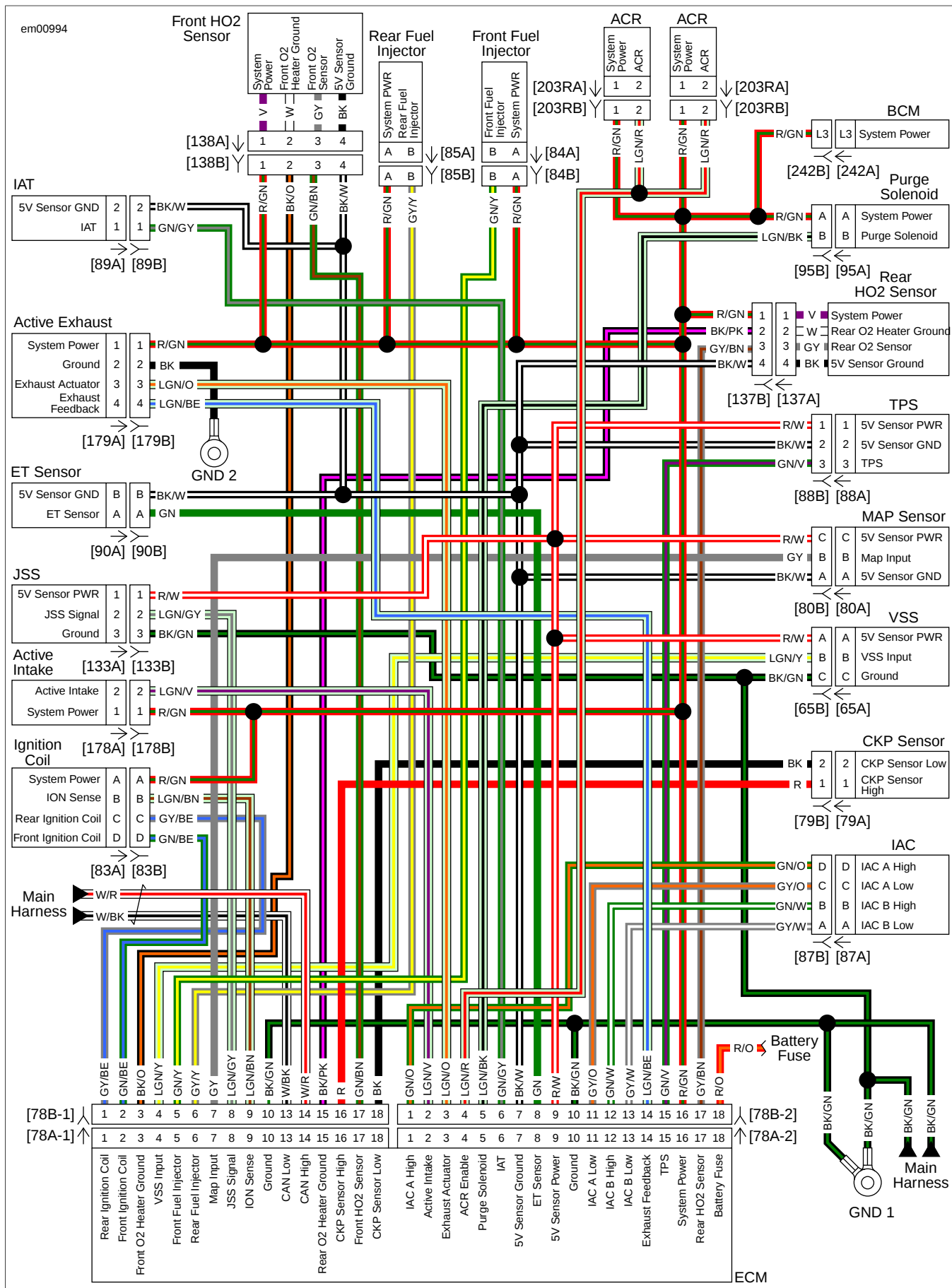
The EFI system operates as an open or closed loop system, allowing it to adjust for all possible operating conditions.

- 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 HO2 sensors provide input for an optimal air/fuel mixture resulting in reduced emissions, good fuel economy and smooth power. HO2 sensors must be at the normal operating temperature of the engine.

By using both open and closed loop systems, engine performance is tuned. This compensates for change in conditions and provides maximum performance. A simplified signal flow diagram for the EFI system is shown in [Figure 6-1](#).

Symptom Diagnostics

These sections contain diagnostic test procedures for DTCs listed in [2.1 INITIAL DIAGNOSTICS](#). For symptoms of engine malfunctions not specifically covered by DTCs, refer to [Table 6-1](#), [Table 6-2](#) and [Table 6-3](#).



ELECTRONIC CONTROL MODULE

6.2

GENERAL

See [Figure 6-2](#) and [Figure 6-3](#). The ECM receives and processes signals from the sensors and applies output signals to the drivers to crank, start, idle and run the engine. This section describes the configuration of the ECM.

ECM

The ECM is mounted under the seat. It computes the spark advance for proper ignition timing and fuel control based on sensor inputs (from CKP, MAP and TPS sensors). The ECM 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 provides adequate spark at all speeds. (The ECM has 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 Crankshaft

The crankshaft 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. These continual ECM adjustments allow smooth engine operation 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.

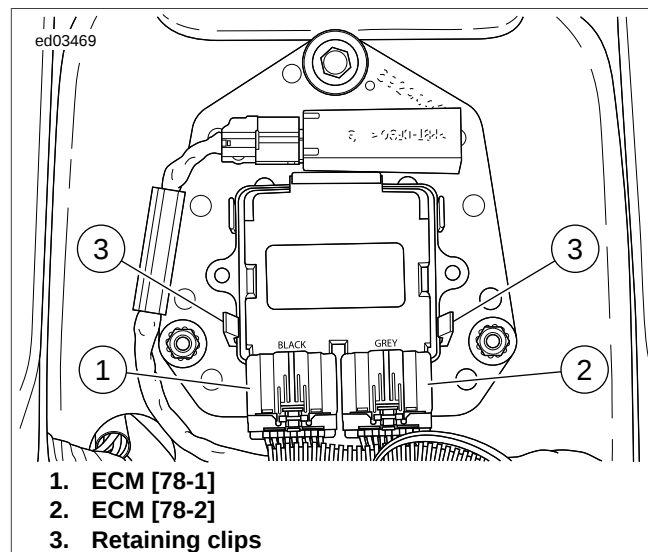


Figure 6-2. ECM [78-1] and [78-2]: Except FXSB

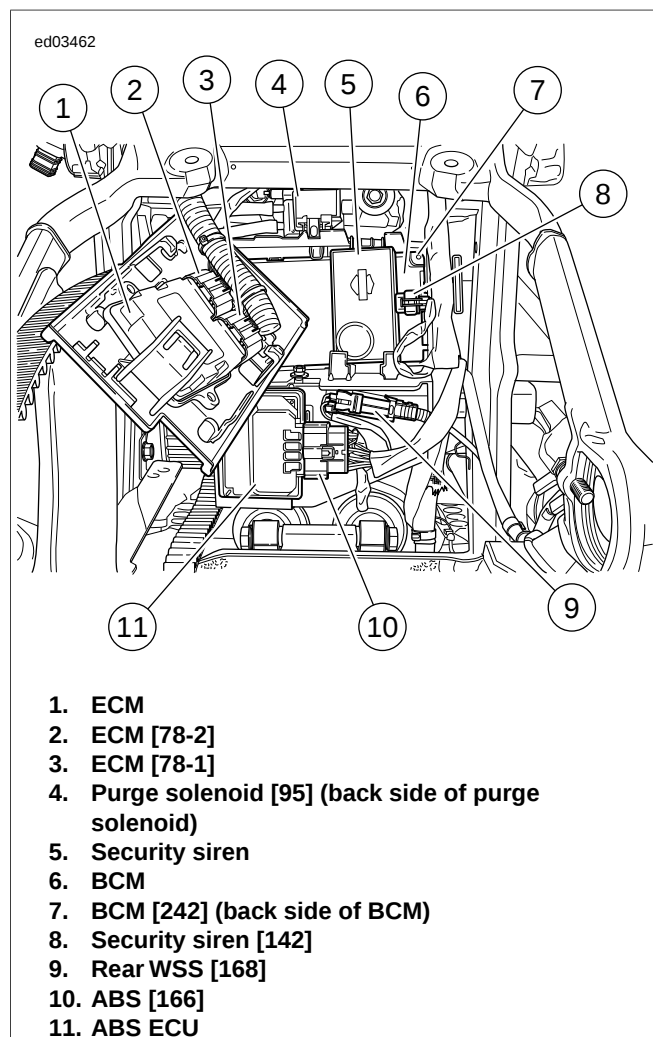


Figure 6-3. Electrical Panel: FXSB

SENSORS AND DRIVERS

6.3

DESCRIPTION AND OPERATION

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

SENSORS

A failed CKP sensor completely disables the engine. Other sensor problems may cause engine performance issues or complete engine shutdowns. 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 crankshaft 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. It is mounted on the throttle plate. The output of the sensor is a voltage dependent on the position of the throttle plate. The output is used by the ECM to determine ignition timing and fuel required at any given rpm and engine load.

Jiffy Stand Sensor (JSS)

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.

Accelerometer

The accelerometer is within the BCM. The BCM 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 CAN communication.

Clutch Switch

The clutch switch is part of the left hand control module. Its operation is communicated to the ECM and BCM over the CAN communication circuits.

Neutral Switch

The BCM 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 BCM will not allow the engine to start unless the transmission is in neutral or the clutch is pulled in.

Engine Temperature (ET) Sensor

The ET sensor is a thermistor device. 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. This effectively lowers the signal voltage on ECM [78-2] terminal 8.
- 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.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor is supplied 5V from the ECM and sends a signal back to the ECM. This signal changes 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 sensor output determines 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. At a specific temperature it has a specific resistance across its terminals. As the temperature varies, the thermistor resistance varies and so does the voltage on ECM [78-2] terminal 6.

- At high temperatures, the resistance of the sensor is very low. This effectively lowers the signal voltage on ECM [78-2] 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.

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 CAN bus to the speedometer to indicate vehicle speed.

HO2S: Front and Rear

The HO2S detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0-1.0V.

- The normal output is 0.5V which represents a balance between a lean (not enough fuel) and rich (too much fuel) air/fuel mixture.
- An output less than 0.5V represents a lean mixture; greater than 0.5V represents a rich mixture.
- The change in output level signals the ECM to modify the air/fuel ratio.

The HO2S does not operate efficiently until the engine is at operating temperature. Always warm-up the vehicle prior to troubleshooting the HO2S. The heater elements on the HO2S helps bring the HO2S up to operating temperature quicker. 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 BCM provides battery voltage to the fuel pump which is inside the fuel tank.

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](#). The BCM power a separate ignition coil for each cylinder.

Fuel Injectors

The BCM 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.

Active Intake Solenoid (AIS): HDI Only

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).

Active Exhaust Actuator: HDI Only

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe. This valve is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

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 P0371, P0372 or P0374 is present, diagnose and correct DTC.
Manifold leak	Perform intake leak test.
Ignition coil circuit/spark plugs	Repair the circuit. If DTC P1353, P1356, P2300, P2301, P2303 or P2304 is present, diagnose and correct DTCs.
Leaky injectors	Check for mechanical failures of the fuel injectors. If DTC P0261, P0262, P0264 or P0265 is present, diagnose and correct them.
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 P0371, P0372 and P0374 are present, diagnose and correct DTC.
Fuel or ignition system fault	Perform misfire diagnostics.
Manifold leak Note: If manifold leak is large enough, the IAC closes and sets a DTC.	Perform intake leak test.
Clogged fuel injectors	Clean or replace fuel injectors.
Throttle plates not opening fully	Perform throttle cable adjustment.
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, P0264 or P0265 are present, diagnose and correct DTCs.
IAT sensor circuit	Repair the circuit. If DTC P0112 or P0113 are present, diagnose and correct DTCs.

DTC B2102, B2103, B2104

DESCRIPTION AND OPERATION

The BCM supplies and monitors the 12V system power circuit from terminal L3 of the BCM to the following components:

- Ignition coil
- Active intake
- Active exhaust
- Front fuel injector
- Rear fuel injector
- Purge solenoid
- ECM
- Front HO2 sensor
- Rear HO2 sensor
- Front ACR
- Rear ACR

If the vehicle is equipped with ACRs, the power for the ACRs is also supplied by the BCM through the system power circuit. The system power circuit is energized when the ignition is turned on.

Table 6-4. Code Description

DTC	DESCRIPTION
B2102	System power output shorted high
B2103	System power output shorted low
B2104	System power output overloaded

Conditions for Setting

DTC B2104 will set if the system power circuit draws more than 10 Amps.

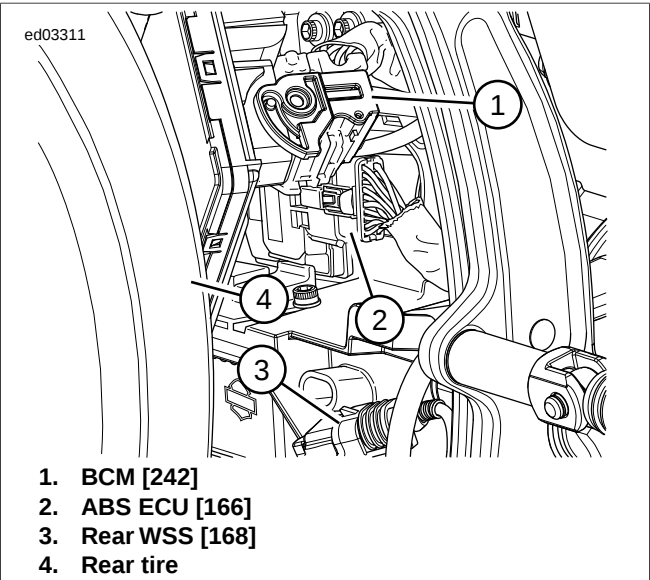


Figure 6-4. ABS [166]: Except FXSB

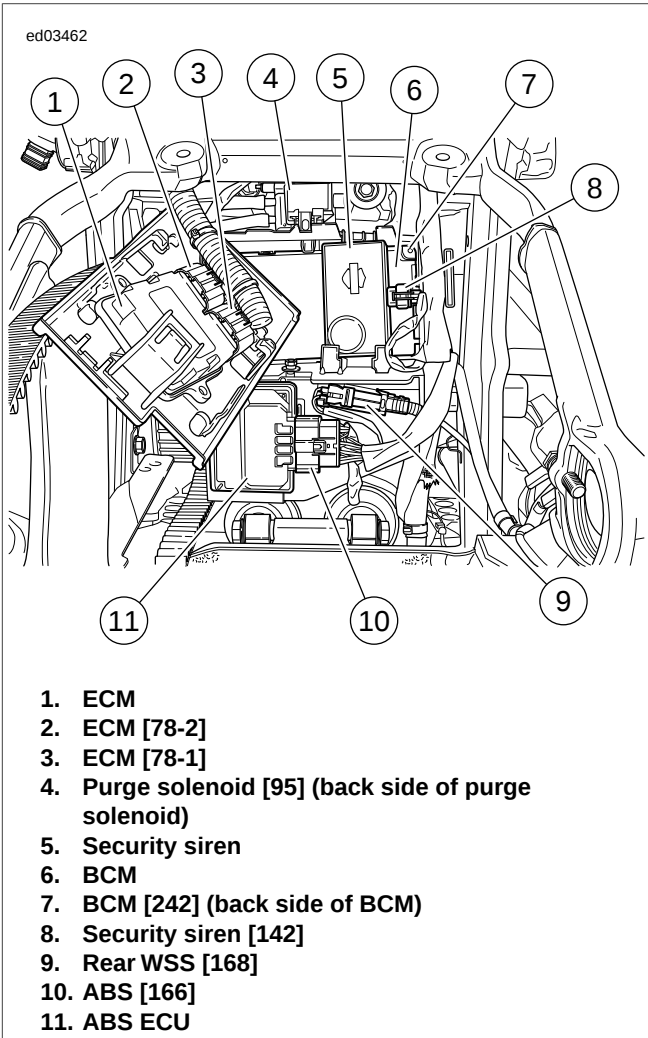


Figure 6-5. Electrical Panel: FXSB

Diagnostic Tips

Since the system power circuit normally has ignition voltage with IGN ON, the short to voltage will have to be present with the vehicle turned off in order to set DTC B2102.

When disconnecting connectors, always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

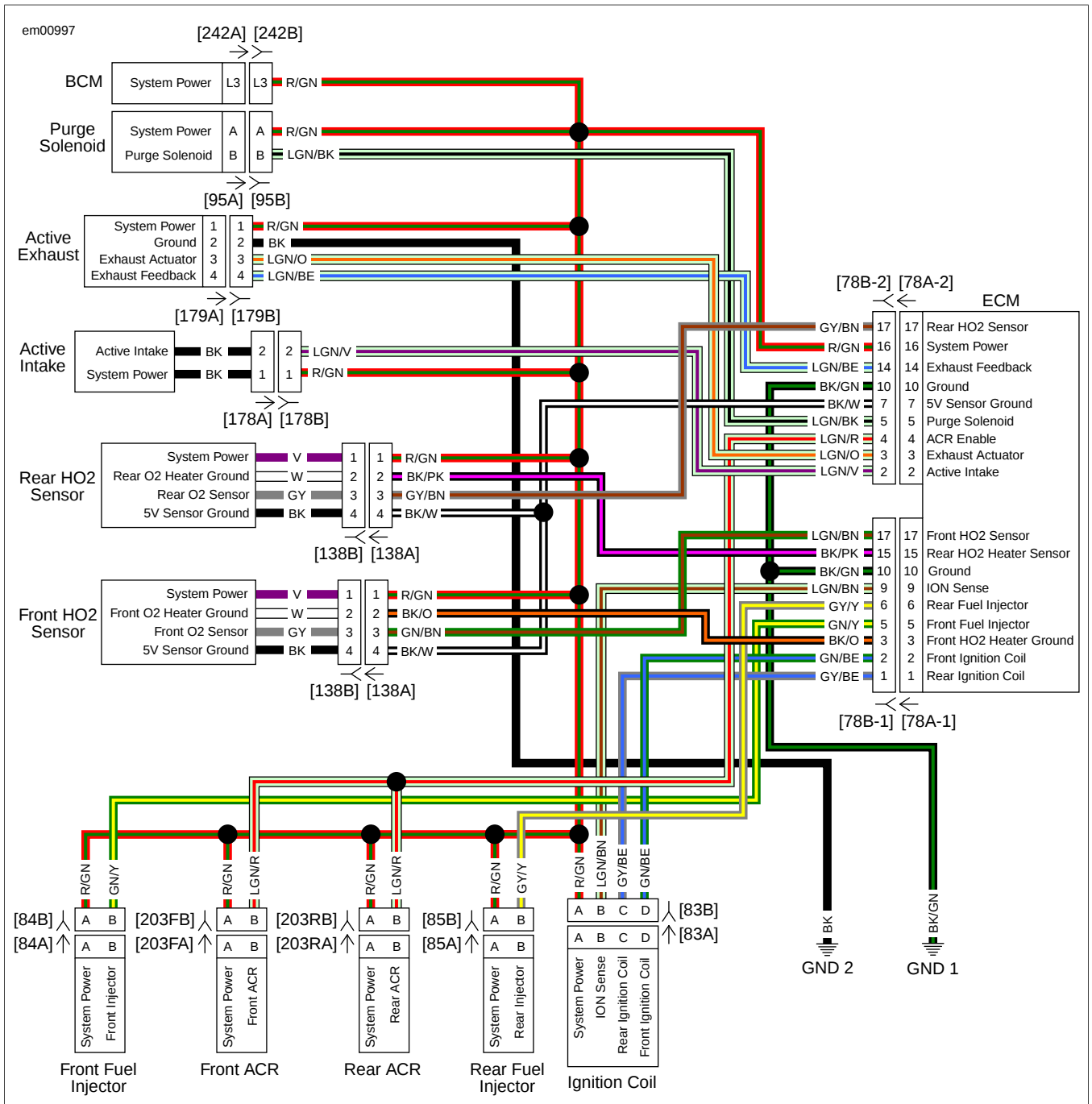


Figure 6-6. System Power Circuit

DTC B2102

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-5. DTC B2102 Diagnostic Faults

POSSIBLE CAUSES
Short to battery in the system power circuit

1. System Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B] leaving ECM [78A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
5. Is battery voltage present?
 - a. **Yes.** Repair short to voltage in (R/GN) wire.
 - b. **No.** Replace BCM.

DTC B2103, B2104

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-6. DTC B2103, B2104 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in the system power circuit
Ignition coil resistance too low
Front coil shorted low
Rear coil shorted low
Active intake resistance too low
Active exhaust resistance too low
Front HO2 resistance too low
Rear HO2 resistance too low
Front fuel injector resistance too low
Rear fuel injector resistance too low
ACR resistance too low
Purge solenoid resistance too low

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Clear DTCs.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace ignition coil.

2. Rear Coil Shorted to Ground Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [83B] terminal C and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (GY/BE) wire
 - b. **No.** [Go to Test 3.](#)

3. Front Coil Shorted to Ground Test

1. Test continuity between [83B] terminal D and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (GN/BE) wire.
 - b. **No.** [Go to Test 4.](#)

4. Rear Fuel Injector Test

1. Turn IGN OFF.
2. Connect [83].
3. Disconnect rear fuel injector [85].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace rear fuel injector.

5. Front Fuel Injector Test

1. Turn IGN OFF.
2. Connect [85].
3. Disconnect front fuel injector [84].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Replace front fuel injector.

6. Purge Solenoid Test

1. Turn IGN OFF.
2. Connect [84].
3. Disconnect purge solenoid [95].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Replace purge solenoid.

7. Exhaust Actuator Test

1. Turn IGN OFF.
2. Connect [95].
3. Disconnect exhaust actuator [179].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 8.](#)
 - b. **No.** Replace exhaust actuator.

8. AIS Test

1. Turn IGN OFF.
2. Connect [179].
3. Disconnect AIS [178].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Replace AIS.

9. Front HO2S Test

1. Turn IGN OFF.
2. Connect [178].
3. Disconnect front HO2S [138].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No.** Replace front HO2S.

10. Rear HO2S Test

1. Turn IGN OFF.
2. Connect [138].
3. Disconnect rear HO2S [137].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Replace rear HO2S.

11. Front ACR Test

1. Turn IGN OFF.
2. Connect [137].
3. Disconnect front ACR [203F].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 12.](#)
 - b. **No.** Replace front ACR.

12. Rear ACR Test

1. Turn IGN OFF.
2. Connect [203F].
3. Disconnect rear ACR [203R].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 13.](#)
 - b. **No.** Replace rear ACR.

13. ECM Test

1. Turn IGN OFF.
2. Connect [203R].
3. Disconnect ECM [78-1] and [78-2].
4. Clear DTCs.
5. Turn IGN ON.

6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 14.](#)
 - b. **No.** Replace ECM.

14. BCM Test

1. Turn IGN OFF.
2. Connect [78].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B] leaving BCM [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal L3 and ground.
6. Is continuity present?
 - a. **Yes.** Repair short to ground in (R/GN) wire.
 - b. **No.** Replace BCM.

DESCRIPTION AND OPERATION

The BCM supplies and monitors the 12V system power circuit from terminal F4 of the BCM to the fuel pump. The fuel pump is constantly grounded. The BCM controls the fuel pump by turning on and off the power to the pump on the (R/BN) wire.

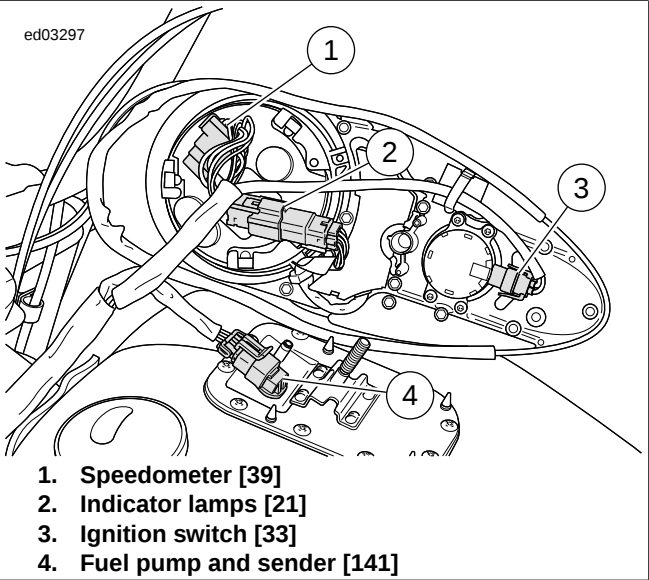


Figure 6-7. Under Console: Except FXS/B

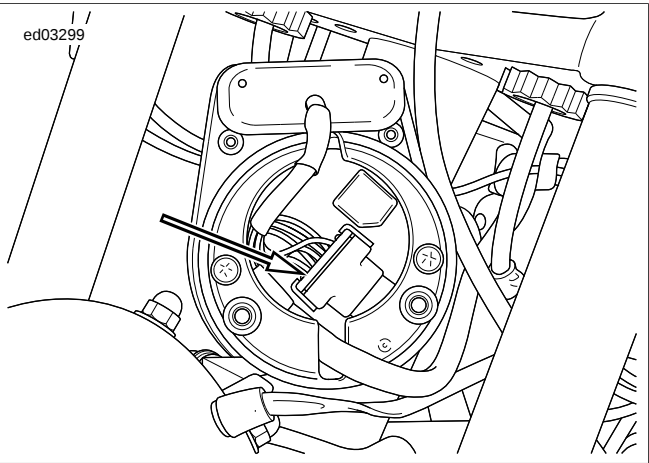


Figure 6-8. Speedometer [39]: FXS/B Typical

Table 6-7. Code Description

DTC	DESCRIPTION
B2116	Fuel pump output open
B2117	Fuel pump output shorted high
B2118	Fuel pump output shorted low
B2119	Fuel pump output overloaded

Conditions for Setting

DTC B2116 will set if the fuel pump circuit draws less than 600 milliamps.

DTC B2119 will set if the fuel pump circuit draws more than 6 Amps.

Diagnostic Tips

DTC B2119 can set if the BCM sees an excessive load on the fuel pump circuit. This could be caused by a fuel pump being run dry. If the fuel pump was replaced or the vehicle was run out of gas, prime the pump and clear the code. Start the vehicle and check DTCs to see if the code returns.

Any circuit that is powered up continually with IGN ON could cause DTC B2117 or B2119 to set if shorted to the fuel pump circuit. If a short to voltage or overload condition is found, test for continuity between fuel pump circuit and the other power circuits from the BCM.

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](#).

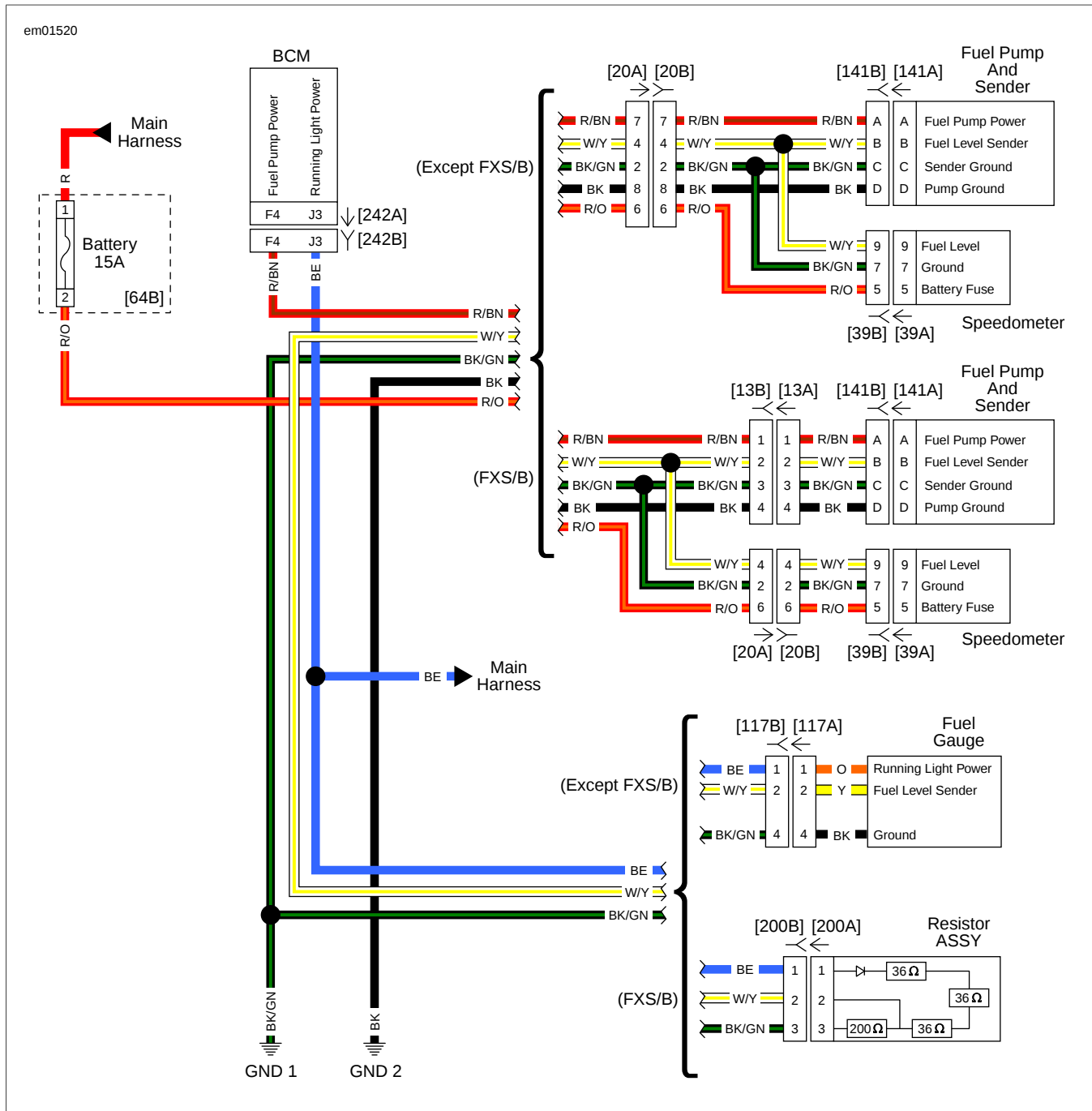


Figure 6-9. Fuel Sensor Circuit

DTC B2116

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-8. DTC B2116 Diagnostic Faults

POSSIBLE CAUSES
Open in the fuel pump power circuit
Fuel pump fault or malfunction

1. Fuel Pump Circuit Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect voltmeter between [141B] terminals A and D.
4. Turn IGN ON.
5. Was battery voltage displayed for a short time?
 - a. **Yes.** Replace fuel pump.
 - b. **No.** [Go to Test 2.](#)

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Test continuity between [141B] terminal D and ground.
3. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK) ground wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal F4 and [141B] terminal A.
4. Is continuity present?
 - a. **Yes.** Replace BCM.
 - b. **No.** Repair open in (R/BN) wire.

DTC B2117

Table 6-9. DTC B2117 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in the fuel pump power circuit

1. Fuel Pump Power Circuit Short to Voltage Test

1. Turn IGN ON.
2. Does fuel pump continue to run after the initial 2 second start up?
 - a. **Yes.** Repair short to voltage in (R/BN) wire. See diagnostic tips. If no source of short is found, replace the BCM.
 - b. **No.** [Go to Test 2.](#)

2. Code Verification Test

1. Clear DTC.
2. Start engine.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace BCM.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC B2118, B2119

Table 6-10. DTC B2118, B2119 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in the fuel pump power circuit
Fuel pump malfunction

1. Fuel Test

1. Verify there is fuel in fuel tank.
2. Is fuel present in tank?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Fill tank with fuel and clear DTCs. If the DTC returned, then continue with tests. [Go to Test 2.](#)

2. Fuel Pump Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Clear DTC.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC B2118 or B2119 reset?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace fuel pump.

3. Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Test continuity between [141B] terminal A (R/BN) wire and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground on (R/BN) wire.
 - b. **No.** See diagnostic tips. If problem not found, replace BCM.

DTC P0107, P0108

6.6

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-23738	VACUUM PUMP

See [Figure 6-10](#). The MAP sensor is supplied 5V from the ECM [78-2] terminal 9 and sends a signal back to the ECM [78-1] terminal 7. This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

Table 6-11. Code Description

DTC	DESCRIPTION
P0107	MAP sensor failed low/open
P0108	MAP sensor failed high/open port

Diagnostic Tips

Shorted IAC wiring can cause MAP sensor DTCs.

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.

- Check MAP sensor output. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the MAP sensor. The signal voltage should decrease as the vacuum is applied.
- The MAP, 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.

- MAP sensor codes may be set in cases of an intermittent TPS which has not yet set TPS codes.

See [Figure 6-11](#) 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](#).

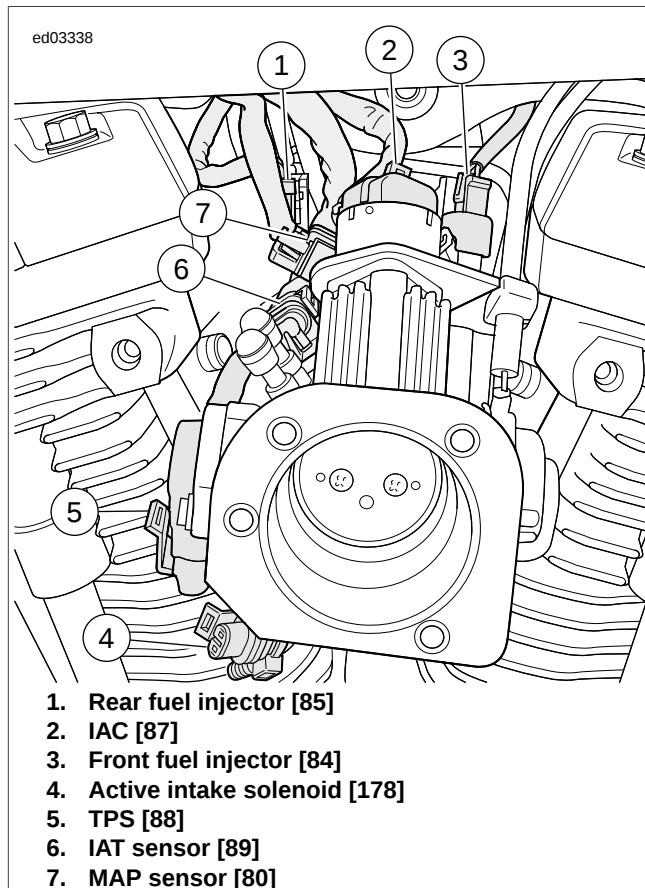


Figure 6-10. Between Cylinders Right Side

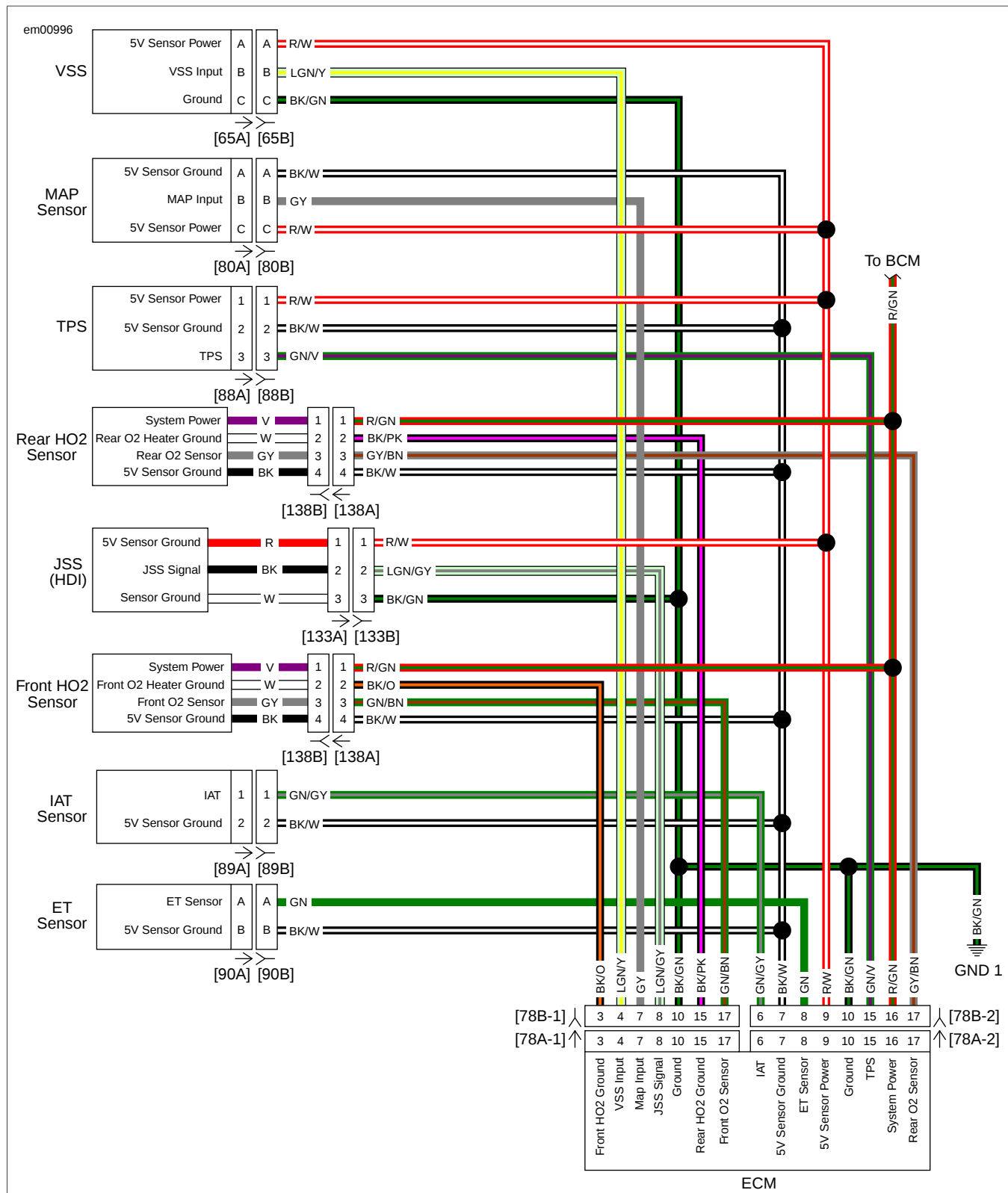


Figure 6-11. Sensor Circuit

DTC P0107

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-12. DTC P0107 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Open or shorted to ground signal wire
Open or shorted to ground 5V reference circuit

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire between [80B] terminals B (GY) wire and C (R/W) wire.
4. Clear DTCs.
5. Start engine.
6. Turn IGN OFF.
7. Check DTCs.
8. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace MAP sensor.

2. Signal Voltage Test

1. Turn IGN OFF.
2. Remove test wire.
3. Turn IGN ON.
4. Test voltage between [80B] terminal C (R/W) wire to ground.
5. Is voltage approximately 5V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 6.](#)

3. Signal Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [80B] terminal B (GY) wire and BOB [78-1] terminal 7.

5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GY) wire.

4. Signal Wire Shorted to Ground Test

1. Test continuity between BOB [78-1] terminal 7 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (GY) wire.
 - b. **No.** [Go to Test 5.](#)

5. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-1] terminal 7 and [78-2] terminal 7.
2. Is continuity present?
 - a. **Yes.** Repair short between (GY) and (BK/W) wires.
 - b. **No.** Replace ECM.

6. 5V Reference Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [80B] terminal C (R/W) wire and BOB [78-2] terminal 9.
5. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open in (R/W) wire.

7. 5V Reference Shorted to Signal Ground Test

1. Test continuity between BOB [78-2] terminals 9 and 7.
2. Is continuity present?
 - a. **Yes.** Repair short between the (R/W) and (BK/W) wires.
 - b. **No.** [Go to Test 8.](#)

NOTE

The following tests are related to IAC circuitry.

8. IAC A High Shorted to Voltage Test

1. Disconnect IAC [87].
2. Turn IGN ON.
3. Test voltage between BOB [78B-2] terminal 1 and ground.
4. Is voltage greater than 1.0V?
 - a. **Yes.** Repair short to voltage on (GN/O) wire.
 - b. **No.** [Go to Test 9.](#)

9. B High Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 12 and ground.
2. Is voltage greater than 1.0V?
 - a. **Yes.** Repair short to voltage on (GN/W) wire.
 - b. **No.** [Go to Test 10.](#)

10. B Low Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 13 and ground.
2. Is voltage greater than 1.0V?
 - a. **Yes.** Repair short to voltage on (GY/W) wire.
 - b. **No.** Replace ECM.

DTC P0108

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4-P	ECM OVERLAY

Table 6-13. DTC P0108 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Short to voltage

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Clear DTC.
4. Start engine.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace MAP sensor.

2. Signal Wire Short to 5V Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) to wire harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).

3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 7 and [78-2] terminal 9.
5. Is continuity present?
 - a. **Yes.** Repair short between (R/W) and (GY) wires.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-1] terminal 7 and ground.
3. Is voltage present?
 - a. **Yes.** Repair short to voltage in (GY) wire.
 - b. **No.** [Go to Test 4.](#)

4. Ground Wire Open Test

1. Turn IGN ON.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) to wire harness [78B-1] and [78B-2], leaving EMC [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [80B] terminal A and BOB [78-2] terminal 7.
4. Is continuity present?
 - a. **Yes.** Replace the MAP sensor.
 - b. **No.** [Go to Test 5.](#)

5. IAC B High Shorted to Voltage Test

1. Disconnect IAC [87].
2. Turn IGN ON.
3. Test voltage between BOB [78B-2] terminal 12 and ground.
4. Is voltage greater than 1.0V?
 - a. **Yes.** Repair short to voltage on (GN/W) wire.
 - b. **No.** [Go to Test 6.](#)

6. B Low Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 13 and ground.
2. Is voltage greater than 1.0V?
 - a. **Yes.** Repair short to voltage on (GY/W) wire.
 - b. **No.** Replace ECM.

DTC P0112, P0113

6.7

DESCRIPTION AND OPERATION

The ECM supplies and monitors a voltage signal on [78-2] terminal 6 to one side of the IAT sensor. The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM [78-2] terminal 7.

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 [78-2] terminal 6.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on [78-2] 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.

Table 6-14. Code Description

DTC	DESCRIPTION
P0112	IAT sensor low/shorted
P0113	IAT sensor high/open

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 [78-1] and [78-2] 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.

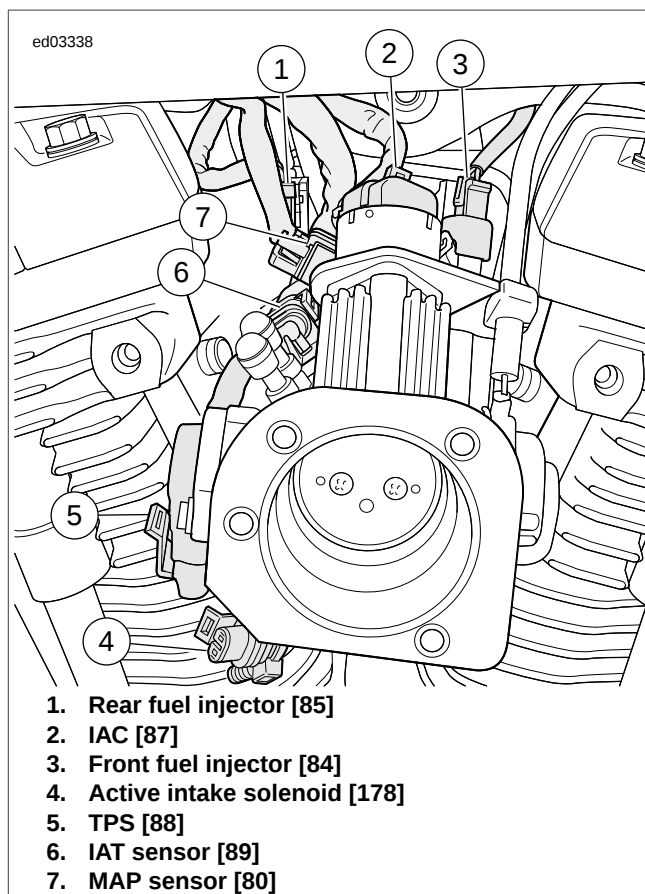


Figure 6-12. Between Cylinders Right Side

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](#).

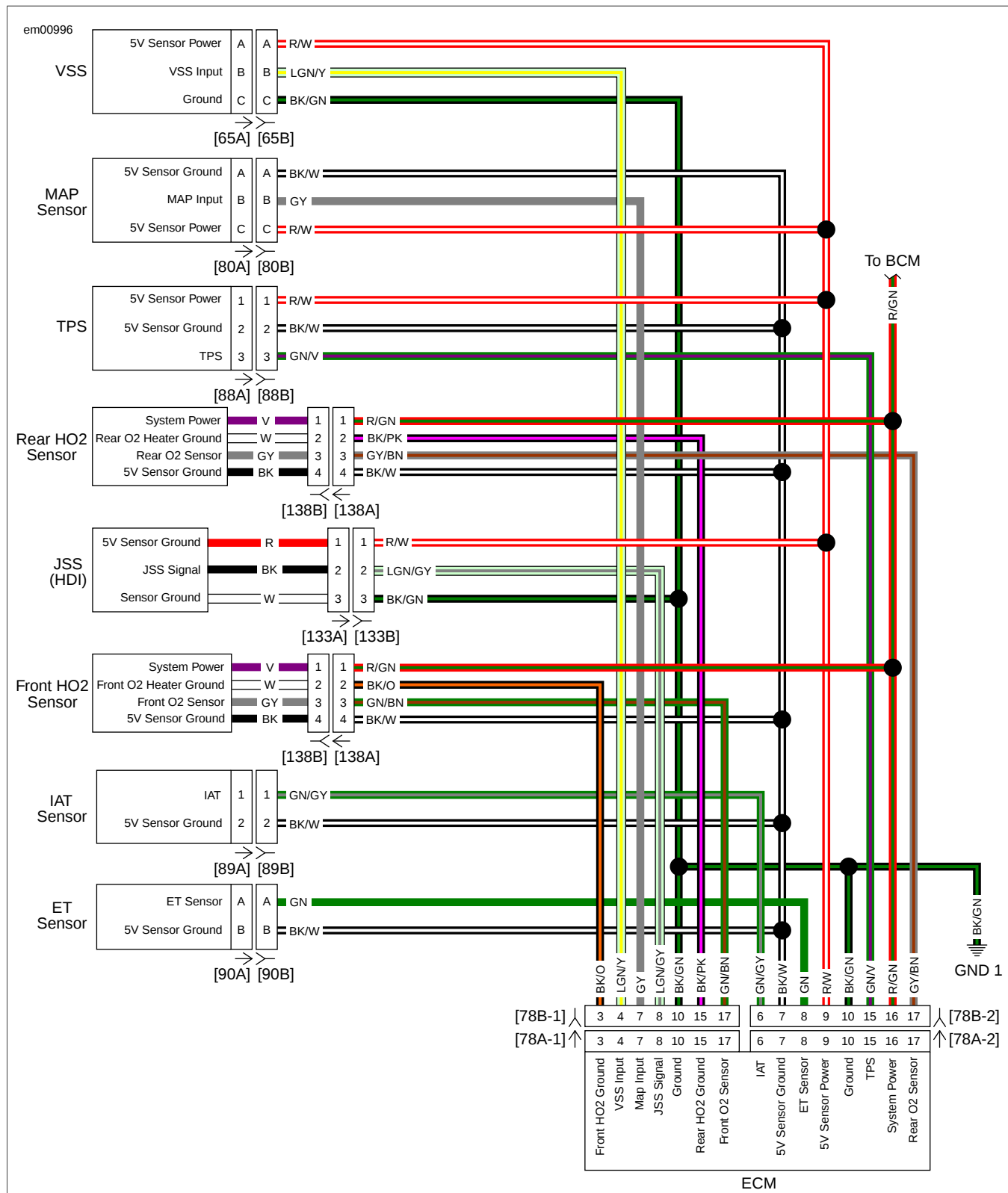


Figure 6-13. Sensor Circuit

DTC P0112

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-15. DTC P0112 Diagnostic Faults

POSSIBLE CAUSES
IAT sensor malfunction
Short to ground in 5V reference circuit

NOTE

Vehicle and sensor must be at ambient room temperature before starting diagnostic test.

1. IAT Sensor Test

1. Turn IGN OFF.
2. Disconnect IAT sensor [89].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [89A] terminals 1 (GN/GY) wire and 2 (BK/W) wire.
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace IAT sensor.
4. Is resistance between 500-5000?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace IAT sensor.

2. Signal Grounded Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-2] terminals 6 and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground on (GN/GY) wire.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-2] terminals 6 and 7.
2. Is continuity present?
 - a. **Yes.** Repair short between [89B] terminals 1 (GN/GY) wire and 2 (BK/W) wire.
 - b. **No.** Replace ECM.

DTC P0113

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-16. DTC P0113 Diagnostic Faults

POSSIBLE CAUSES
IAT sensor malfunction
Open or short to voltage in 5V reference circuit

1. IAT Signal Voltage Test

1. Turn IGN OFF.
2. Disconnect IAT sensor [89].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [89B] terminal 1 (GN/GY) wire and ground.
4. Turn IGN ON.
5. Is voltage greater than 6V?
 - a. **Yes.** Repair short to voltage on (GN/GY) wire.
 - b. **No.** [Go to Test 2.](#)

2. Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [89B] terminal 1 (GN/GY) and BOB [78-2] terminal 6.
5. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open circuit.

3. Open Ground Wire Test

1. Test continuity between BOB [78-2] terminal 7 and [89B] terminal 2 (BK/W) wire.
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 continuity between BOB [78-2] terminals 6 and 9.

2. Is continuity present?
 - a. **Yes.** Repair short between (GN/GY) and (R/W) wires.
 - b. **No.** [Go to Test 5.](#)
2. Test continuity between BOB [78-2] terminals 6 and 7.
3. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace IAT sensor.

5. IAT Sensor Test

1. Connect [89].

DTC P0117, P0118

6.8

DESCRIPTION AND OPERATION

The ECM supplies and monitors a voltage signal from [78-2] terminal 8 to one side of the ET sensor. The other side of the ET sensor is connected to a common sensor ground. The ground is also connected to the ECM [78-2] terminal 7.

The ET sensor is a thermistor device. At a specific temperature it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on ECM [78-2] terminal 8.

- At high temperatures, the resistance of the sensor is very low. This lowers the signal voltage on ECM [78-2] terminal 8.
- At low temperatures, the resistance is very high. This allows 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 6-17. Code Description

DTC	DESCRIPTION
P0117	ET sensor shorted low
P0118	ET sensor high/open

Diagnostic Tips

Once the engine is started, the temperature should rise steadily to operating temperature.

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 [78-1] and [78-2] 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:** Measure ET and IAT sensor temperatures with a cool engine. The sensor temperatures should be within 10 °F (5.6 °C) of each other. If the two sensors are not within the specified range replace the inaccurate sensor.

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](#).

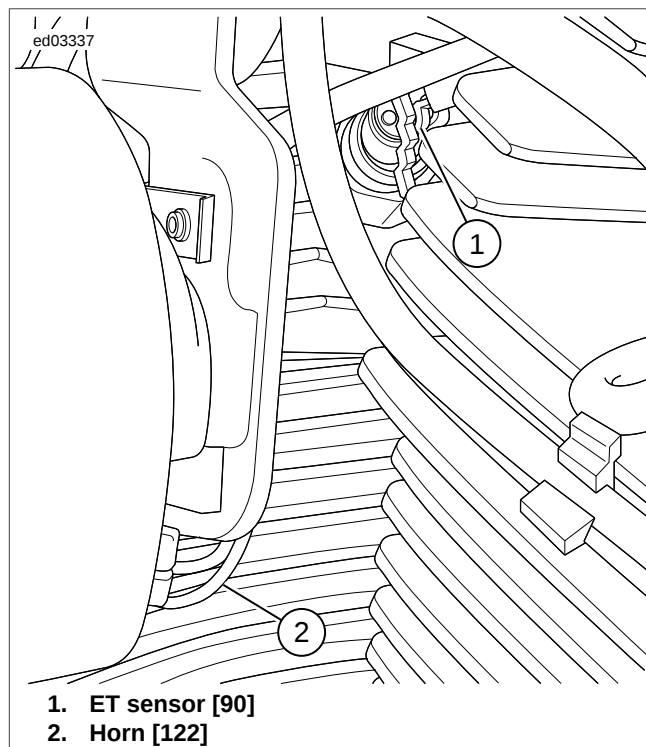


Figure 6-14. Horn and ET Sensor: Except FXS/B

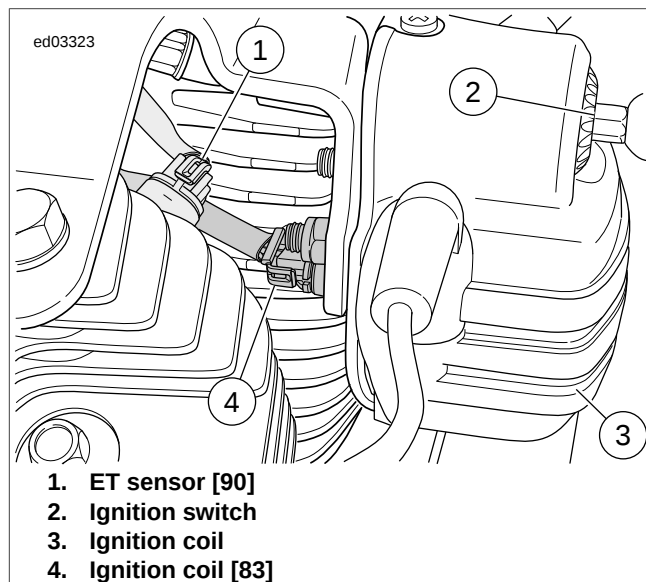


Figure 6-15. Behind Ignition Switch: FXS/B

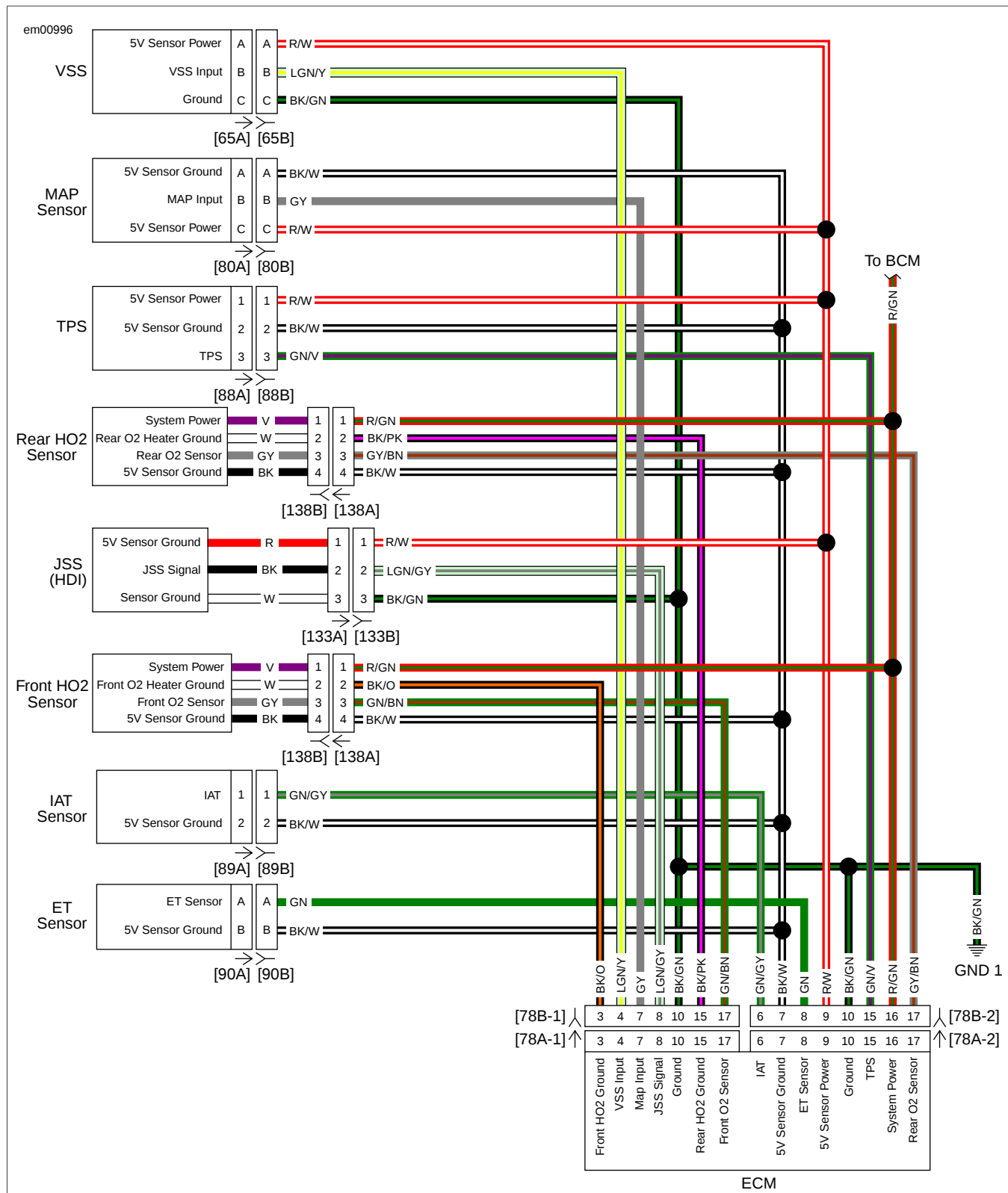


Figure 6-16. Sensor Circuit

DTC P0117

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-18. DTC P0117 Diagnostic Faults

POSSIBLE CAUSES
ET sensor malfunction
Short to ground in 5V reference circuit

1. ET Sensor Test

NOTE

Vehicle and sensor must be at ambient room temperature before starting diagnostic test.

1. Turn IGN OFF.
2. Disconnect ET sensor [90].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test the resistance between [90A] terminals A (GN) wire and B (BK/W) wire.
4. Is the resistance reading between 900-10,000 Ohms?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace ET sensor.

2. ET Sensor Signal Wire Shorted to Ground Test

1. Test resistance between [90B] terminal A (GN) wire and ground.
2. Is resistance less than 1 Ohm?
 - a. **Yes.** Repair short to ground in (GN) wire.
 - b. **No.** [Go to Test 3.](#)

3. ET Sensor Signal Wire Shorted to Sensor Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-2] terminals 8 and 7.
4. Is continuity present?
 - a. **Yes.** Repair short between [90B] terminals A (GN) wire and B (BK/W) wire.
 - b. **No.** Replace ECM.

DTC P0118

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-19. DTC P0118 Diagnostic Faults

POSSIBLE CAUSES
ET sensor malfunction
Open or short to voltage in 5V reference circuit

1. ET Signal Voltage Test

1. Turn IGN OFF.
2. Disconnect ET sensor [90].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [90B] terminal A (GN) wire and ground.
4. Turn IGN ON.
5. Is voltage greater than 6V?
 - a. **Yes.** Repair short to voltage on (GN) wire.
 - b. **No.** [Go to Test 2.](#)

2. ET Sensor Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [90B] terminal A (GN) wire and BOB [78-2] terminal 8.
5. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (GN) wire.

3. ET Sensor Open Ground Wire Test

1. Test continuity between [90B] terminal B (BK/W) wire and BOB [78-2] terminal 7.
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 continuity between BOB [78-2] terminals 8 and 9.

2. Is continuity present?
 - a. **Yes.** Repair short between (GN) and (R/W) wires.
 - b. **No.** [Go to Test 5.](#)

5. ET Sensor Test

1. Connect [90].

2. Test continuity between BOB [78-2] terminals 8 and 7.
3. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace ET sensor.

DTC P0122, P0123

DESCRIPTION AND OPERATION

The ECM supplies a 5V signal on [78-2] terminal 9 to terminal 1 of the TPS. The TPS sends a signal back to the ECM on [78-2] terminal 15. 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 6-20. Code Description

DTC	DESCRIPTION
P0122	TPS low/open
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 (GN/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.

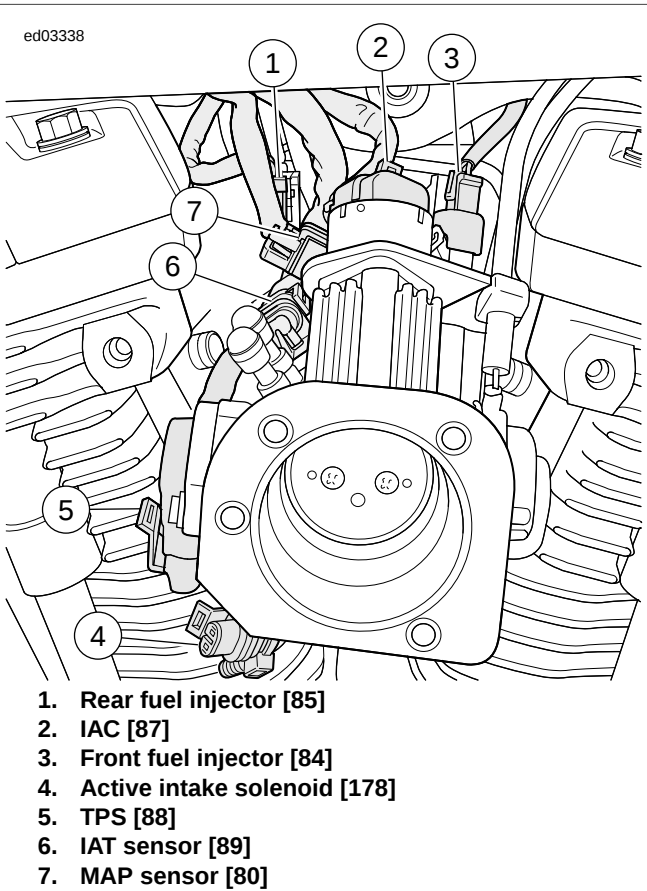


Figure 6-17. Between Cylinders Right Side

NOTE

The MAP, JSS (HDI), VSS and TPSs are 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-1] and [78B-2] 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. A TPS voltage change when a part is moved indicates an intermittent.
- **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.

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](#).

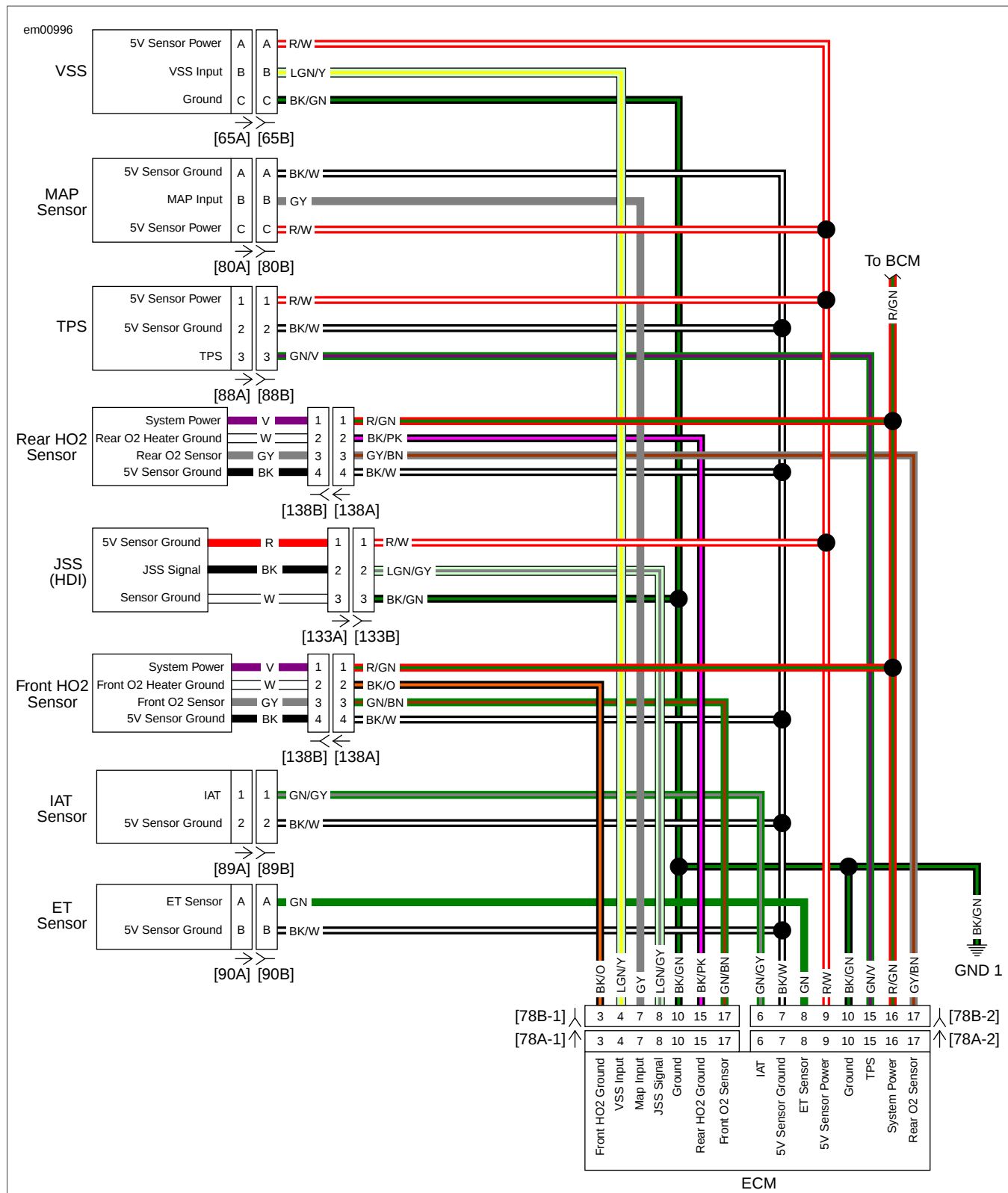


Figure 6-18. Sensor Circuit

DTC P0122

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-21. DTC P0122 Diagnostic Faults

POSSIBLE CAUSES
TPS malfunction
Open or short to ground in 5V reference circuit
Short to ground in signal circuit
Open in TPS sensor wire

1. TPS Circuit Test

1. Turn IGN OFF.
2. Disconnect TPS [88].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire across [88B] terminals 1(R/W) wire and 3 (GN/V) wire.
4. Clear DTCs.
5. Turn IGN OFF and ON.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace TPS.

2. Signal Voltage Test

1. Turn IGN OFF.
2. Remove test wire.
3. Turn IGN ON.
4. Test voltage between [88B] terminal 1 (R/W) wire and ground.
5. Is voltage approximately 5V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 6.](#)

3. Signal Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [88B] terminal 3 (GN/V) wire and BOB [78-2] terminal 15.

5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GN/V) wire.

4. Signal Wire Shorted to Ground Test

1. Test continuity between BOB [78-2] terminal 15 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (GN/V) wire.
 - b. **No.** [Go to Test 5.](#)

5. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-2] terminals 15 and 7.
2. Is continuity present?
 - a. **Yes.** Repair short between (GN/V) and (BK/W) wires.
 - b. **No.** Replace ECM.

6. 5V Sensor Power Open Wire Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [88B] terminal 1 (R/W) wire and BOB [78-2] terminal 9.
5. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (R/W) wire.

DTC P0123

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-22. DTC P0123 Diagnostic Faults

POSSIBLE CAUSES
TPS malfunction
Short to voltage in 5V reference circuit
Open sensor ground

1. TPS Test

1. Turn IGN OFF.
2. Disconnect TPS [88].

3. Clear DTCs.
4. Turn IGN OFF and ON.
5. Check DTCs.
6. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 4.](#)

2. Signal Wire Short to 5V Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [88B] terminals 1 (R/W) wire and 3 (GN/V) wire.
4. Is continuity present?
 - a. **Yes.** Repair short between (R/W) and (GN/V) wires.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [88B] terminal 3 (GN/V) wire and ground.

3. Is voltage present?
 - a. **Yes.** Repair short to voltage in (GN/V) wire.
 - b. **No.** Replace ECM.

4. 5V Shorted to Battery Voltage Test

1. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [88B] terminal 1 (R/W) wire 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. Ground Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [88B] terminal 2 (BK/W) wire and BOB [78-2] terminal 7.
5. Is continuity present?
 - a. **Yes.** Replace TPS.
 - b. **No.** Repair open in (BK/W) wire.

DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154

6.10

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The HO2S 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 HO2S fails.
- A P0132 (front) or P0152 (rear) is set when the ECM detects an excessively rich condition for a specified length of time. This can be caused by oil contamination or fuel injector malfunctions. DTCs may also set if HO2S fails.
- 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. Excessive oil usage may also cause these codes to set.
- When the air/fuel mixture is ideal, approximately 14.6 parts air to 1 part fuel, the voltage will be approximately 0.45V when measuring across the sensor. If the voltage is measured from the sensor (terminals 46 or 66) to ground, the voltage will read approximately 1.2V. This difference is due to an internal bias in the ECM. When using DIGITAL TECHNICIAN II (Part No. HD-48650), the O2 voltage reading is displayed in the higher range 0.7-1.7V.

Table 6-23. Code Description

DTC	DESCRIPTION
P0031	Front O2 heater open/low
P0032	Front O2 heater shorted/high
P0051	Rear O2 heater open/low
P0052	Rear O2 heater shorted/high
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

The heater portion of the HO2S is powered through the system relay. The front and rear HO2S heaters share a common ground through terminal 31 of the ECM. If the ECM recognizes an open or short in the heater circuit, it will set either DTC P0031 or P0032.

Diagnostic Tips

The HO2S 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. All historic HO2S DTCs are to be ignored and cleared. The multimeter displays the signal from the HO2S 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 [78-1] and [78-2], fuel injector [84, 85] and HO2S [137, 138] 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.
- **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.
- **Loose HO2S:** If an HO2S is loose, engine performance may be affected. This could also show up as a slow changing HO2S 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 HO2S will read a lean condition, causing the system to go rich.
- **Engine misfire:** See [6.29 MISFIRE AT IDLE OR UNDER LOAD](#).
- **Intake leaks:** See the service manual.

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](#).

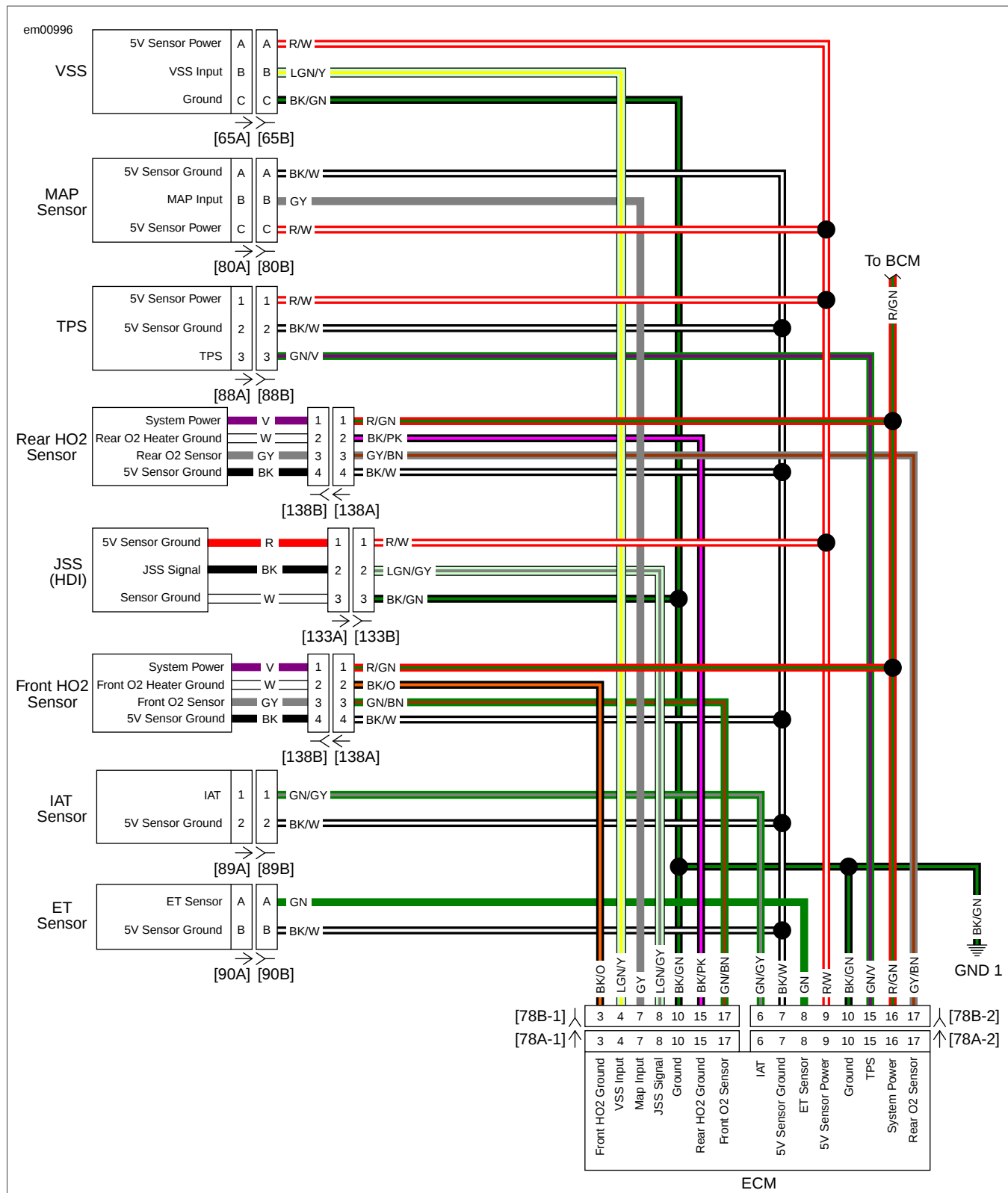


Figure 6-19. Sensor Circuit

DTC P0031

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-24. DTC P0031 Diagnostic Faults

POSSIBLE CAUSES
Open or short to ground on front HO2 circuit
HO2 malfunction
Open in sensor power circuit

1. Front HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 1 (R/GN) wire and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R/GN) wire.

2. Open Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 3 and [138A] terminal 2 (BK/O) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK/O) wire.

3. Short to Ground Test

1. Test for continuity between BOB [78-1] terminal 3 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (BK/O) wire.
 - b. **No.** [Go to Test 4.](#)

4. Resistance Test

1. Test resistance between [138B] terminals 1 (R/GN) wire and 2 (BK/O) wire.

2. Is resistance between 13.5-23.5 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace front HO2S.

DTC P0032

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-25. DTC P0032 Diagnostic Faults

POSSIBLE CAUSES
Front HO2 circuit shorted to 12V
HO2 malfunction

1. Front HO2S Shorted to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test voltage between BOB [78-1] terminal 3 and ground.
5. Is voltage present?
 - a. **Yes.** Repair short to voltage on (BK/O) wire.
 - b. **No.** [Go to Test 2.](#)

2. Resistance Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Test resistance between [138B] terminals 1 (R/GN) wire and 2 (BK/O) wire.
4. Is resistance between 13.5-23.5 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace front HO2S.

DTC P0051

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-26. DTC P0051 Diagnostic Faults

POSSIBLE CAUSES
Open or short to ground on rear HO2 circuit
HO2 malfunction
Open in sensor power circuit

1. Rear HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 1 (R/GN) wire and ground.
5. Is battery voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (R/GN) wire.

2. Open Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 15 and [137A] terminal 2 (BK/PK) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (BK/PK) wire.

3. Short to Ground Test

1. Test continuity between BOB [78-1] terminal 15 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground in (BK/PK) wire.
 - b. **No.** [Go to Test 4.](#)

4. Resistance Test

1. Test resistance between [137B] terminals 1 (R/GN) wire and 2 (BK/PK) wire.

2. Is resistance between 13.5-23.5 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace rear HO2S.

DTC P0052

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-27. DTC P0052 Diagnostic Faults

POSSIBLE CAUSES
Rear HO2 circuit shorted to voltage
Rear HO2 malfunction

1. Rear HO2S Shorted to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-1] terminal 15 and ground.
6. Is voltage present?
 - a. **Yes.** Repair short to voltage on (BK/PK) wire.
 - b. **No.**

2. Resistance Test

1. Turn IGN OFF.
2. Test resistance between [137B] terminals 1 (R/GN) wire and 2 (BK/PK) wire.
3. Is resistance between 13.5-23.5 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace front HO2S.

DTC P0131

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-28. DTC P0131 Diagnostic Faults

POSSIBLE CAUSES
Front HO2S malfunction
Short to ground in signal circuit
Fuel system malfunction

NOTE

Vehicle and sensor must be at ambient room temperature before starting diagnostic test.

1. Front HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 3 (GN/BN) wire, to ground.
5. Is voltage approximately 5V?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** [Go to Test 2.](#)

2. HO2S Test

1. Test continuity between [138B] terminal 3 (GY) wire and ground.
2. Is continuity present?
 - a. **Yes.** Replace HO2S.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [138A] terminals 3 (GN/BN) wire and 4 (BK/W) wire.
4. Is continuity present?
 - a. **Yes.** Repair short between (GN/BN) and (BK/W) wires.
 - b. **No.** [Go to Test 4.](#)

4. Signal Wire Shorted to Ground Test

1. Test continuity between [138A] terminal 3 (GN/BN) wire and ground.

2. Is continuity present?
 - a. **Yes.** Repair short between (GN/BN) wire and ground.
 - b. **No.** Replace ECM.

5. Operation Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Connect [138].
4. Start engine and allow it to reach operating temperature.
5. With engine speed at a steady rpm, test voltage between BOB [78-1] terminal 17 and [78-2] terminal 7.
6. Is voltage approximately 0.45V?
 - a. **Yes.** Replace ECM.
 - b. **No.** (0.0-0.4V). Perform fuel pressure test. Look for incorrect ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace HO2S.

DTC P0132

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-29. DTC P0132 Diagnostic Faults

POSSIBLE CAUSES
Front HO2S malfunction
Fuel system malfunction

1. Front HO2S Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start engine and allow it to reach operating temperature.
5. With engine speed at a steady rpm, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-1] terminal 17 and [78-2] terminal 7.

6. Is voltage approximately 0.45V?
 - a. **Yes.** Replace ECM.
 - b. **No.** (0.6-1.0V) Perform fuel pressure test. Look for incorrect ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the HO2S.

DTC P0134

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-30. DTC P0134 Diagnostic Faults

POSSIBLE CAUSES
Front O2 sensor malfunction
Open or short to voltage in signal circuit
Open sensor ground

1. Front HO2S Signal Wire Short Circuit Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 3 (GN/BN) wire to ground.
5. Is voltage greater than 5V?
 - a. **Yes.** Repair short to voltage on (GN/BN) wire.
 - b. **No. Greater than 4V.** [Go to Test 2.](#)
 - c. **No. Less than 4V.** [Go to Test 3.](#)

2. Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [138A] terminal 4 (BK/W) wire and BOB [78-2] terminal 7.
5. Is continuity present?
 - a. **Yes.** Replace front O2 sensor.
 - b. **No.** Repair open on (BK/W) wire.

3. Signal Wire Open Test

1. Test continuity between [138A] terminal 3 (GN/BN) wire and BOB [78-1] terminal 17.
2. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (GN/BN) wire.

DTC P0151

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-31. DTC P0151 Diagnostic Faults

POSSIBLE CAUSES
Rear O2 sensor malfunction
Short to ground in signal circuit
Fuel system malfunction

NOTE

Vehicle and sensor must be at ambient room temperature before starting diagnostic test.

1. Rear HO2S Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 3 (GY/BN) wire to ground.
5. Is voltage approximately 5V?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** [Go to Test 2.](#)

2. HO2S Test

1. Test continuity between [138B] terminal 3 (GY) wire and ground.
2. Is continuity present?
 - a. **Yes.** Replace HO2S.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [137A] terminals 3 (GY/BN) wire and 4 (BK/W) wire.

4. Is continuity present?
 - a. **Yes.** Repair short between (GY/BN) and (BK/W) wires.
 - b. **No.** [Go to Test 4.](#)

4. Signal Wire Shorted to Ground Test

1. Test continuity between [137A] terminal 3 (GY/BN) wire and ground.
2. Is continuity present?
 - a. **Yes.** Repair short between (GY/BN) wire and ground.
 - b. **No.** Replace ECM.

5. Operation Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Start engine and allow it to reach operating temperature.
4. With engine speed at a steady rpm, test voltage between BOB [78-2] terminal 17 and [78-2] terminal 7.
5. Is voltage approximately 0.45V?
 - a. **Yes.** Replace ECM.
 - b. **No.** (0.0-0.4V). Perform fuel pressure test. Look for incorrect ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace HO2S.

DTC P0152

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-32. DTC P0152 Diagnostic Faults

POSSIBLE CAUSES
Rear O2 sensor malfunction
Fuel system malfunction

1. Rear HO2S Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start engine and allow it to reach operating temperature.

5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with engine speed at a steady rpm, test voltage between BOB [78-2] terminal 17 and [78-2] terminal 7.
6. Is voltage approximately 0.45V?
 - a. **Yes.** Replace ECM.
 - b. **No.** (0.6-1.0V). Perform fuel pressure test. Look for incorrect ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the HO2S.

DTC P0154

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-33. DTC P0154 Diagnostic Faults

POSSIBLE CAUSES
Rear O2 sensor malfunction
Open or short voltage in signal circuit
Open sensor ground

1. Rear HO2S Signal Wire Short Circuit Voltage Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 3 (GY/BN) wire to ground.
5. Is voltage greater than 5V?
 - a. **Yes.** Repair short to voltage on (GY/BN) wire.
 - b. **No. Greater than 4V.** [Go to Test 2.](#)
 - c. **No. Less than 4V.** [Go to Test 3.](#)

2. Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between [137A] terminal 4 (BK/W) wire and BOB [78-2] terminal 7.
5. Is continuity present?
 - a. **Yes.** Replace rear HO2S.
 - b. **No.** Repair open on (BK/W) wire.

3. Signal Wire Open Test

1. Test continuity between [137A] terminal 3 (GY/BN) wire and BOB [78-2] terminal 17.
2. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (GY/BN) wire.

DTC P0261, P0262, P0264, P0265

6.11

DESCRIPTION AND OPERATION

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 BCM. The ECM provides the path to ground to trigger the injectors.

NOTE

System power failures or wiring harness problems will cause 12V power to be lost to both injectors and the ignition coils.

Table 6-34. Code Description

DTC	DESCRIPTION
P0261	Fuel injector low/open (front)
P0262	Fuel injector high/shorted (front)
P0264	Fuel injector low/open (rear)
P0265	Fuel injector high/shorted (rear)

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

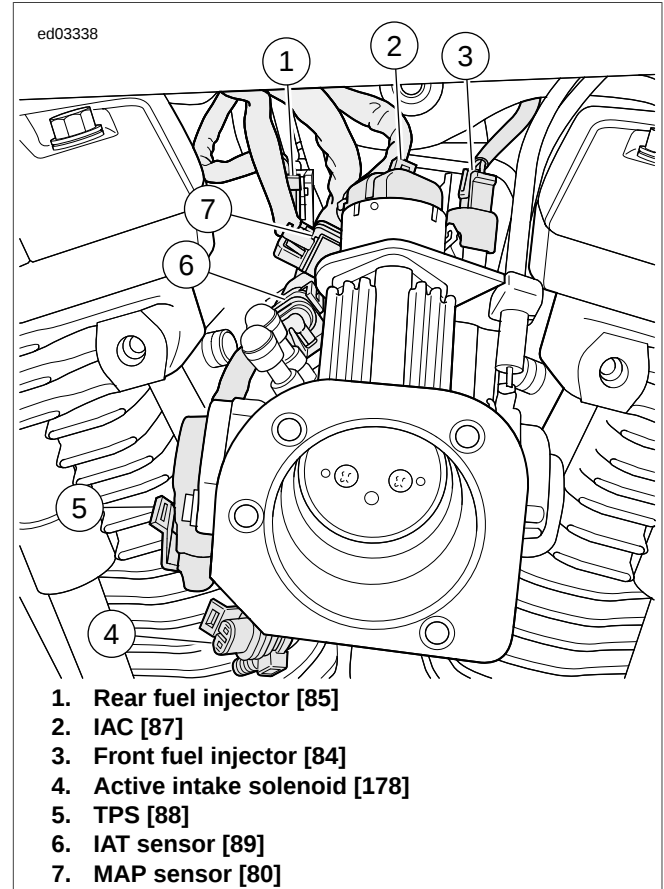


Figure 6-20. Between Cylinders Right Side

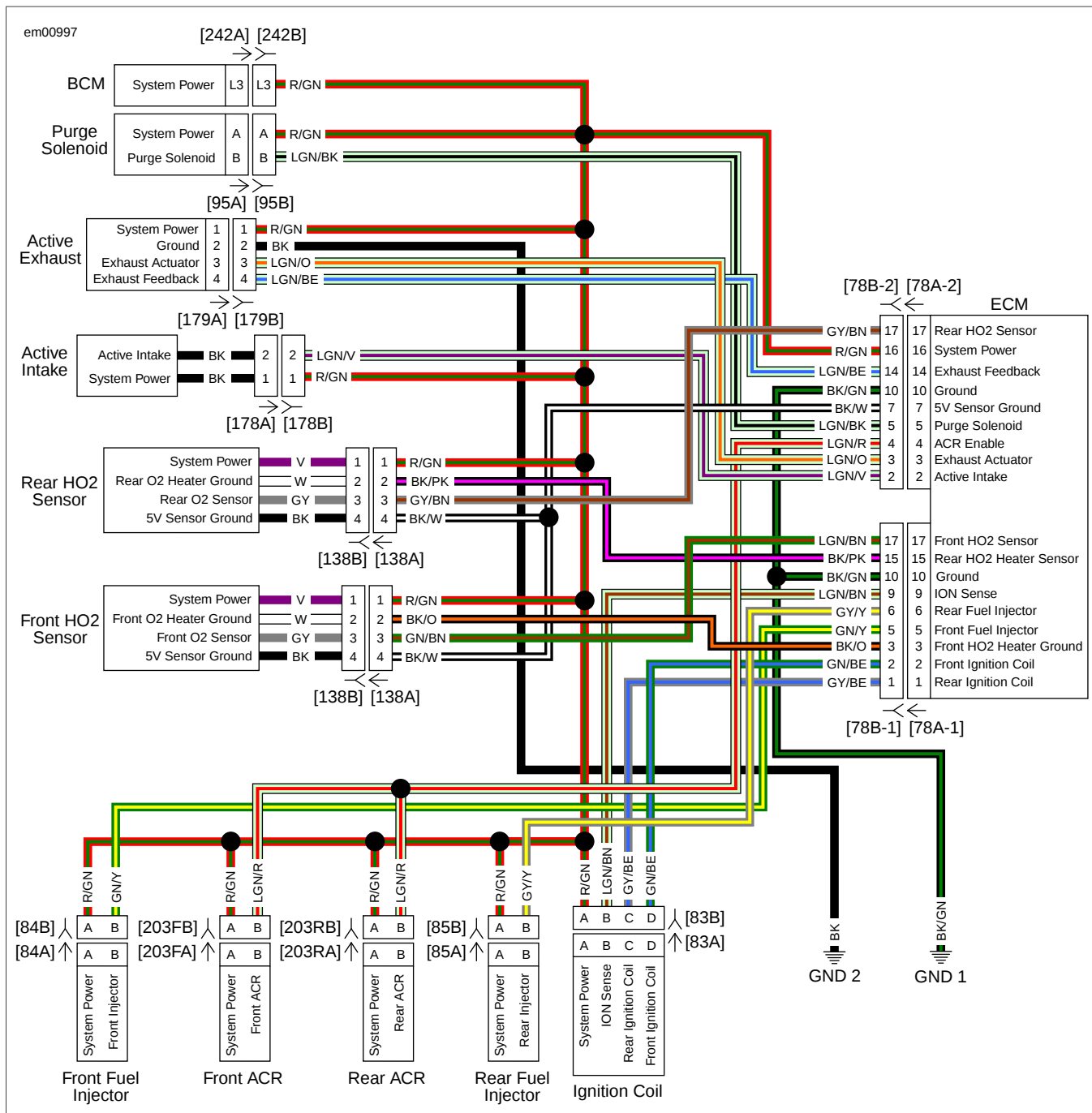


Figure 6-21. System Power Circuit

DTC P0261

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-35. DTC P0261 Diagnostic Faults

POSSIBLE CAUSES
Front fuel injector malfunction
Open signal circuit
Open power circuit

1. Front Fuel Injector Test

1. Turn IGN OFF.
2. Disconnect front fuel injector [84].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [84B].
4. Crank engine.
5. Does light flash when engine is cranking (or running)?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No, lamp does not illuminate.** [Go to Test 2.](#)
 - c. **No, lamp is on steady.** [Go to Test 5.](#)

2. Power Circuit Open Test

1. Turn IGN OFF.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-2] terminal 16 and [84B] terminal A (R/GN) wire.
6. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (R/GN) wire.

3. Control Circuit Open Test

1. Test continuity between BOB [78-1] terminal 5 and [84B] terminal B (GN/Y) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GN/Y) wire.

4. Injector Resistance Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [84A] terminals A (R/GN) wire and B (GN/Y) wire.
2. Is resistance between 10-20 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace front injector.

5. Driver Short to Ground Test

1. Remove fuel injector test light.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [84A] terminal B and ground.
3. Is continuity present?
 - a. **Yes.** Repair short to ground on (GN/Y) wire.
 - b. **No.** Replace ECM.

DTC P0262

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-36. DTC P0262 Diagnostic Faults

POSSIBLE CAUSES
Front fuel injector malfunction
Short to ground in signal circuit

1. Front Fuel Injector Control Circuit Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect front injector [84].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [84B] terminal B (GN/Y) wire and ground.
5. Is voltage less than 5.0V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 2.](#)

2. Control Circuit Shorted to System Test

1. Turn IGN OFF.
2. Test continuity between [84B] terminals A (R/GN) wire and B (GN/Y) wire.
3. Is continuity present?
 - a. **Yes.** Repair short between (R/GN) and (GN/Y) wires.
 - b. **No.** Repair short to voltage on (GN/Y) wire.

3. Injector Resistance Test

1. Test resistance between [84A] terminals A (R/GN) wire and B (GN/Y) wire.

2. Is resistance between 10-20 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace front injector.

DTC P0264

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-37. DTC P0264 Diagnostic Faults

POSSIBLE CAUSES
Rear fuel injector malfunction
Open signal circuit
Open power circuit

1. Rear Fuel Injector Test

1. Turn IGN OFF.
2. Disconnect rear fuel injector [85].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [85B].
4. Crank engine.
5. Does lamp flash when engine is cranking (or running)?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No, lamp does not illuminate.** [Go to Test 2.](#)
 - c. **No, lamp is on steady.** [Go to Test 5.](#)

2. Power Circuit Open Test

1. Turn IGN OFF.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-2] terminal 16 and [85B] terminal A (R/GN) wire.
6. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (R/GN) wire.

3. Control Circuit Open Test

1. Test continuity between BOB [78-1] terminal 6 and [85B] terminal B (GY/Y) wire.

2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GY/Y) wire.

4. Injector Resistance Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [85A] terminal A and B of injector [85A].
2. Is resistance between 10-20 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace rear injector.

5. Driver Short to Ground Test

1. Remove fuel injector test light.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [85B] terminal B and ground.
3. Is continuity present?
 - a. **Yes.** Repair short to ground on (GY/Y) wire.
 - b. **No.** Replace ECM.

DTC P0265

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-38. DTC P0265 Diagnostic Faults

POSSIBLE CAUSES
Rear fuel injector malfunction
Short to ground in signal circuit

1. Rear Fuel Injector Control Circuit Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect rear injector [85].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [85B] terminal B (GY/Y) wire and ground.
5. Is voltage less than 5.0V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 2.](#)

2. Control Circuit Shorted to System Test

1. Turn IGN OFF.
2. Test continuity between [85B] terminals A (R/GN) wire and B (GY/Y) wire.
3. Is continuity present?
 - a. **Yes.** Repair short between (R/GN) and (GY/Y) wires.
 - b. **No.** Repair short to voltage on (GY/Y) wire.

3. Injector Resistance Test

1. Test resistance between [85A] terminals A (R/GN) wire and B (GY/Y) wire.
2. Is resistance between 10-20 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace rear injector.

DTC P0371, P0372, P0374

6.12

DESCRIPTION AND OPERATION

If the CKP sensor signal is weak or absent, DTCs P0371, P0372 or P0374 will be set. DTC P0371 or P0372 is usually set when several attempts to crank the engine have failed.

NOTE

If signal is not detected or cannot synchronize (DTC P0374), engine will not start.

Table 6-39. Code Description

DTC	DESCRIPTION
P0371	Crank position sensor too many pulses
P0372	Crank position sensor too few pulses
P0374	Crank position sensor no pulses

Diagnostic Tips

Engine must be cranked for more than five seconds without CKP signal to set P0374 code. Intermittent MAP or IAT wiring or sensor issues may cause these codes to set prior to setting MAP or IAT codes. Verify MAP or IAT wiring and sensor prior to replacing the ECM.

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

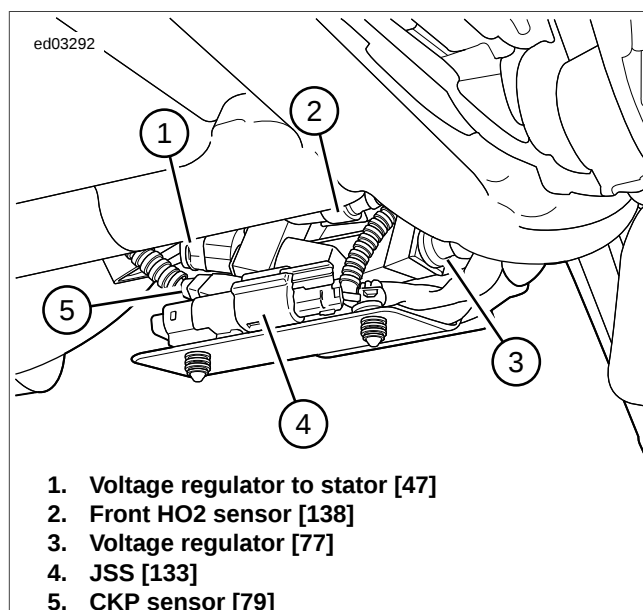


Figure 6-22. Under Voltage Regulator

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](#).

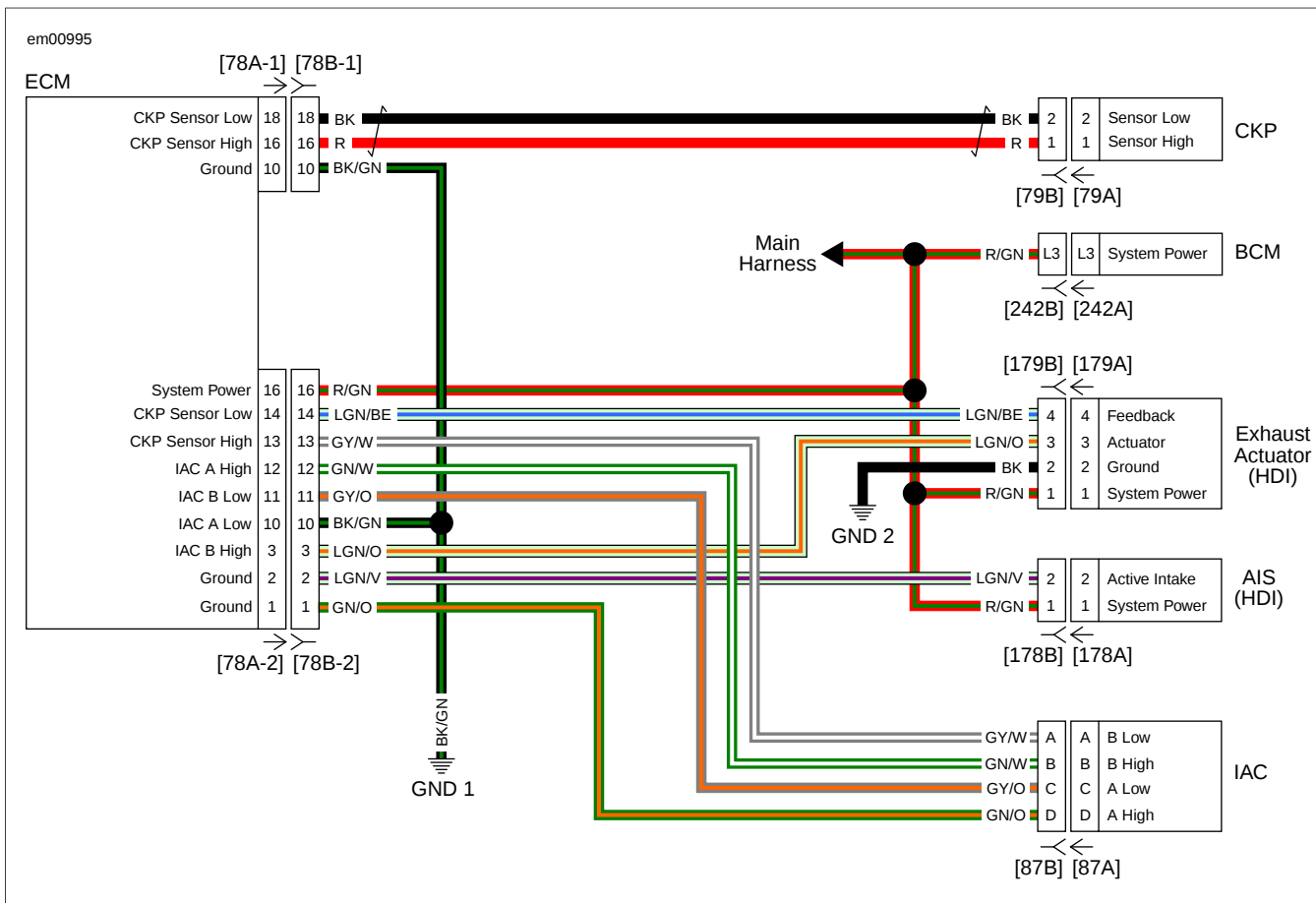


Figure 6-23. Active Exhaust Actuator and AIS Circuit

DTC P0371, P0372, P0374

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-40. DTC P0371, P0372, P0374 Diagnostic Faults

POSSIBLE CAUSES
CKP sensor malfunction
Open or short to ground in signal circuit
May be set if there are incorrect fluctuations from MAP that does not set MAP codes (examples - intermittent sensor or wiring issue)

1. CKP Sensor Connections Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Inspect connection for corrosion or backed out terminals.

4. Are terminal problems present?
 - a. **Yes.** Repair terminals as required.
 - b. **No.** [Go to Test 2.](#)

2. Signal Wire Continuity Test

1. Disconnect CKP sensor [79].
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-1] terminal 16 to [79B] terminal 1 (R) wire.
5. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open on (R) wire.

3. Ground Wire Continuity Test

1. Test continuity between BOB [78-1] terminal 18 to [79B] terminal 2 (BK) wire.

2. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open on (BK) wire.

4. Signal Wire Shorted to CKP Ground Wire Test

1. Test continuity between BOB [78-1] terminals 16 and 18.
2. Is continuity present?
 - a. **Yes.** Repair short between [79B] terminals 1 (R) and 2 (BK).
 - b. **No.** [Go to Test 5.](#)

5. Output Test

1. Connect CKP sensor [79].
2. Test AC voltage between BOB [78-1] terminals 16 and 18.
3. Crank engine for 5 seconds while observing multimeter.
4. Is AC voltage greater than 2V?
 - a. **Yes.** See diagnostic tips. If MAP and IAT sensors are good, replace the ECM.
 - b. **No.** Replace CKP sensor.

DTC P0444, P0445

DESCRIPTION AND OPERATION

Purge Solenoid (CA and Select Foreign Market Models Only)

See [Figure 6-24](#) and [Figure 6-25](#). The purge solenoid is mounted in front of the rear tire above the BCM. The solenoid connects to a fuel tank vent line and a vent canister.

A return line from the canister reconnects to the air intake manifold allowing vented fumes to be recirculated, for emission efficiency. The purge solenoid is timed to the throttle position and is disabled during startup, low engine temperature, low engine speed or low vehicle speed.

Power for the purge solenoid is supplied by the BCM. The BCM also provides power for the VSS, fuel injectors, active exhaust, active intake, ECM and the ignition coil.

The ECM provides a path to ground to trigger the purge solenoid.

NOTES

- *BCM or wiring harness problems will cause 12V power to be lost to the VSS, fuel injectors, active exhaust, active intake, ECM, ignition coil and purge solenoid.*
- *Purge solenoid is not installed on non-emission vehicles and DTCs P0444 and P0445 are not available. If these DTCs appear, the ECM should be reprogrammed.*

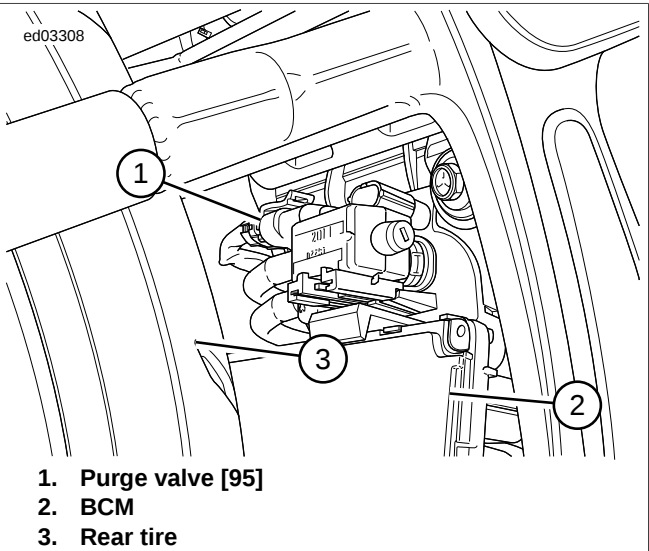


Figure 6-24. Purge Valve [95]: Except FXSB

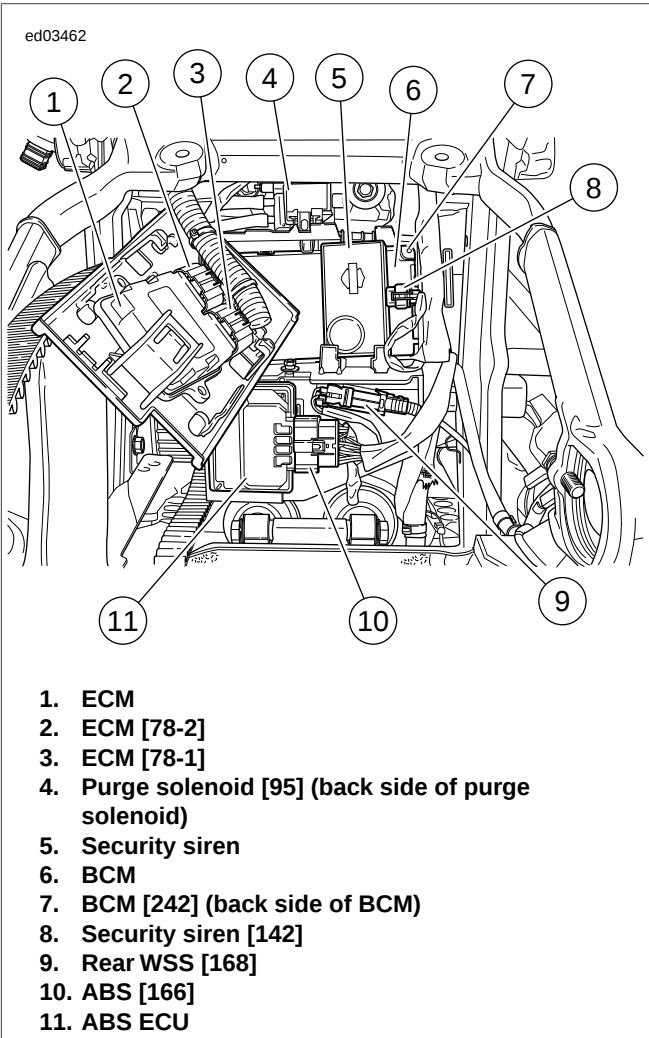


Figure 6-25. Electrical Panel: FXSB

Table 6-41. Code Description

DTC	DESCRIPTION
P0444	Purge solenoid low/open
P0445	Purge solenoid shorted high

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

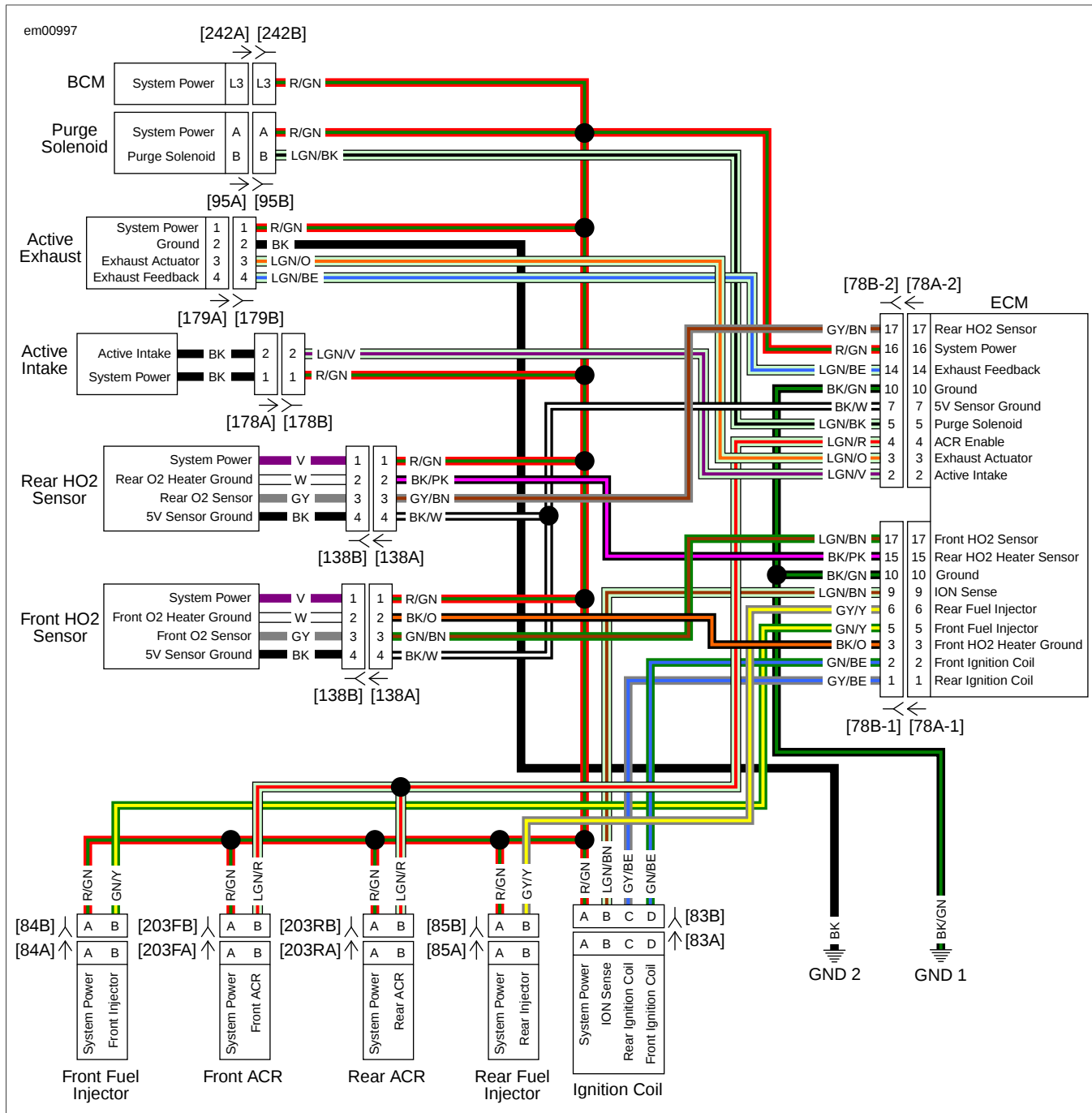


Figure 6-26. System Power Circuit

DTC P0444

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-42. DTC P0444 Diagnostic Faults

POSSIBLE CAUSES
Purge solenoid malfunction
Short to ground in signal circuit

1. Purge Solenoid Test

1. Turn IGN OFF.
2. Disconnect purge solenoid [95].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [95A] terminals A (R/GN) wire and B (LGN/BK) wire.
4. Is resistance between 4-21 Ohms?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace purge solenoid.

2. Purge Solenoid Voltage Test

1. Test voltage between [95B] terminal A (R/GN) wire and ground.
2. Turn IGN ON.
3. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 5.](#)

3. Control Wire Shorted to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [95B] terminal B (LGN/BK) wire and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground on (LGN/BK) wire.
 - b. **No.** [Go to Test 4.](#)

4. Control Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).

2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between [95B] terminal B (LGN/BK) wire and BOB [78-2] terminal 5.
4. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (LGN/BK) wire.

5. Power Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on breakout box.
3. Test continuity between [95B] terminal A (R/GN) wire and BOB terminal 16.
4. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (R/GN) wire.

DTC P0445

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-43. DTC P0445 Diagnostic Faults

POSSIBLE CAUSES
Purge solenoid malfunction
Short to voltage in signal circuit

1. Purge Solenoid Test

1. Turn IGN OFF.
2. Disconnect purge solenoid [95].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [95A] terminals A (R/GN) wire and B (LGN/BK) wire.
4. Is resistance between 4-21 Ohms?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace purge solenoid.

2. Purge Solenoid Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [95B] terminal B (LGN/BK) wire and ground.
3. Is voltage greater than 5.0V?
 - a. **Yes.** Repair short to voltage on (LGN/BK) wire.
 - b. **No.** Replace ECM.

DTC P0502, P0503

6.14

DESCRIPTION AND OPERATION

See [Figure 6-27](#). The VSS is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the BCM and the speedometer through the CAN bus circuit.

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 MAP, 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, P0502, P0503, 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 6-44. Code Description

DTC	DESCRIPTION
P0502	VSS failed low
P0503	VSS failed high

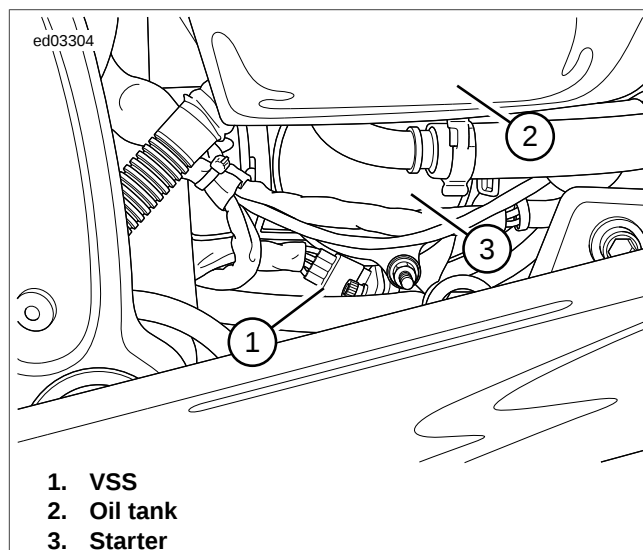


Figure 6-27. VSS

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

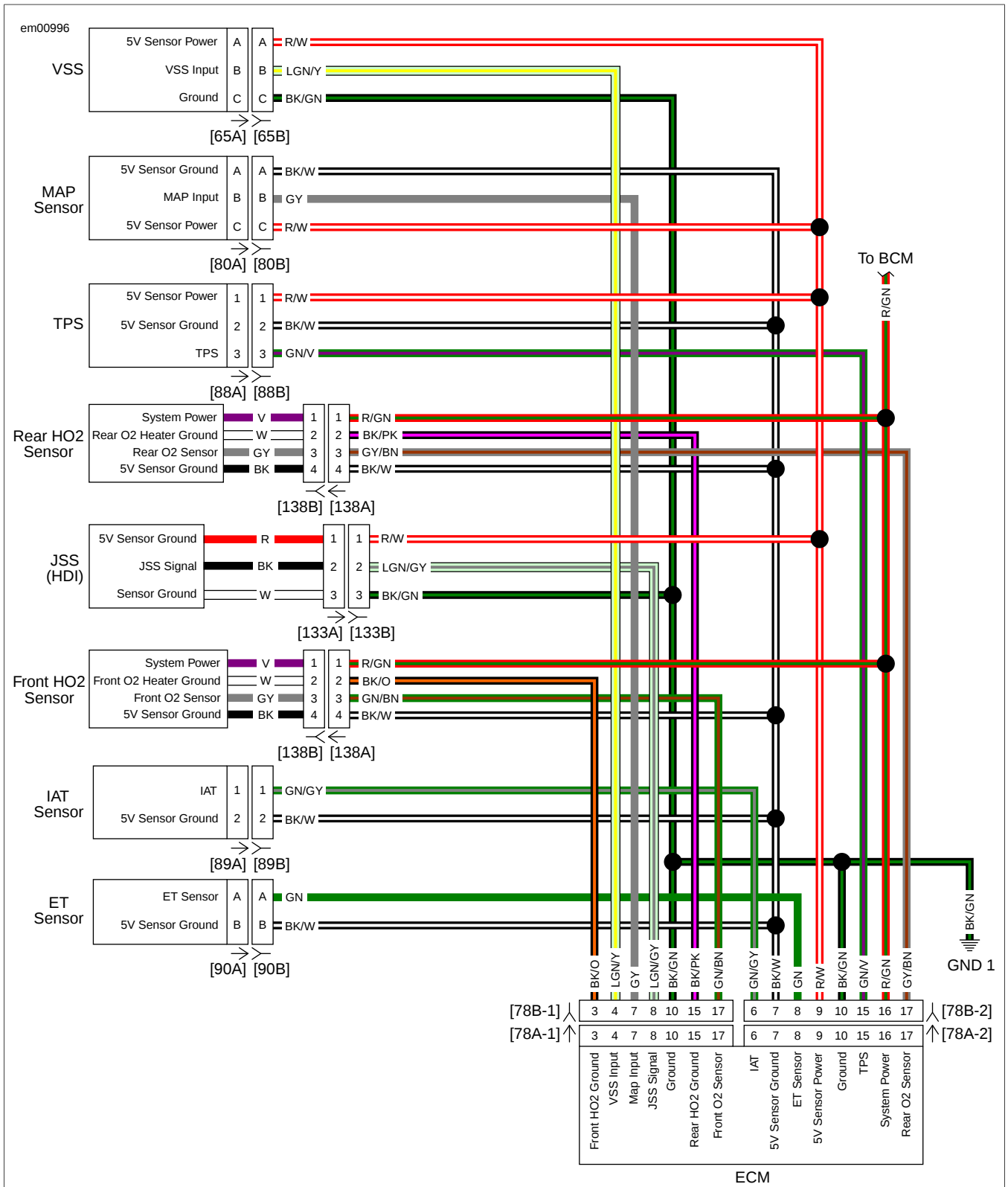


Figure 6-28. Sensor Circuit

DTC P0502

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-45. DTC P0502 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. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [65B] terminal A (R/W) wire and ground.
5. Is voltage approximately 5.0V?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open on (R/W) wire.

2. Signal Wire Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminals 4 and 10.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on (LGN/Y) wire.
 - b. **No.** [Go to Test 3.](#)

3. Signal Wire Open Test

1. Test continuity between BOB [78-1] terminal 4 and [65B] terminal B (LGN/Y) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open on (LGN/Y) wire.

4. Dirty or Damaged Test

1. Remove VSS.
2. Check for debris on sensor tip.

3. Is debris present?
 - a. **Yes.** Clean debris from VSS and install.
 - b. **No.** Replace VSS.

DTC P0503

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-46. DTC P0503 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. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [65B] terminals A (R/W) wire and C (BK/GN) wire.
5. Is voltage greater than 6.0V?
 - a. **Yes.** Repair short to voltage on (R/W) wire.
 - b. **No.** [Go to Test 2.](#)

2. Signal Wire Short to Voltage Test

1. Test voltage between [65B] terminal B (LGN/Y) wire and ground.
2. Is voltage above 6.0V?
 - a. **Yes.** Repair short to voltage on (LGN/Y) wire.
 - b. **No.** [Go to Test 3.](#)

3. VSS Ground Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-1] terminal 10 and [65B] terminal C (BK/GN) wire.
4. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open on (BK/GN) wire.

4. Signal Wire Shorted to Sensor Power Test

1. Test continuity between BOB [78-1] terminal 4 and [78-2] terminal 9.
2. Is continuity present?
 - a. **Yes.** Repair short between (LGN/Y) and (R/W) wires.
 - b. **No.** [Go to Test 5.](#)

5. VSS Test

1. Connect [78A-1] and [78A-2] to breakout box.
2. Clear DTC.
3. Did DTC reset?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace VSS.

DTC P0506, P0507

6.15

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

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 with 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.

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. These DTCs may occur with others for a multiple code situation. Resolve the other codes first to correct. A misfire condition or similar symptom affecting idle can cause P0506 to set. Inspect for these conditions before diagnosing DTCs.

Table 6-47. Code Description

DTC	DESCRIPTION
P0506	Idle speed control - rpm too low
P0507	Idle speed control - rpm too high

Diagnostic Tips

The following items may impact engine idle speed:

- 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-OE engine configuration can lead to idle instability and could generate a DTC.
- 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.

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

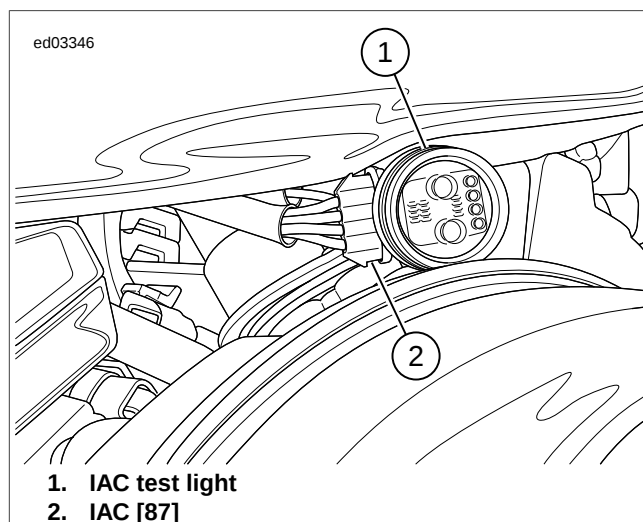


Figure 6-29. IAC Test Light

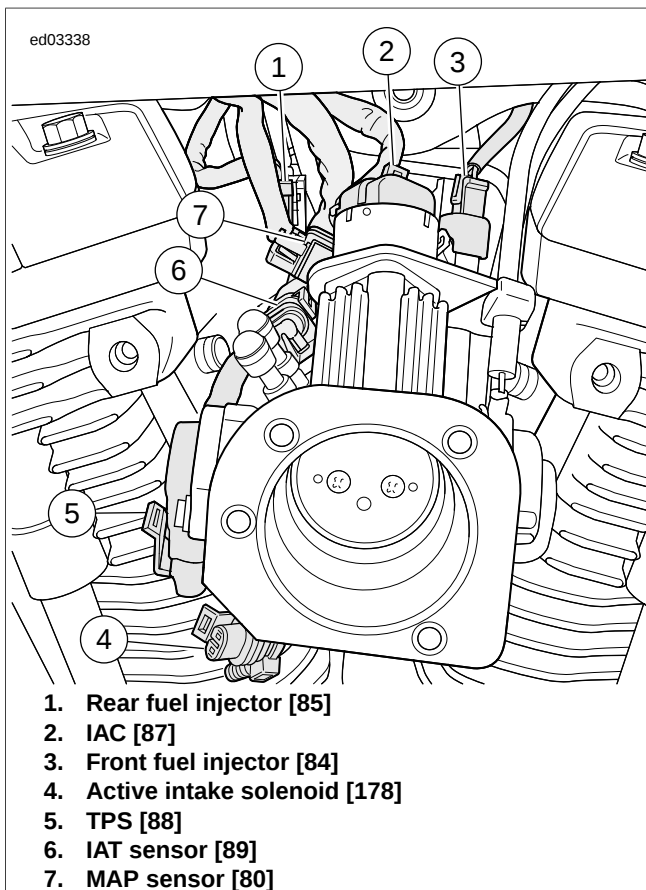


Figure 6-30. Between Cylinders Right Side

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](#).

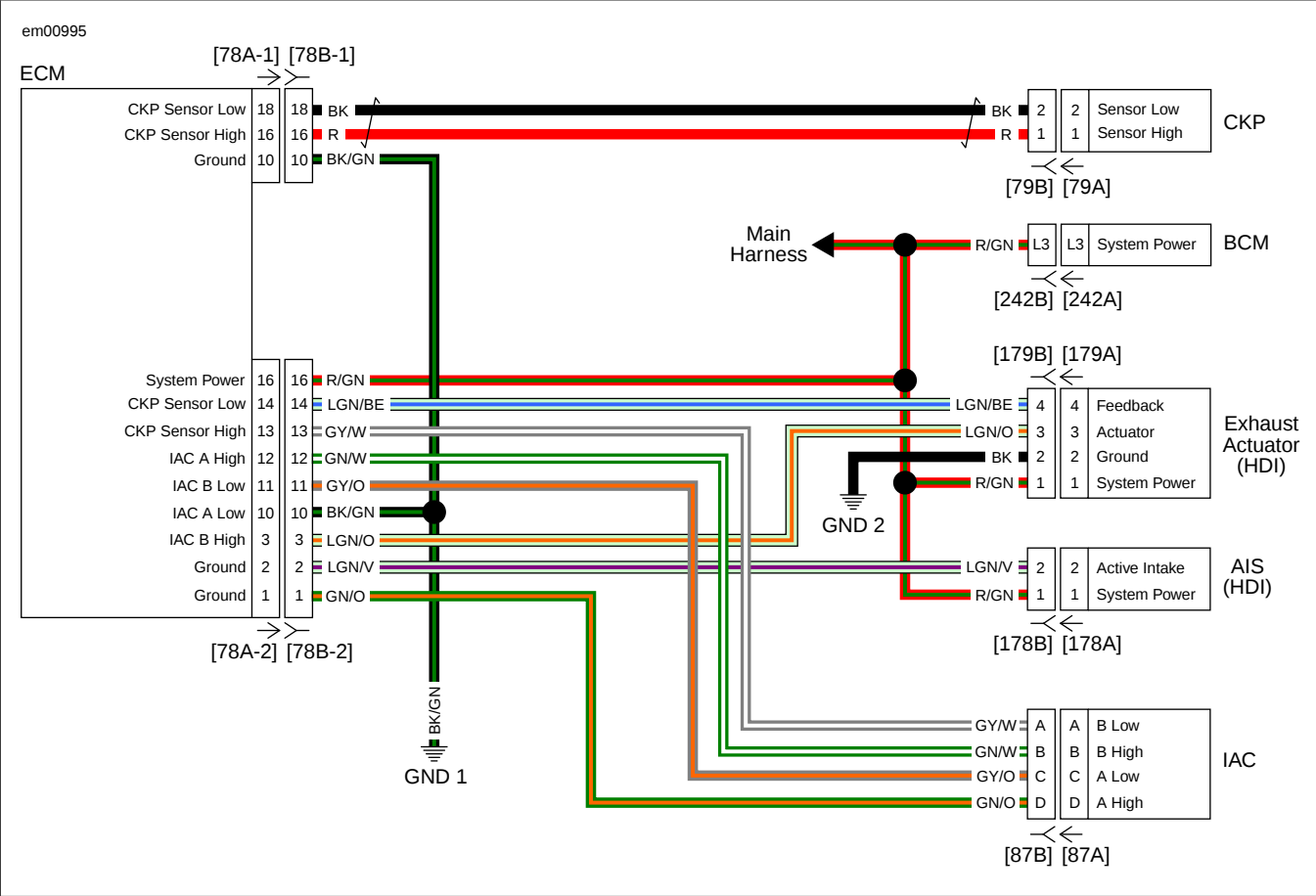


Figure 6-31. Active Exhaust Actuator and AIS Circuit

DTC P0506, P0507

PART NUMBER	TOOL NAME
HD-41199-3	IAC TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-48. DTC P0506, P0507 Diagnostic Faults

POSSIBLE CAUSES
IAC malfunction
Short to voltage in circuits
Short to ground in circuits
Open in system power circuit
Short between IAC circuits
Open circuits
Vacuum/air leaks
Fuel system problems

1. IAC Operational Test

- While watching the IAC pintle for movement turn IGN OFF, ON, then OFF.
- Did pintle move?
 - Yes.** IAC system operating properly. Check for improperly adjusted throttle stop, vacuum leaks, cylinder misfire, contaminated fuel, leaking injectors and engine mechanical failure.
 - No.** [Go to Test 2.](#)

2. Connector Test

- Disconnect IAC [87].
- Connect IAC TEST LIGHT (Part No. HD-41199-3) to [87B].
- Turn IGN ON.
- While observing test light, turn IGN OFF.
- Did both IAC test lights flash alternately?
 - Yes.** Replace IAC.
 - No.** [Go to Test 3.](#)

Table 6-49. IAC, Wire Color, ECM

IAC [87B]	WIRE COLOR	ECM [78-2]
A	GY/W	13
B	GN/W	12
C	GY/O	11
D	GN/O	1

3. Circuits Open Test

1. Turn IGN OFF.
2. Remove test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity on each IAC wire between BOB and [87B]. Refer to [Table 6-49](#).
6. Is continuity present on all circuits?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in appropriate circuit.

4. Circuits Shorted to Ground Test

1. Test continuity on each IAC wire between BOB and ground. Refer to [Table 6-49](#).
2. Is continuity present on any circuits?
 - a. **Yes.** Repair short to ground on appropriate circuit.
 - b. **No.** [Go to Test 5.](#)

5. Circuits Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB and ground on each IAC wire. Refer to [Table 6-49](#).
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 Circuits Test

1. Turn IGN OFF.
2. Test continuity between each IAC circuit and the other IAC circuits.
3. Is continuity present between any two IAC circuits?
 - a. **Yes.** Repair short between IAC circuits.
 - b. **No.** Replace ECM.

DTC P0603, P0605

6.16

DESCRIPTION AND OPERATION

See [Figure 6-32](#) and [Figure 6-33](#). The DTCs listed indicate a failure which requires replacement of the ECM. Refer to [Table 6-50](#).

NOTE

After replacing ECM, perform password learning procedure and clear DTCs using odometer self-diagnostics. See [2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics](#).

Table 6-50. Code Description

DTC	DESCRIPTION
P0603	ECM EEPROM memory error
P0605	ECM flash memory error

DTC P0603 Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** Replace ECM.
 - b. **No.** System operating properly.

DTC P0605 Test

1. Clear DTCs.
2. Attempt to program ECM using correct calibration.
3. Start engine.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ECM.
 - b. **No.** System operating properly.

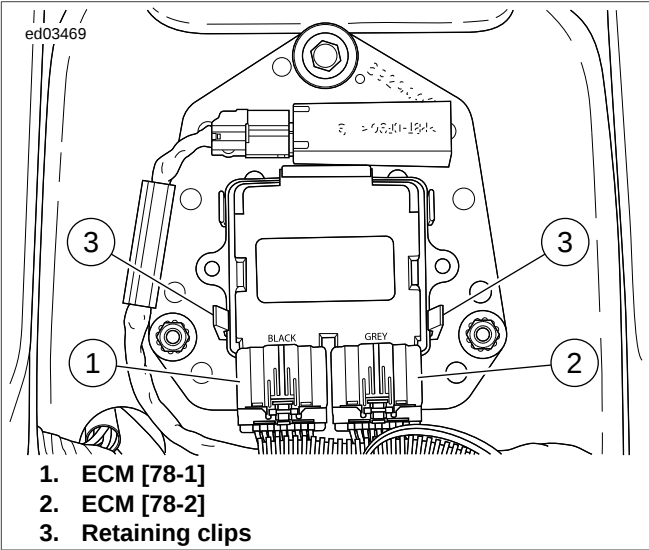


Figure 6-32. ECM [78-1] and [78-2]: Except FXSB

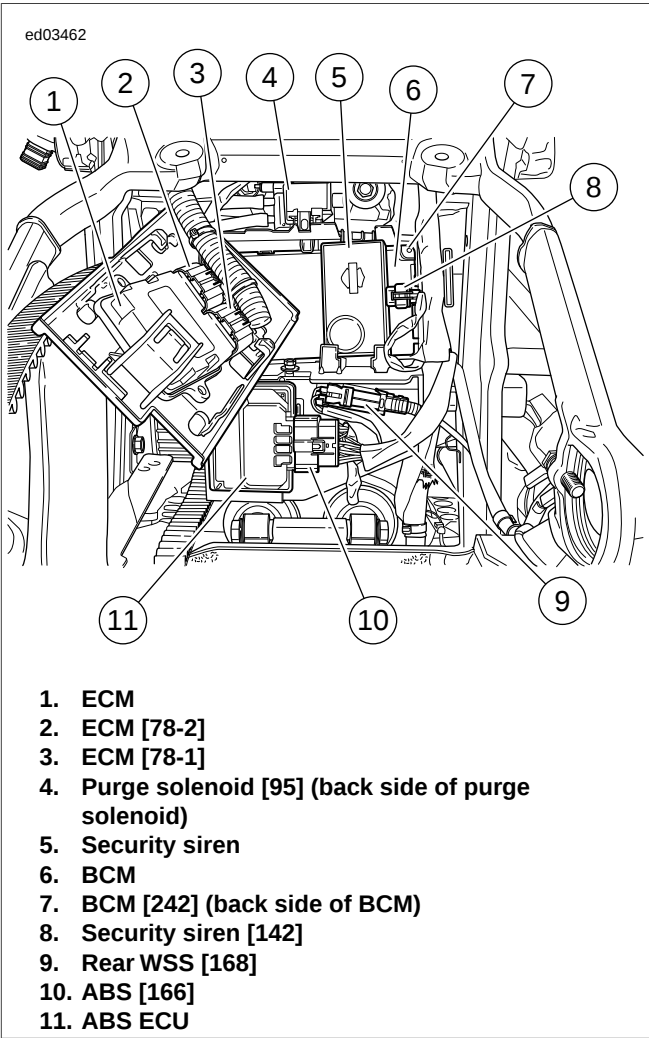


Figure 6-33. Electrical Panel: FXSB

DTC P0641

6.17

DESCRIPTION AND OPERATION

See [Figure 6-34](#), [Figure 6-35](#) and [Figure 6-36](#). The ECM supplies 5V to the VSS, MAP, TPS and JSS from [78-2] terminal 9. These sensors may have individual codes along with this code since they all share the 5V ref circuit. If the ECM sees a voltage of less than 4V or greater than 6V on the 5V ref circuit, P0641 will be set.

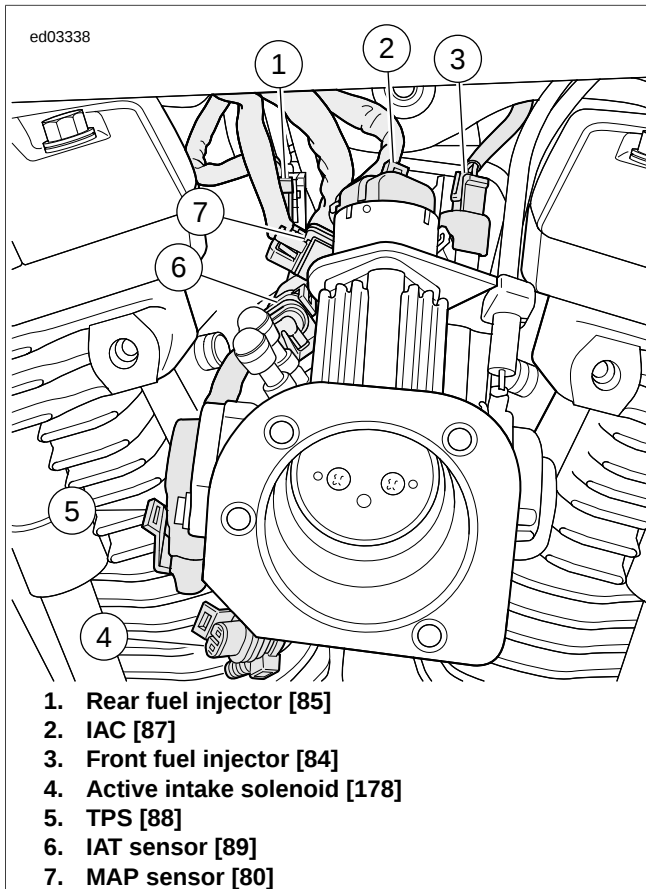


Figure 6-34. Between Cylinders Right Side

Table 6-51. Code Description

DTC	DESCRIPTION
P0641	5V Vref out of range

Any of these conditions will set a DTC P0641:

- Short to ground on the 5V sensor power circuit.
- Short to voltage on the 5V sensor power circuit.
- VSS fault or malfunction.
- MAP sensor fault or malfunction.
- TPS fault or malfunction.
- JSS (HDI) fault or malfunction.
- ECM fault or malfunction.

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](#).

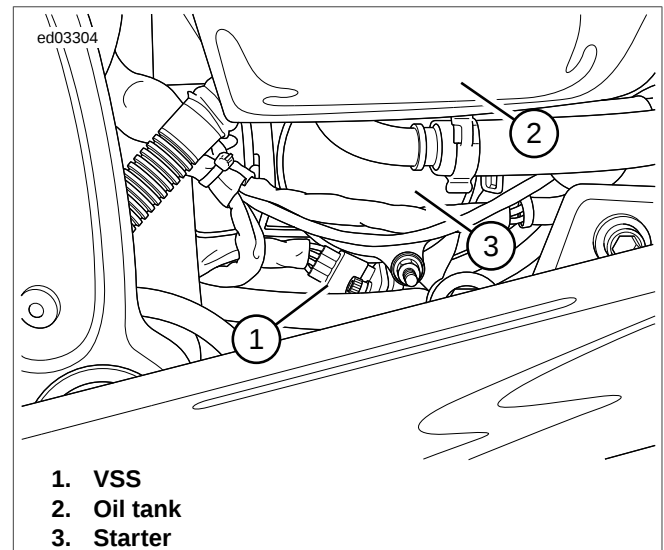


Figure 6-35. VSS

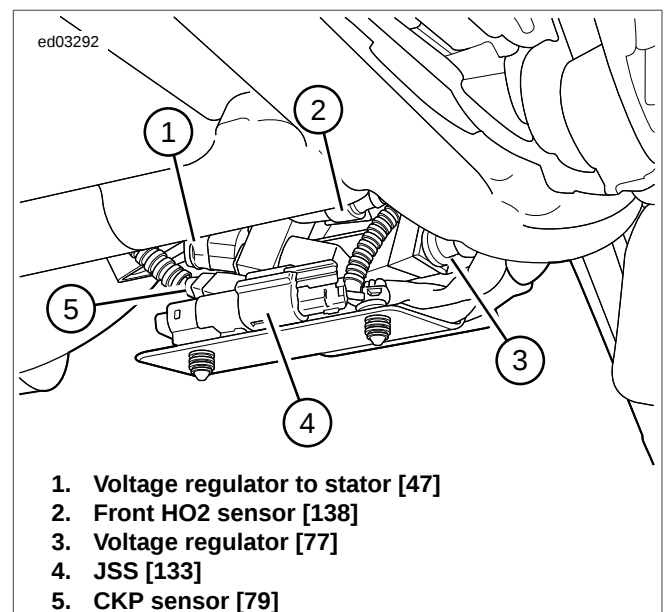


Figure 6-36. Under Voltage Regulator

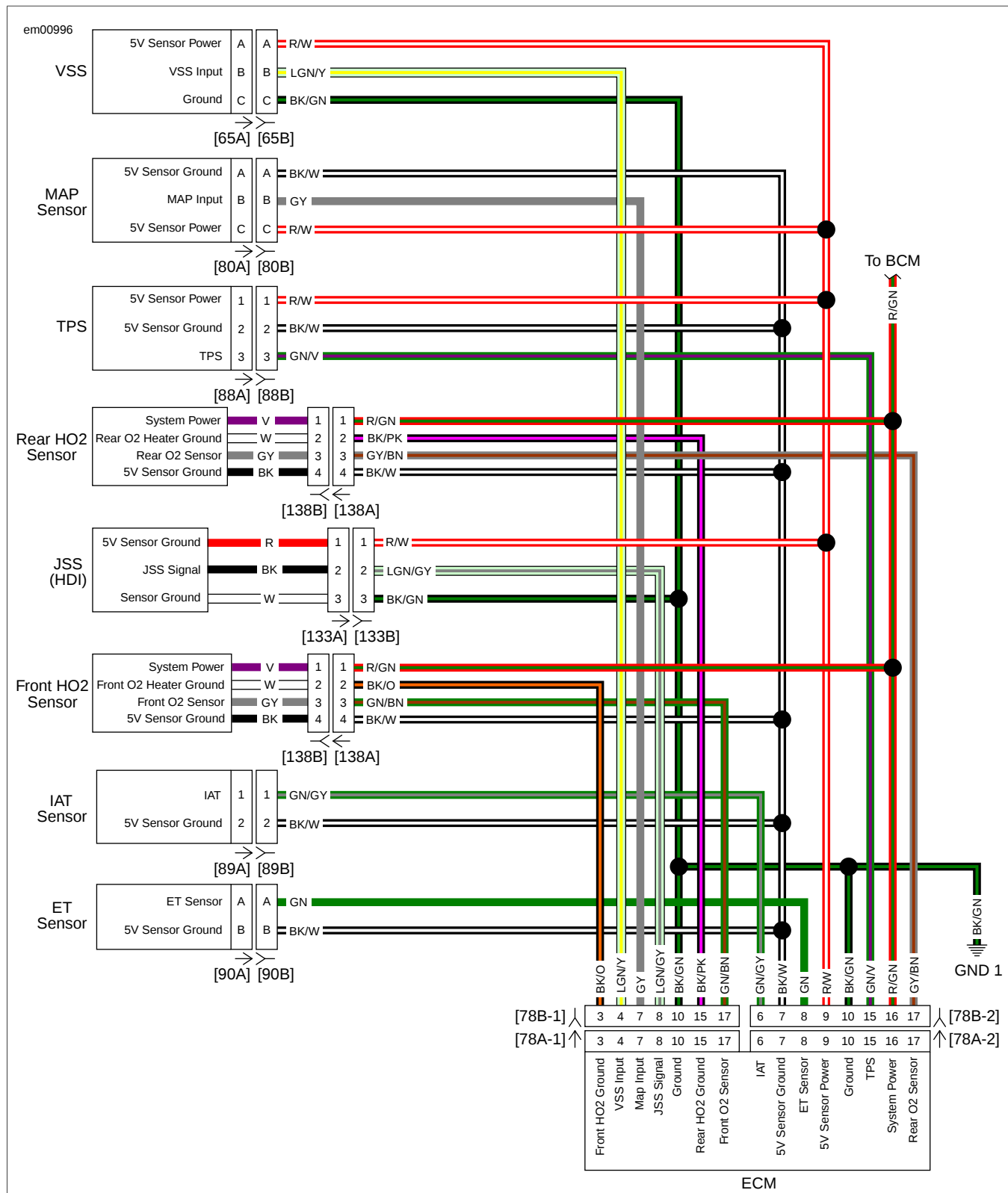


Figure 6-37. Sensor Circuit

DTC P0641

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-52. DTC P0641 Diagnostic Faults

POSSIBLE CAUSES
Short to ground on the 5V sensor power circuit
Short to voltage on the 5V sensor power circuit
VSS fault or malfunction
MAP sensor fault or malfunction
TPS fault or malfunction
JSS (HDI) fault or malfunction

1. 5V Sensor Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 9 and ground.
6. Is voltage between 4-6V?
 - a. **Yes.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).
 - b. **No. Greater than 6V.** Repair short to voltage on (R/W) wire.
 - c. **No. Less than 4V.** [Go to Test 2.](#)

2. TPS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect TPS [88].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace TPS.

3. MAP Power Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace MAP sensor.

4. VSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
 - a. **Yes, with JSS.** [Go to Test 5.](#)
 - b. **Yes, without JSS.** [Go to Test 6.](#)
 - c. **No.** Replace VSS.

5. JSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Replace JSS.

6. Circuit Short to Ground Test

1. Disconnect ECM from breakout box.
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
 - a. **Yes.** Repair short to ground in (R/W) wire.
 - b. **No.** [Go to Test 7.](#)

7. Circuit Shorted to Sensor Ground Circuit Test

1. Test continuity between BOB [78-2] terminals 9 and 7.
2. Is continuity present?
 - a. **Yes.** Repair short between (R/W) and (BK/W) wires.
 - b. **No.** Replace ECM.

DTC P0661, P0662

6.18

DESCRIPTION AND OPERATION

Active intake solenoid (AIS) is included on HDI vehicles only.

See [Figure 6-39](#). 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). The power for the AIS comes from the BCM. The ECM provides the path to ground to trigger the AIS.

Table 6-53. Code Description

DTC	DESCRIPTION
P0661	AIS low/open
P0662	AIS shorted/high

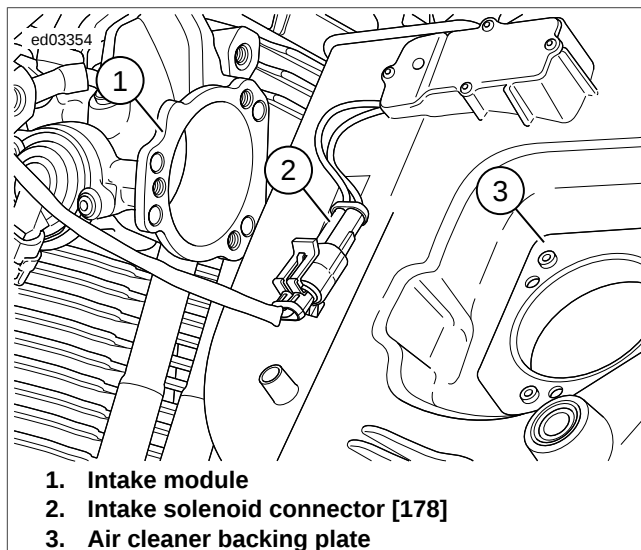


Figure 6-38. Intake Solenoid Connector Location

NOTE

The AIS and active exhaust actuator share the same power source and function simultaneously.

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](#).

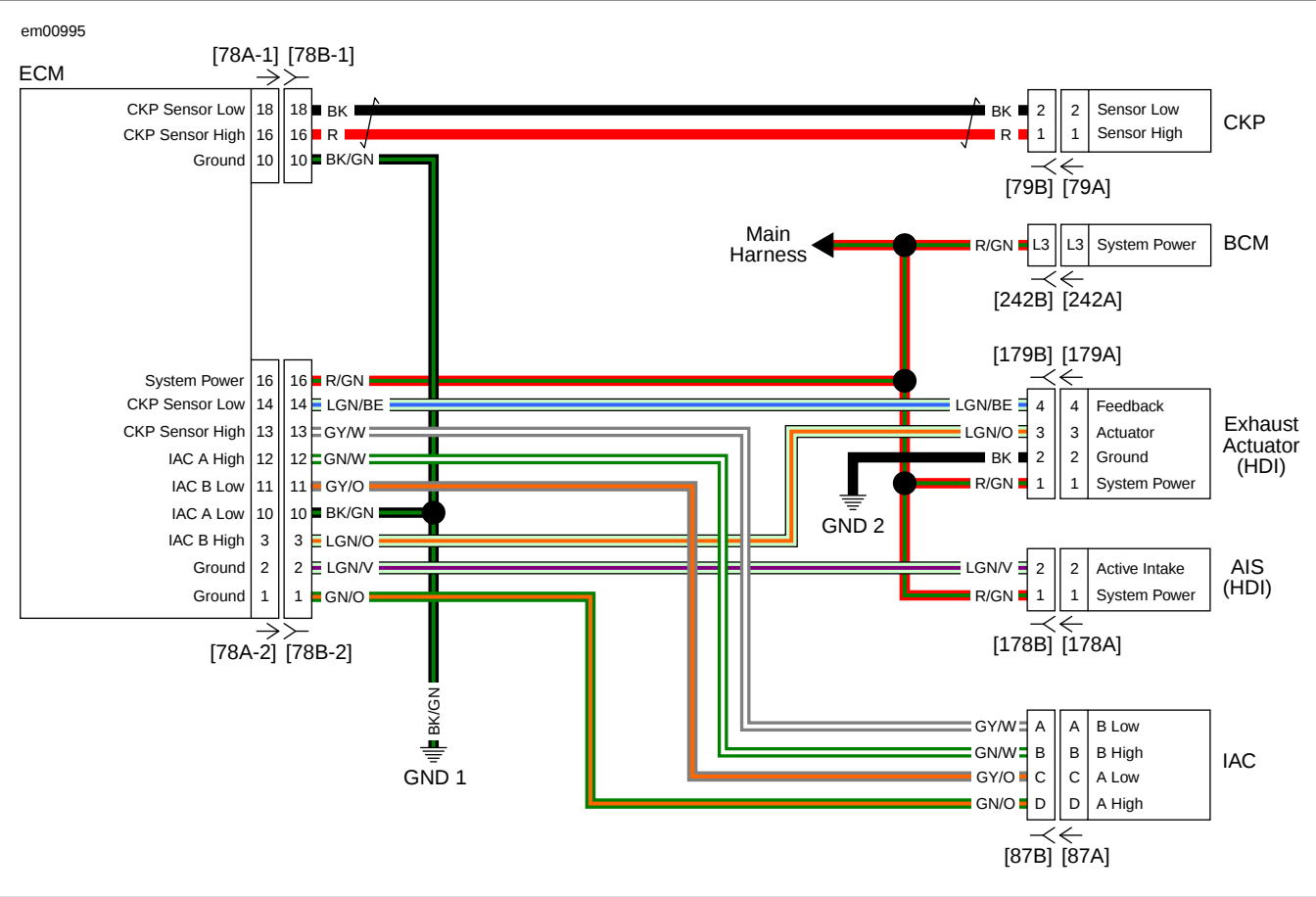


Figure 6-39. Active Exhaust Actuator and AIS Circuit

DTC P0661

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-54. DTC P0661 Diagnostic Faults

POSSIBLE CAUSES
AIS malfunction
Active intake shorted low
Open in circuit

1. AIS Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump BOB [78-2] terminals 2 to 10.
5. Turn IGN ON.
6. Does AIS activate immediately?
 - a. **Yes.** Replace ECM.
 - b. **No.** [Go to Test 2.](#)

2. Resistance Test

1. Turn IGN OFF.
2. Disconnect AIS [178].
3. Test resistance between [178A] terminals 1 and 2.
4. Is resistance between 16-20 Ohms?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace AIS.

3. Open Ground Wire Test

1. Test continuity between BOB [78-2] terminal 2 to AIS [178B] terminal 2 (LGN/V) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (LGN/V) wire.

4. Low Short to Ground Test

1. Test continuity between BOB [78-2] terminal 2 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (LGN/V) wire.
 - b. **No.** [Go to Test 5.](#)

5. Open Supply Wire Test

1. Test continuity between [78B-2] terminal 2 and [178B] terminal 1 (R/GN) wire.
2. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (R/GN) wire.

DTC P0662

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-55. DTC P0662 Diagnostic Faults

POSSIBLE CAUSES
Active intake shorted high

1. AIS Resistance Test

1. Turn IGN OFF.

2. Disconnect AIS [178].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [178A] terminals 1 and 2.
4. Is resistance between 16-20 Ohms?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace AIS.

2. Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [178B] terminal 2 and ground.
3. Is voltage greater than 5.0V?
 - a. **Yes.** Repair short to voltage on (LGN/V) wire
 - b. **No.** Replace ECM.

DTC P1009

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Password Problem

The ECM and BCM exchange passwords during operation. An incorrect 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 2-1](#).

NOTE

Vehicle will not start if BCM is disconnected.

Table 6-56. Code Description

DTC	DESCRIPTION
P1009	Incorrect password

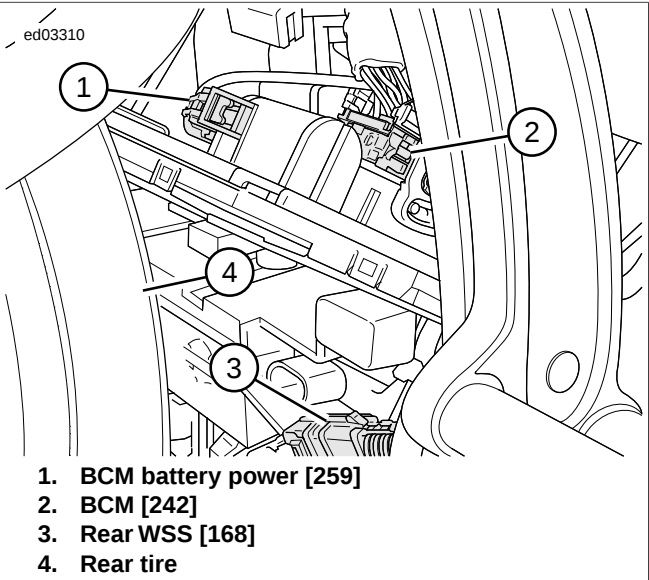


Figure 6-40. BCM [242]: Except FXSB

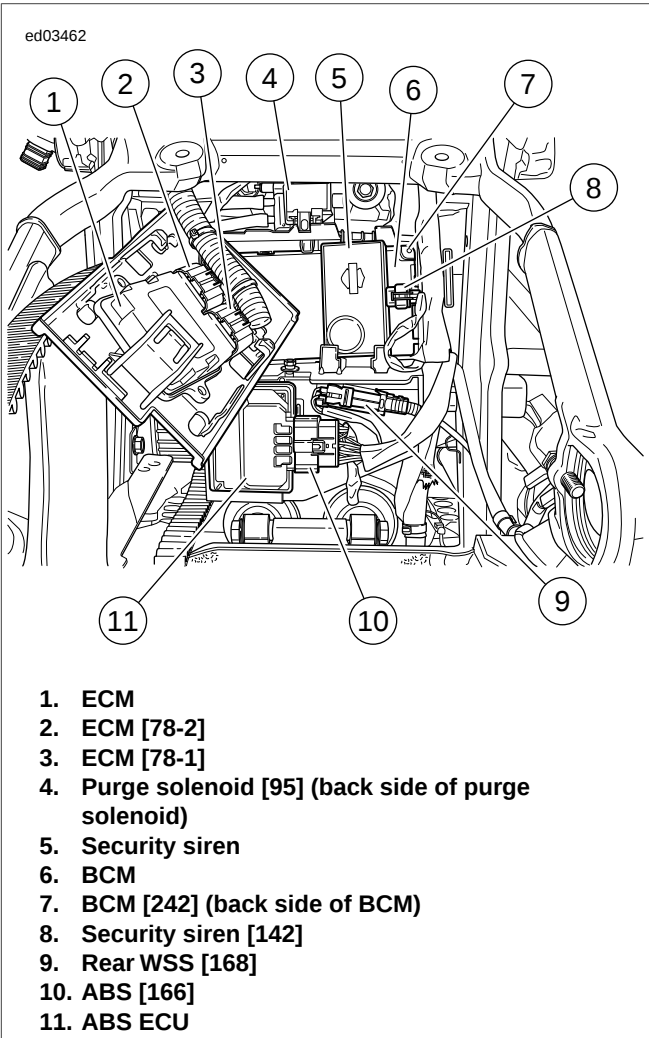


Figure 6-41. Electrical Panel: FXSB

Diagnostic Tips

This code will usually appear after replacing the ECM or BCM. **New** modules must be programmed using DIGITAL TECHNICIAN II (Part No. HD-48650). After parts are programmed and matched correctly for specific vehicle, clear codes.

DTC P1009

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 6-57. DTC P1009 Diagnostic Faults

POSSIBLE CAUSES
ECM malfunction
BCM malfunction

1. Incorrect Password Test

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650), attempt to calibrate the ECM using the module replace feature found in vehicle set up.
2. Clear DTCs.
3. Turn IGN OFF.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** System operating properly.

2. BCM Replacement Test

1. Turn IGN OFF.
2. Replace BCM.
3. Attempt to calibrate the BCM using the module replace feature found in vehicle set up.
4. Clear DTCs.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** Install original BCM and replace ECM.
 - b. **No.** System operating properly.

DTC P1353, P1356

6.20

DESCRIPTION AND OPERATION

See [Figure 6-42](#). A feedback voltage signal in the secondary ignition circuit (terminal B) detects the presence of combustion each time a cylinder fires on ECM [78-1] terminal 9. For diagnostic purposes, this signal is only analyzed at high speed and load conditions where it may be easily measured. Failure to detect combustion at high speed and load means one of following conditions is true:

- Cylinder is truly misfiring.
- There is a lack of continuity in the ignition coil secondary circuit.

NOTES

Check for non-OE spark plugs and cables before testing.

- *The incorrect resistance values of non-original equipment components will set these DTCs.*
- *Make sure vehicle is running properly before performing the tests in this section. Perform fuel pressure tests if required.*

Table 6-58. Code Description

DTC	DESCRIPTION
P1353	No combustion detected (front)
P1356	No combustion detected (rear)

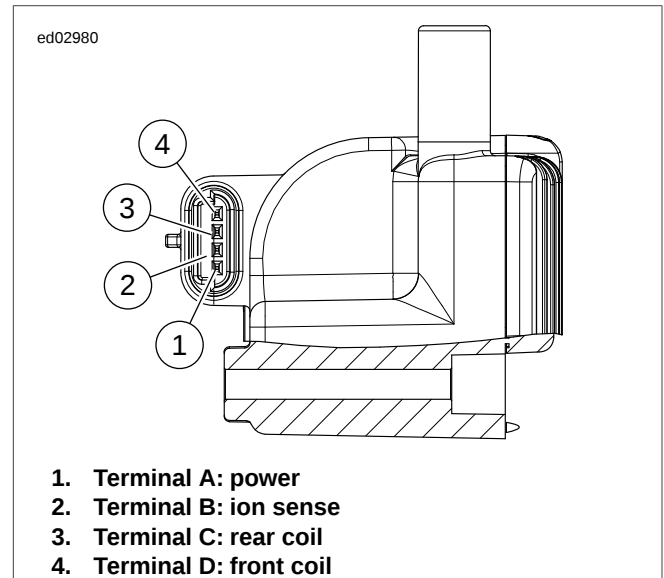


Figure 6-42. Ignition Coil: Typical

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](#).

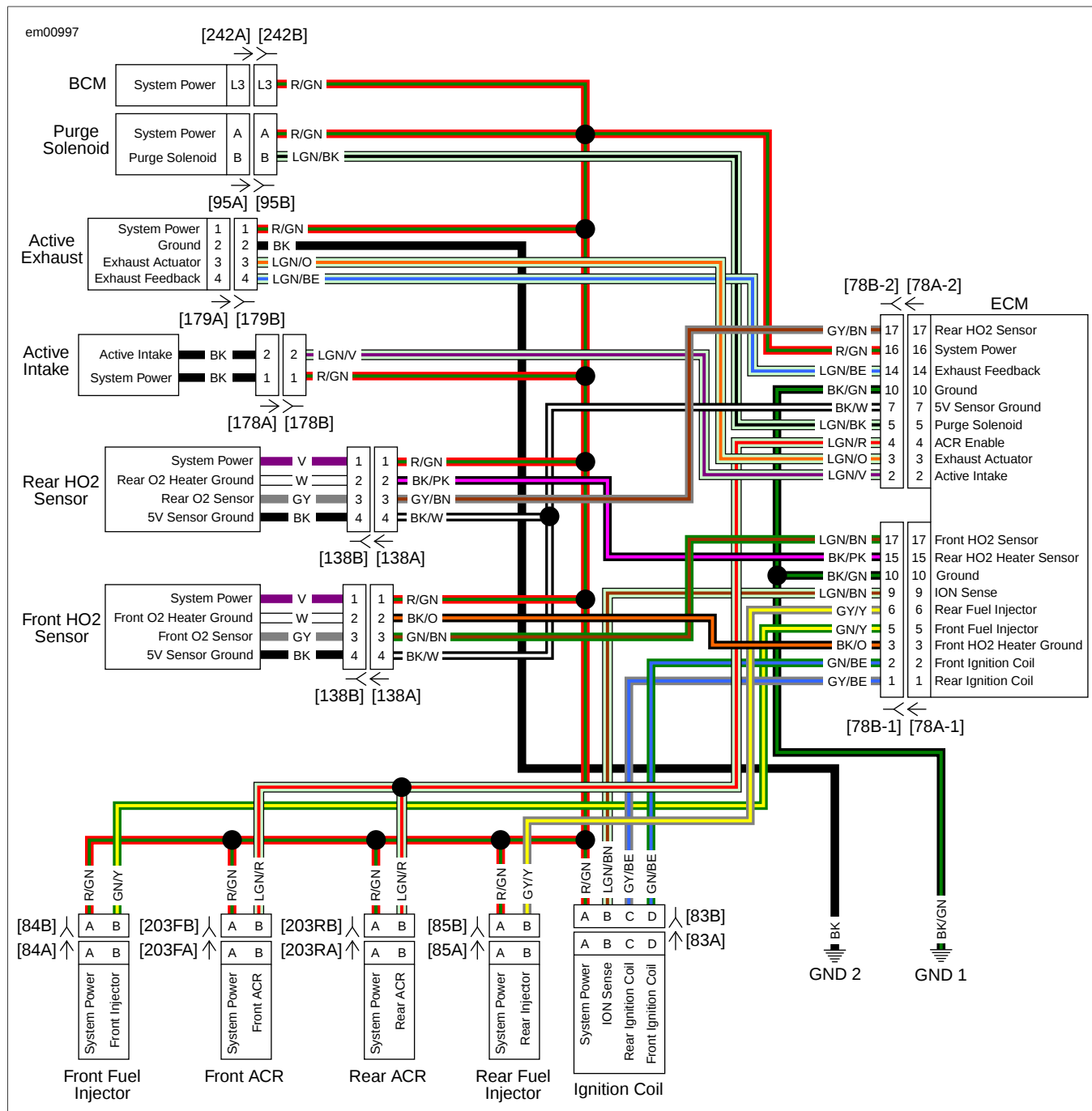


Figure 6-43. System Power Circuit

DTC P1353, P1356

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-59. DTC P1353, P1356 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Fuel system problems
Open or short to voltage in signal circuit
Spark plug wire connections faulty
Spark plug cables
Spark plug

1. Absence of Fuel Test

1. Verify vehicle has fuel.
2. Has vehicle run out of fuel recently?
 - a. **Yes.** Clear DTCs. Fill with fresh fuel and restart. If code returns, then continue with tests. [Go to Test 2.](#)
 - b. **No.** [Go to Test 2.](#)

2. Ion Sense Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Disconnect ignition coil [83].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [83B] terminal B (LGN/BN) wire and BOB [78-1] terminal 9.
5. Is continuity present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (LGN/BN) wire.

3. Ion Sense Short to Voltage Test

1. Connect [78A-1] and [78A-2].
2. Turn IGN ON.
3. Test voltage between [83B] terminal B (LGN/BN) wire and BOB [78-1] terminal 10.
4. Is voltage present?
 - a. **Yes.** Repair short to voltage on (LGN/BN) wire.
 - b. **No.** [Go to Test 4.](#)

4. Spark Plug Cable Test

1. Disconnect spark plug cables.
2. Inspect spark plug cables for carbon tracking or loose connections.
3. Test resistance of the spark plug cables.
4. Is resistance within specifications? Refer to [Table 1-5](#).
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace out of range spark plug cable.

5. Ignition Rear Coil Primary Resistance Test

1. Test resistance between [83A] terminals A and C.
2. Is resistance 0.3-1.5 Ohms?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Replace ignition coil.

6. Ignition Front Coil Primary Resistance Test

1. Test resistance between [83A] terminals A and D.
2. Is resistance 0.3-1.5 Ohms?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Replace ignition coil.

7. Ion Sense Coil Resistance Test

1. Test resistance between [83A] terminal B to front coil secondary output tower. Repeat test for rear output tower.
2. Is resistance within specifications?
 - a. **Yes. FXS/B (1200-1800 Ohms).** [Go to Test 8.](#)
 - b. **Yes. Except FXS/B (2700-3800 Ohms).** [Go to Test 8.](#)
 - c. **No.** Replace ignition coil.

8. Ignition Coil Secondary Resistance Test

1. Test resistance across ignition coil front and rear secondary output towers.
2. Is resistance within specifications? Refer to [Table 1-6](#).
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Replace ignition coil.

9. Coil Internal Short Test

1. Test continuity between [83A] terminals A and B.
2. Is continuity present?
 - a. **Yes.** Replace ignition coil.
 - b. **No.** Replace spark plugs and spark plug cables.

DTC P1475, P1478

6.21

DESCRIPTION AND OPERATION

The active exhaust actuator is included on HDI vehicles only.

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

Table 6-60. Code Description

DTC	DESCRIPTION
P1475	Exhaust actuator position error
P1478	Exhaust actuator shorted/high

NOTE

The AIS and active exhaust actuator share the same power source and function simultaneously.

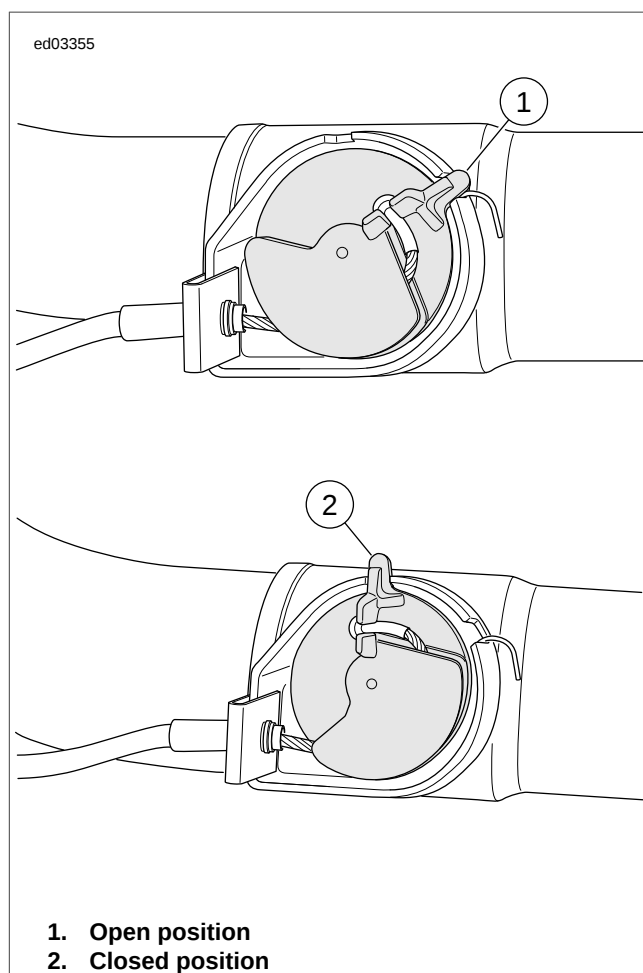


Figure 6-44. Bellcrank

Diagnostic Tips

Before replacing the exhaust actuator, check the cable and bellcrank assembly from exhaust actuator to exhaust valve for proper operation.

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](#).

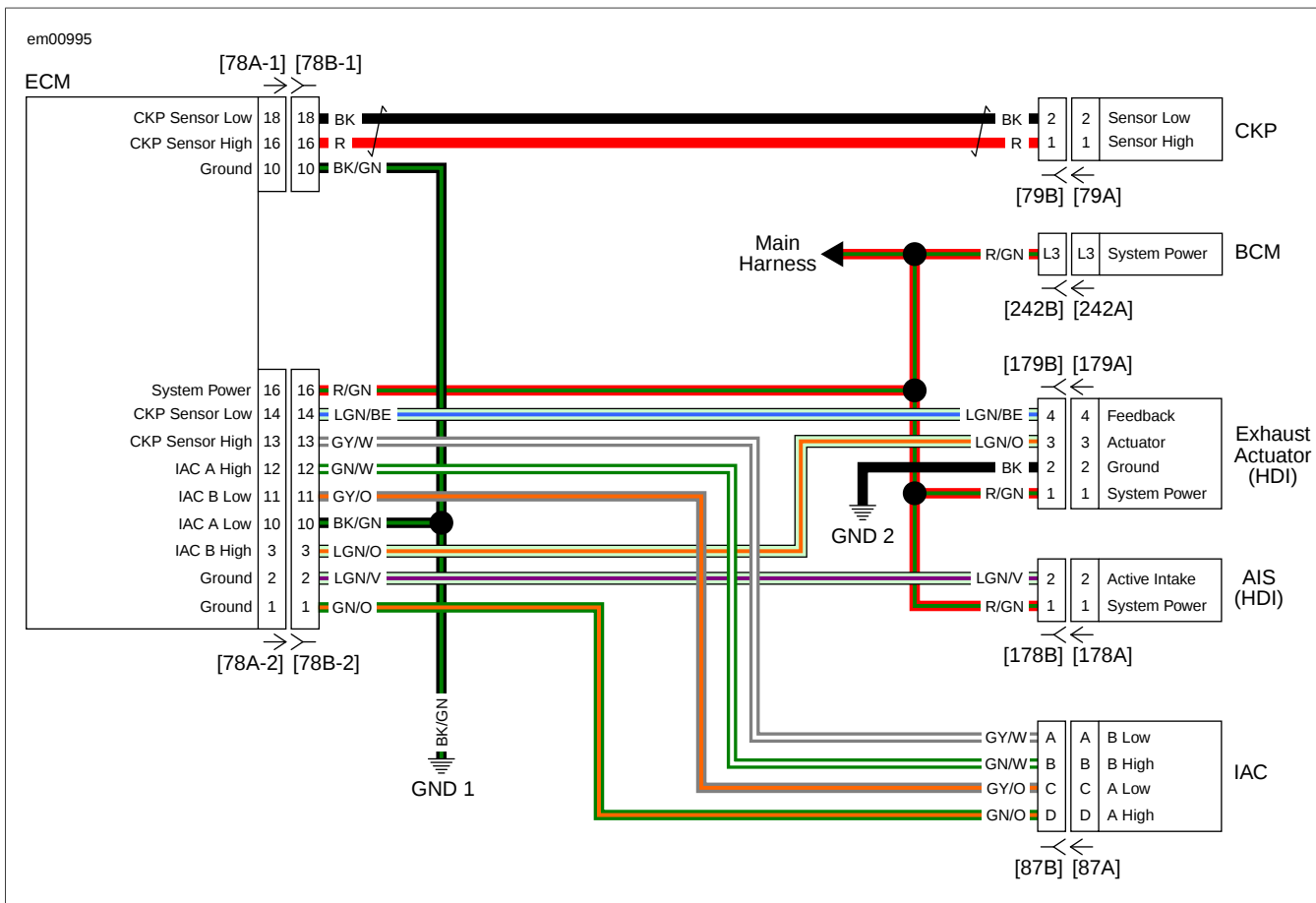


Figure 6-45. Active Exhaust Actuator and AIS Circuit

DTC P1475

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-61. DTC P1475 Diagnostic Faults

POSSIBLE CAUSES
Cable and bellcrank malfunction
Open in ground circuit
Open in power circuit
Open in active exhaust feedback circuit
Exhaust actuator malfunction
Short to voltage in active exhaust feedback circuit
Short to ground in active exhaust feedback circuit

1. Exhaust Actuator Test

- Turn IGN OFF.
- Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness

[78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).

- Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump BOB [78-2] terminals 3 to 10.
- Turn IGN ON.
- Does actuator activate immediately?
 - Yes.** Replace ECM.
 - No.** [Go to Test 2.](#)

2. Voltage Test

- Turn IGN OFF.
- Turn IGN ON.
- Disconnect exhaust actuator [179].
- Test the voltage between [179B] terminals 1 (R/GN) wire and 2 (BK) wire.
- Is battery voltage present?
 - Yes.** [Go to Test 4.](#)
 - No.** [Go to Test 3.](#)

3. Motor Ground Wire Continuity Test

- Turn IGN OFF.

2. Test continuity between [179B] terminal 2 (BK) wire and ground.
3. Is continuity present?
 - a. **Yes.** Repair open in (R/GN) wire.
 - b. **No.** Repair open on (BK) wire.

4. Feedback Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-2] terminal 10 and 14.
3. Is voltage 4.5-5.5V?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No. Battery voltage.** [Go to Test 8.](#)
 - c. **No. 0V.** [Go to Test 9.](#)

5. Feedback Continuity Test

1. Turn IGN OFF.
2. Test continuity between [179B] terminal 4 (LGN/BE) wire and BOB [78-2] terminal 14.
3. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (LGN/BE) wire.

6. Feedback Control Test

1. Connect [179].
2. Turn IGN ON.
3. Test voltage between BOB [78-2] terminals 10 and 14.
4. Jump between BOB [78-2] terminals 3 and 10 several times.
5. Does voltage change to less than 1.0V and exhaust actuator valve open each time?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Replace exhaust actuator.

7. Feedback Run Test

1. Turn IGN OFF.
2. Clear codes.
3. Start engine.
4. Run engine between 1500-2500 rpm.
5. Does exhaust valve open at 1600 rpm or less and close at 1800 or more?
 - a. **Yes.** System operating properly.
 - b. **No.** Replace ECM.

8. Feedback Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78A-1] and [78A-2].
3. Test voltage between BOB [78-2] terminal 14 and ground.

4. Is voltage present?
 - a. **Yes.** Repair short to voltage on (LGN/BE) wire.
 - b. **No.** Replace ECM.

9. Feedback Short to Ground Test

1. Disconnect [78A-1] and [78A-2].
2. Test continuity between [179B] terminal 4 (LGN/BE) wire and ground.
3. Is continuity present?
 - a. **Yes.** Repair short to ground on (LGN/BE) wire.
 - b. **No.** Replace ECM.

DTC P1478

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-62. DTC P1478 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in active exhaust circuit
Exhaust actuator malfunction

1. Exhaust Actuator Motor High Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 3 and ground.
6. Is voltage present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Replace ECM.

2. Motor Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect exhaust actuator [179].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 3 and ground.
5. Is voltage present?
 - a. **Yes.** Repair short to voltage on (LGN/O) wire.
 - b. **No.** Replace active exhaust control actuator.

DTC P1501, P1502

6.22

DESCRIPTION AND OPERATION

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 BCM determines the transmission is in neutral. This is done by monitoring the neutral switch input to the BCM and communicating that input over the CAN bus circuit to the ECM.

See [Figure 6-47](#). 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 "SlidE Stand." DTC P1501 or P1502 will set if the JSS circuits are out of range.

Table 6-63. Code Description

DTC	DESCRIPTION
P1501	JSS low
P1502	JSS high/open

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.

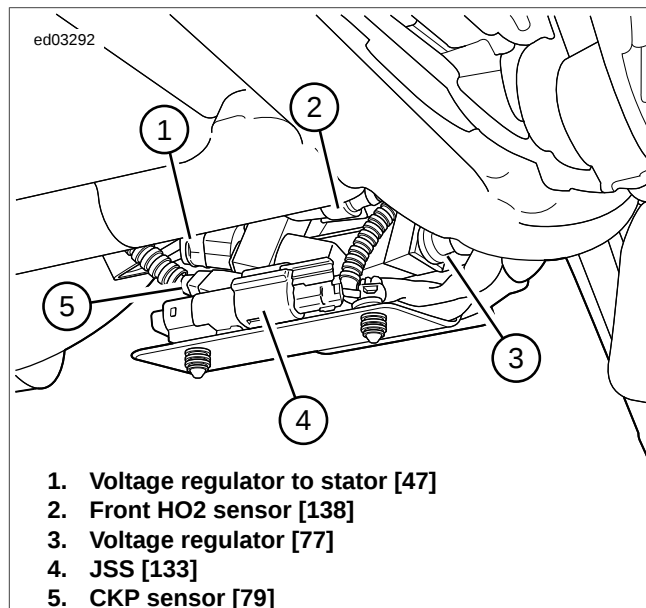


Figure 6-46. Under Voltage Regulator

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

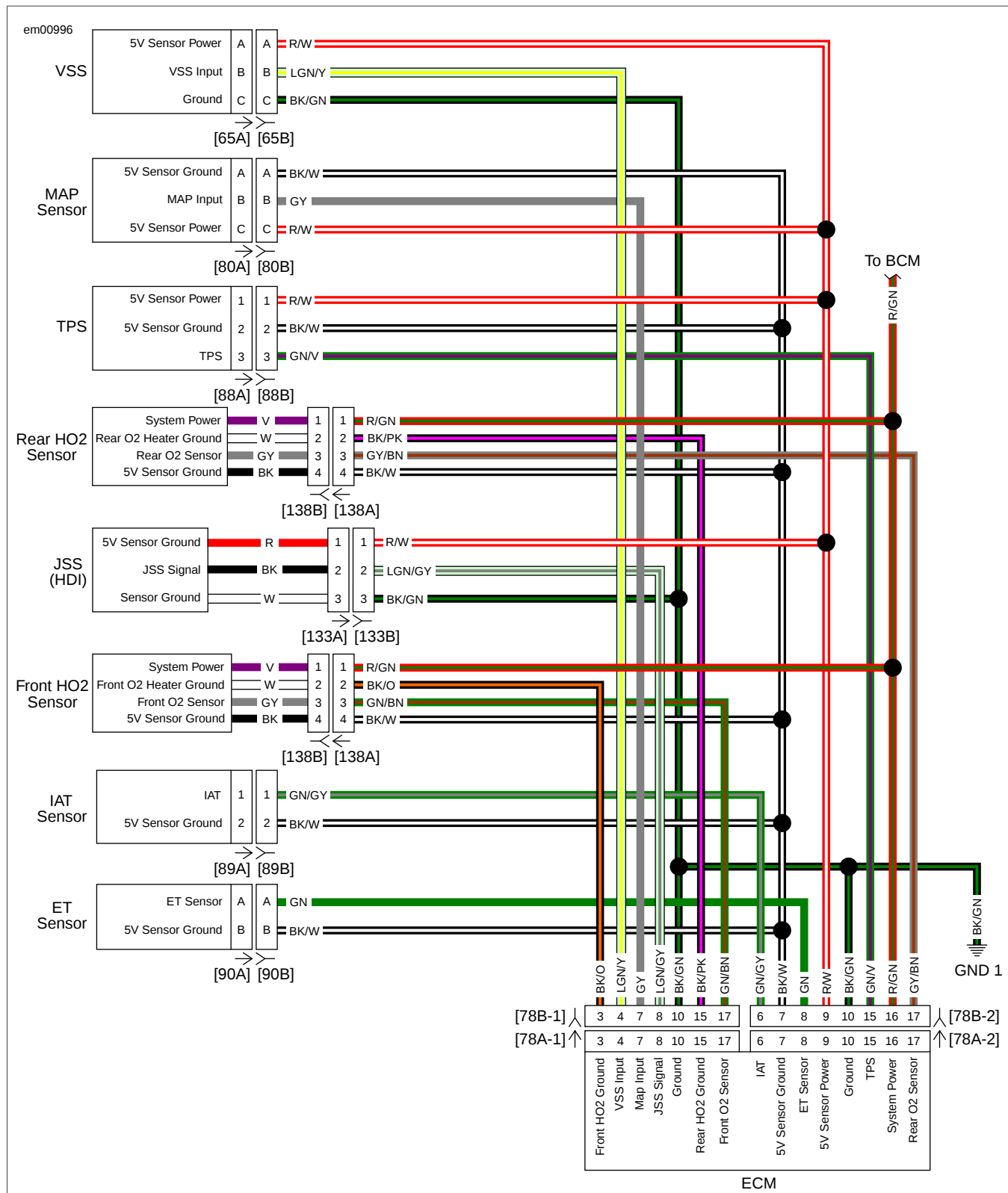


Figure 6-47. Sensor Circuit

DTC P1501

Table 6-64. DTC P1501 Diagnostic Faults

POSSIBLE CAUSES
JSS malfunction
Open or short to ground in signal circuit

1. Signal Wire Shorted to Ground Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Test continuity between [133B] terminal 2 (LGN/GY) wire and ground.
4. Is continuity present?
 - a. **Yes.** Repair short to ground on (LGN/GY) wire.
 - b. **No.** Replace JSS.

DTC P1502

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-65. DTC P1502 Diagnostic Faults

POSSIBLE CAUSES
JSS malfunction
Short to voltage in signal circuit
Open ground
Short between 5V reference circuit and signal circuit
Open in signal circuit

1. JSS Ground Wire Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [133B] terminal 3 and ground.
4. Is continuity present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open in (BK/GN) wire.

2. JSS Signal Wire Short to Voltage Test

1. Test voltage between [133B] terminal 2 (LGN/GY) wire and ground.
2. Is voltage greater than 5V?
 - a. **Yes.** Repair short to voltage between (LGN/GY) wire.
 - b. **No.** [Go to Test 3.](#)

3. 5V Reference and Signal Shorted Together Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [133B] terminals 1 (R/W) wire and 2 (LGN/GY) wire.
4. Is continuity present?
 - a. **Yes.** Repair short between (R/W) and (LGN/GY) wires.
 - b. **No.** [Go to Test 4.](#)

4. Signal Wire Open Circuit Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-1] terminal 8 and [133B] terminal 2 (LGN/GY) wire.
4. Is continuity present?
 - a. **Yes.** Replace JSS.
 - b. **No.** [Go to Test 4.](#) Repair open on (LGN/GY) wire.

SIDE STAND DISPLAYED ON SPEEDOMETER

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-66. Side Stand Displayed on Speedometer Diagnostic Faults

POSSIBLE CAUSES
Jiffy stand is down
Jiffy stand out of adjustment
Open 5V sensor power wire

1. Starts, Then Stalls Test

1. Start engine.
2. Does engine start and stall?
 - a. **Yes.** See [6.28 STARTS, THEN STALLS](#).
 - b. **No.** [Go to Test 2.](#)

2. Neutral Test

1. Verify transmission is in neutral.

2. Is neutral indicator on?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** See [4.5 INDICATOR LAMPS.](#)

3. JSS Clearance Test

1. Inspect JSS and jiffy stand for correct mounting and clearance to jiffy stand tab.
2. Is clearance less than 0.18 in (4.5 mm)?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Install JSS and jiffy stand correctly.

4. 5V Reference Open Circuit Test

1. Disconnect JSS [133].

2. With IGN OFF, connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS.](#)
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-2] terminal 9 and [133B] terminal 1 (R/W) wire.
5. Is continuity present?
 - a. **Yes.** Replace JSS.
 - b. **No.** Repair open on (R/W) wire.

DTC P1632

DESCRIPTION AND OPERATION

If the speedometer mileage is higher than the mileage in the ECM, the ECM will set a DTC P1632 and increase its mileage to match the speedometer. This will normally occur when the ECM is replaced or if continuous battery is not present on [78-2] terminal 18 of the ECM. If this code is set, verify the speedometer or ECM have not been replaced with a used part from another vehicle. Clear the DTC. See [2.1 INITIAL DIA-](#)

[GNOSTICS, Odometer Self-Diagnostics](#). If the code returns, the ECM may not be powering down properly. Verify that 12V is continually present on [78-2] terminal 18.

Table 6-67. Code Description

DTC	DESCRIPTION
P1632	Odometer learned up

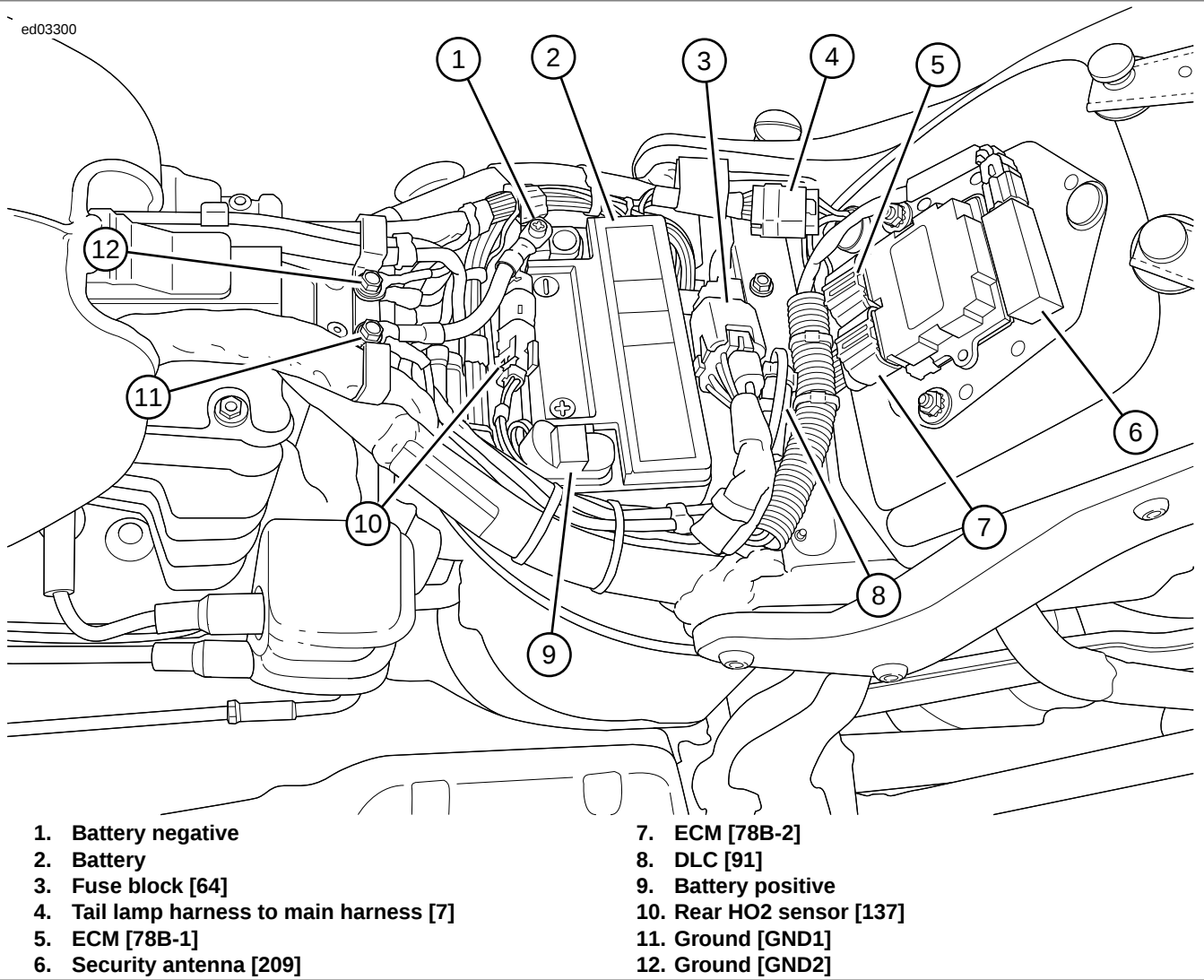


Figure 6-48. Under Seat: Except FXS/B and FLS

ed03468

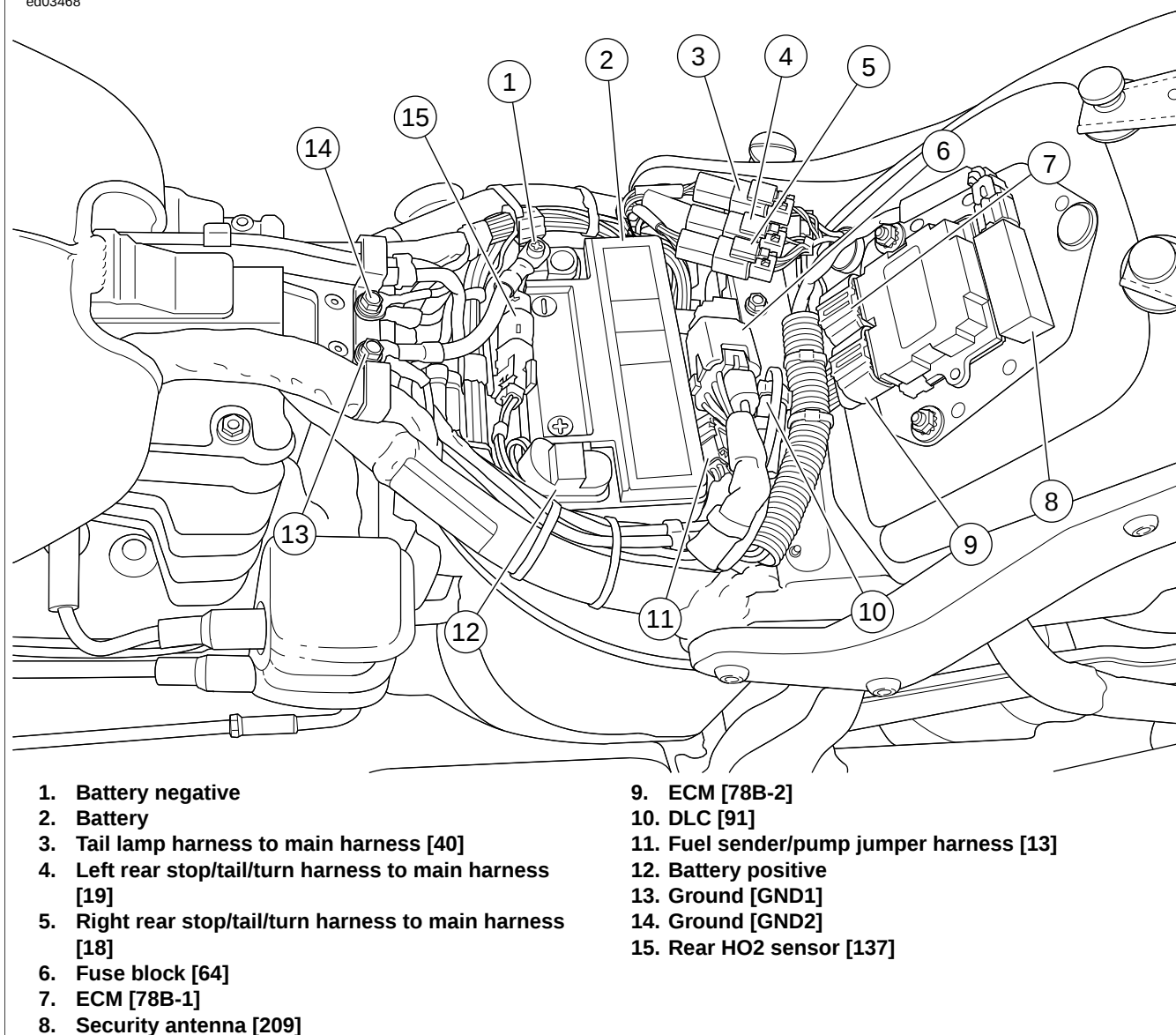


Figure 6-49. Under Seat: FXS and FLS

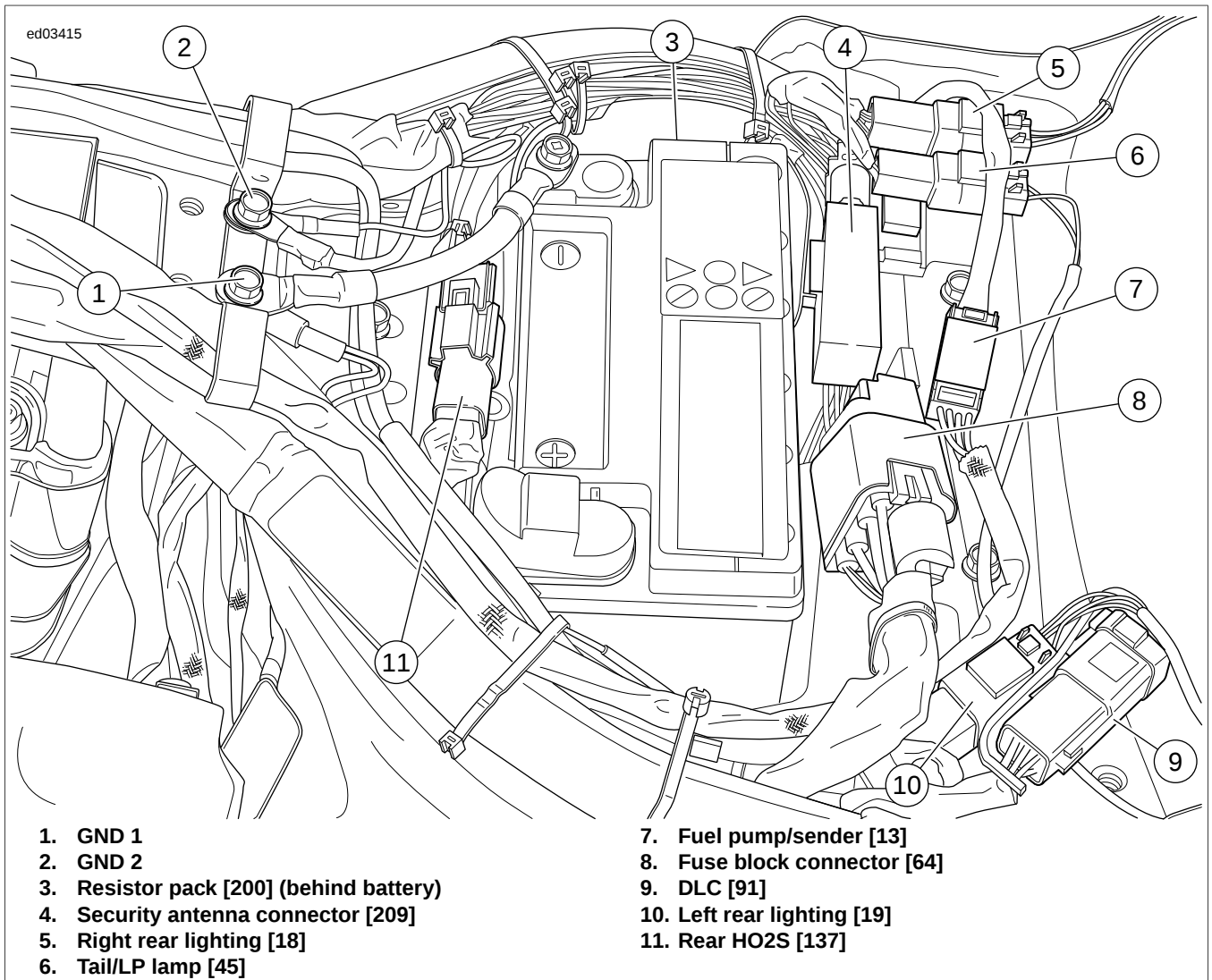


Figure 6-50. Under Seat: FXSB

DTC P1655, P1656

6.24

DESCRIPTION AND OPERATION

See [Figure 6-51](#). When open, compressed gases are released through the exhaust port.

See [Figure 6-52](#). The Automatic Compression Release (ACR) is opened and closed by the ECM to assist starting.

Table 6-68. Code Description

DTC	DESCRIPTION
P1655	ACR solenoid low/open
P1656	ACR solenoid high

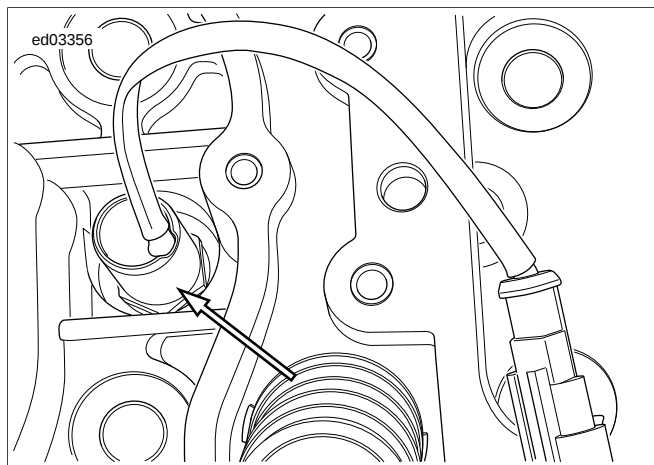


Figure 6-51. ACR in Head

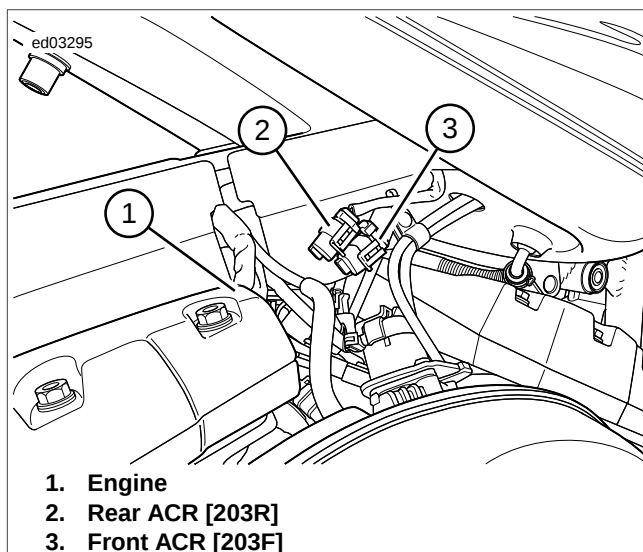


Figure 6-52. Under Fuel Tank Right Side

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](#).

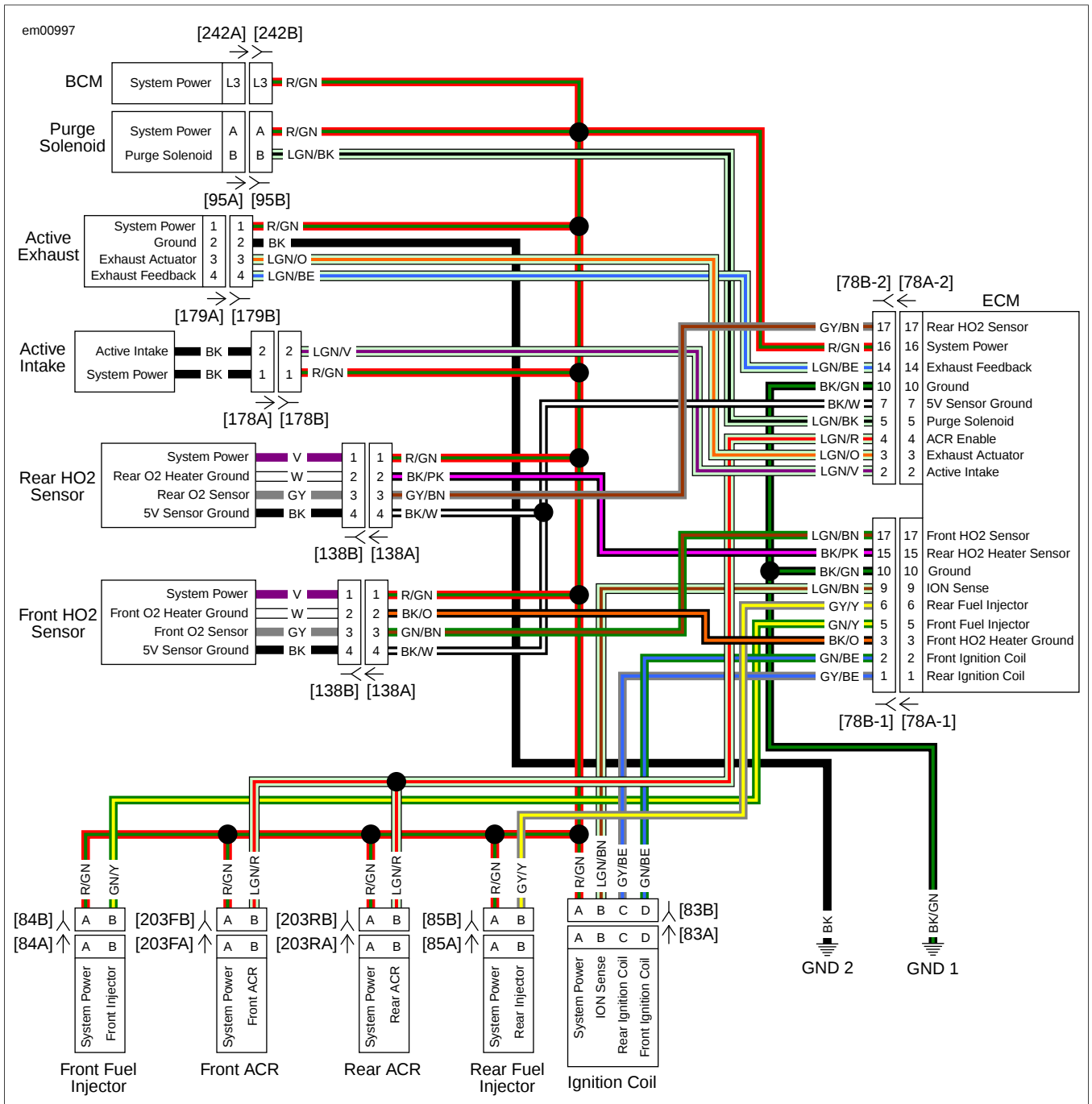


Figure 6-53. System Power Circuit

DTC P1655

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-69. DTC P1655 Diagnostic Faults

POSSIBLE CAUSES
ACR solenoid malfunction
Open in ACR control circuit
Open in system relay circuit
Short to ground in ACR control circuit

1. Front ACR Test

1. Turn IGN OFF.
2. Disconnect front ACR [203F].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.
5. Does the test light flash on and off?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No, test light stays on steady.** [Go to Test 4.](#)
 - c. **No, did not stay on steady.** [Go to Test 6.](#)

2. Rear ACR Test

1. Turn IGN OFF.
2. Disconnect rear ACR [203R].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.
5. Does the test light flash on and off?
 - a. **Yes.** Replace front and rear ACR solenoids.
 - b. **No.** [Go to Test 3.](#)

3. Rear ACR Control Circuit Test

1. Turn IGN OFF.
2. Disconnect test light.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [203FB] terminal 1 (R/GN) wire and [203RB] terminal 1 (R/GN) wire.
4. Is continuity present?
 - a. **Yes.** Repair open in (LGN/R)wire.
 - b. **No.** Repair open in (R/GN) wire.

4. Front ACR Control Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [203FB] terminal 2 (LGN/R) wire and ground.
4. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Replace ECM.

5. Rear ACR Control Circuit Short to Ground Test

1. Disconnect rear ACR [203RB].
2. Test continuity between [203FB] terminal 2 (LGN/R) wire and ground.
3. Is continuity present?
 - a. **Yes.** Repair short to ground in (LGN/R) wire.
 - b. **No.** Replace front and rear ACR solenoids.

6. Shorted ACR Test

1. Turn IGN OFF.
2. Disconnect rear ACR [203RB].
3. Crank engine for 5 seconds.
4. Does the test light flash on and off?
 - a. **Yes.** Replace front and rear ACR solenoids.
 - b. **No.** [Go to Test 7.](#)

7. ACR Control Circuit Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [6.28 STARTS, THEN STALLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on breakout box.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-2] terminal 4 and [203FB] terminal 2 (LGN/R) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 8.](#)
 - b. **No.** Repair open in (LGN/R) wire.

8. Power Circuit Continuity Test

1. Test continuity between BOB [78-2] terminal 16 and [203B] terminal 1 (R/GN) wire.
2. Is continuity present?
 - a. **Yes.** Replace ECM.
 - b. **No.** Repair open in (R/GN) wire.

DTC P1656

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

Table 6-70. DTC P1656 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in ACR control circuit
ACR solenoid malfunction

1. Front ACR Test

1. Turn IGN OFF.
2. Disconnect front ACR [203F].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.
5. Does test light flash on and off?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** [Go to Test 4.](#)

2. Rear ACR Test

1. Turn IGN OFF.
2. Disconnect rear ACR [203R].

3. Disconnect test light from [203F].
4. Connect test light to [203R].
5. Crank engine for 5 seconds.
6. Does test light flash on and off?
 - a. **Yes.** Replace front and rear ACR solenoids.
 - b. **No.** [Go to Test 3.](#)

3. Rear ACR Control Circuit Test

1. Disconnect test light.
2. While cranking the engine, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [203RB] terminal 2 (LGN/R) wire and ground.
3. Is voltage greater than 5.0V?
 - a. **Yes.** Repair short to voltage on (LGN/R) wire.
 - b. **No.** Replace ECM.

4. Front ACR Control Circuit Test

1. Disconnect rear ACR [203R].
2. While cranking the engine, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [203FB] terminal 2 (LGN/R) wire and ground.
3. Is voltage greater than 5.0V?
 - a. **Yes.** Repair short to voltage on (LGN/R) wire.
 - b. **No.** Replace front and rear ACR solenoids.

DTC P2300, P2301, P2303, P2304

6.25

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 BCM at the same time the purge solenoid, active exhaust actuator, active intake solenoid, ECM and injectors are activated.

Table 6-71. Code Description

DTC	DESCRIPTION
P2300	Ignition coil driver low/open (front)
P2301	Ignition coil driver high/shorted (front)
P2303	Ignition coil driver low/open (rear)
P2304	Ignition coil driver high/shorted (rear)

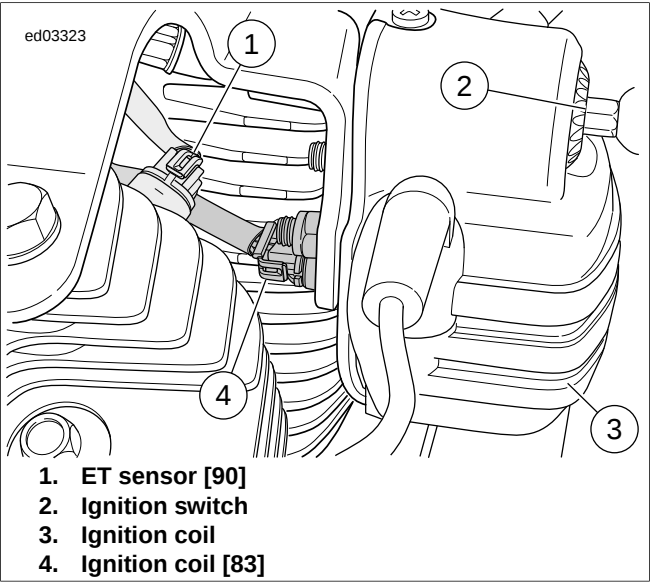


Figure 6-54. Behind Ignition Switch: FXS/B

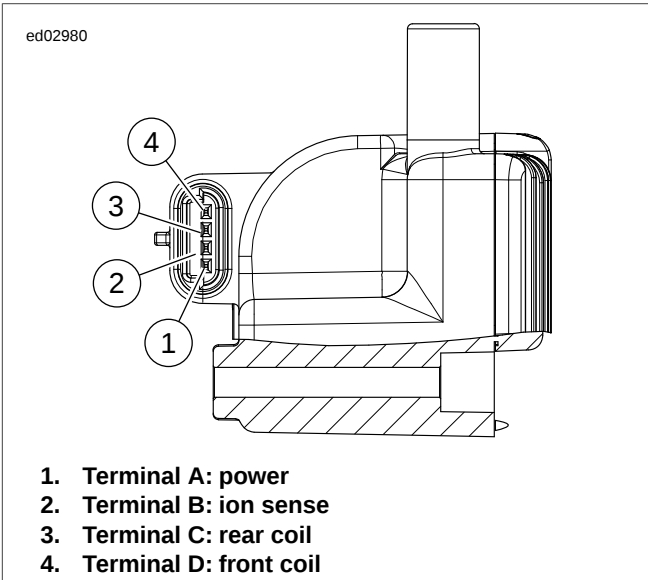


Figure 6-55. Ignition Coil: Typical

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

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](#).

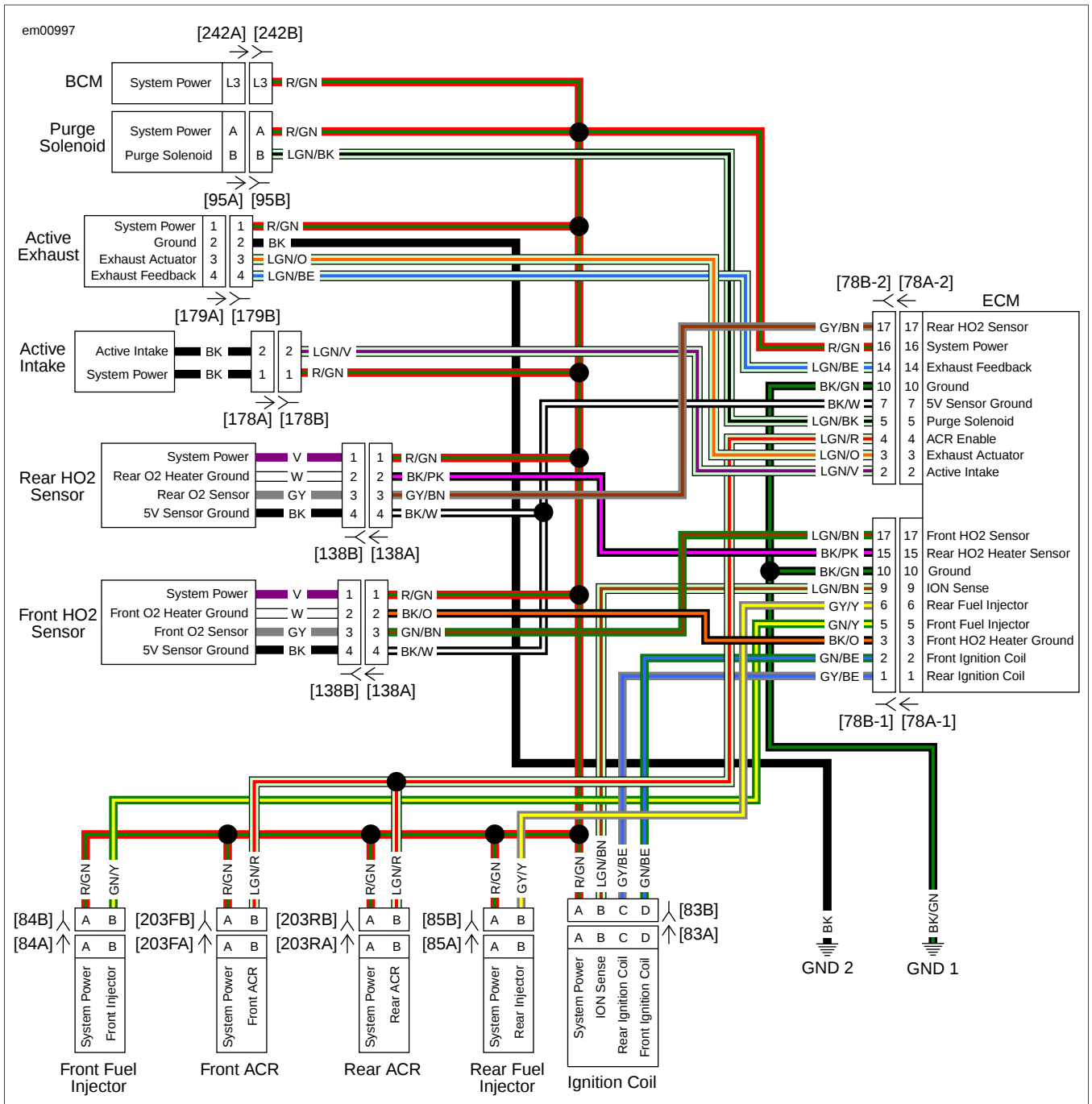


Figure 6-56. System Power Circuit

DTC P2300

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-72. DTC P2300 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Open or short to ground in signal circuit
Open power circuit

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [83A] terminals A and D.
4. Is resistance greater than 2 Ohms?
 - a. **Yes.** Replace ignition coil.
 - b. **No.** [Go to Test 2.](#)

2. Input Voltage Test

1. Turn IGN ON.
2. Test voltage between [83B] terminal A (R/GN) wire and ground.
3. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open on (R/GN) wire.

3. Control Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 2 and [83B] terminal D (GN/BE) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GN/BE) wire.

4. Control Wire Shorted to Ground Test

1. Disconnect [78A-1] and [78A-2].
2. Test continuity between BOB [78-1] terminal 2 and ground.

3. Is continuity present?
 - a. **Yes.** Repair short to ground in (GN/BE) wire.
 - b. **No.** Replace ECM.

DTC P2301

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-73. DTC P2301 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Short to voltage in signal circuit

1. Ignition Coil Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [83B] terminal D (GN/BE) wire and ground.
5. Is voltage greater than 5.0V?
 - a. **Yes.** Repair short to voltage in (GN/BE) wire.
 - b. **No.** [Go to Test 2.](#)

2. Open Test

1. Test resistance between [83A] terminals A and D.
2. Is resistance greater than 0.4 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace ignition coil.

DTC P2303

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-74. DTC P2303 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Open or short to ground in signal circuit
Open power circuit

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].

3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [83A] terminals A and C.
4. Is resistance greater than 2 Ohms?
 - a. **Yes.** Replace ignition coil.
 - b. **No.** [Go to Test 2.](#)

2. Input Voltage Test

1. Turn IGN ON.
2. Test voltage between [83B] terminal A (R/GN) wire and ground.
3. Is battery voltage present?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Repair open in (R/GN) wire.

3. Control Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and to ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 1 and [83B] terminal C (GY/BE) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (GY/BE) wire.

4. Control Wire Shorted to Ground Test

1. Disconnect [78A-1] and [78A-2].
2. Test continuity between BOB [78-1] terminal 1 and ground.

3. Is continuity present?
 - a. **Yes.** Repair short to ground in (GY/BE) wire.
 - b. **No.** Replace ECM.

DTC P2304

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-75. DTC P2304 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Short to voltage in signal circuit

1. Ignition Coil Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [83B] terminal C (GY/BE) wire and ground.
5. Is voltage more than 5.0V?
 - a. **Yes.** Repair short to voltage in (GY/BE) wire.
 - b. **No.** [Go to Test 2.](#)

2. Open Test

1. Test resistance between [83A] terminals A and C.
2. Is resistance greater than 0.4 Ohms?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace ignition coil.

ENGINE CRANKS, BUT WILL NOT START

6.26

DESCRIPTION AND OPERATION

If the starter will not crank the engine, the problem is not EFI related. See [3.2 STARTING SYSTEM](#) or [5.11 SECURITY SYSTEM](#).

There may be DTCs associated with this problem. Check for DTCs and clear them before proceeding with this test.

NOTE

To set a CKP DTC, a start attempt must last at least five seconds.

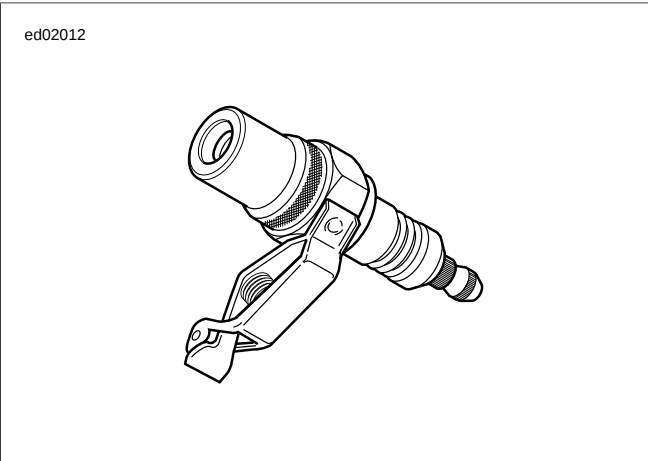


Figure 6-57. Spark Tester

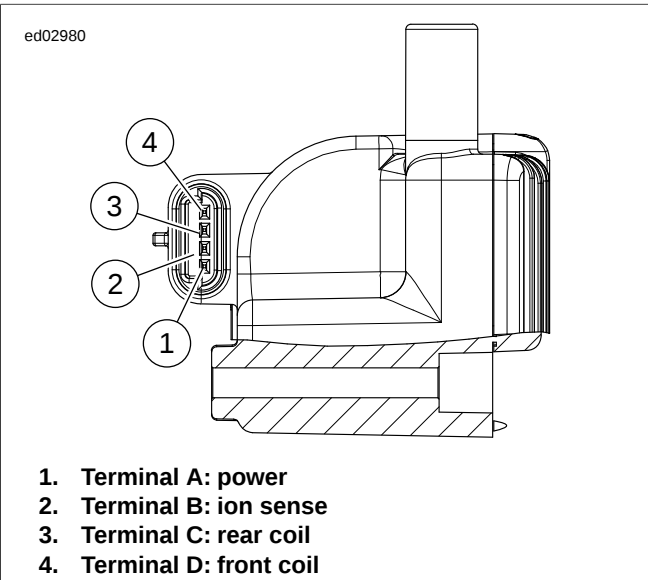


Figure 6-58. Ignition Coil: Typical

ENGINE CRANKS BUT WILL NOT START

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-76. 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, Odo-meter Self-Diagnostics](#). If DTCs are present, see the appropriate DTC procedure.
7. Verify battery condition. See [3.1 BATTERY TESTING](#).
8. Does battery pass tests?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Charge or 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.** Verify all fuses are good. See [2.1 INITIAL DIAGNOSTICS, Initial Diagnostics](#).

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 [6.12 DTC P0371, P0372, P0374](#) or [6.20 DTC P1353, P1356](#).

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) and a multimeter, measure voltage between fuel pump [141B] terminals A and D 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. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B], leaving [242A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for continuity between [141B] terminal A and system relay BOB terminal F4.
5. Is continuity present?
 - a. **Yes.** Repair open on (BK) wire to ground.
 - b. **No.** Repair open (R/BN) wire.

HESITATION, LOSS OF POWER

6.27

DESCRIPTION AND OPERATION

Improper fuel system pressure may contribute to hesitation, loss of power.

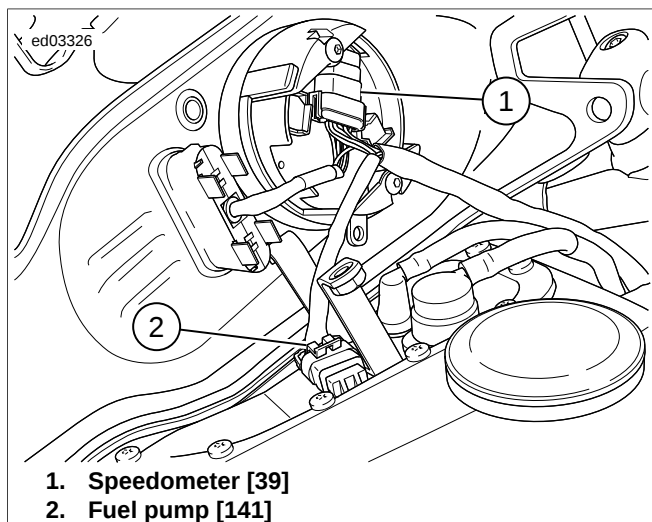
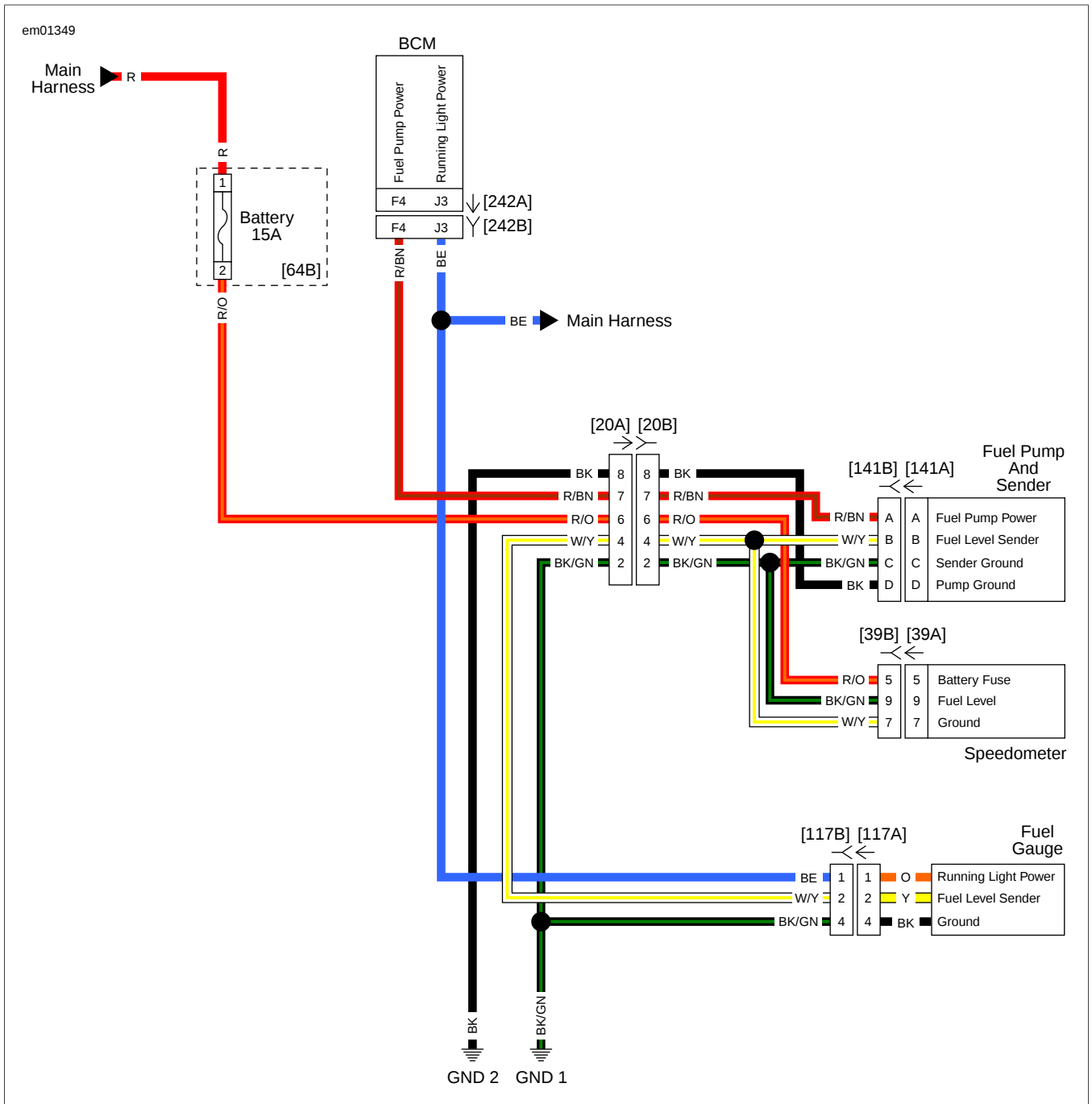


Figure 6-59. Under Console: FXDB/BP/FXDL

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](#).



HESITATION, LOSS OF POWER TEST

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER

Table 6-77. 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, Odo-meter Self-Diagnostics](#). If DTCs are present, see the appropriate DTC procedure.

7. Verify battery condition. See [3.1 BATTERY TESTING](#).
8. Does battery pass tests?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Charge or 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 [6.12 DTC P0371, P0372, P0374](#) or [6.20 DTC P1353, P1356](#).

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 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.

STARTS, THEN STALLS

6.28

DESCRIPTION AND OPERATION

The starts, then stalls condition may be created by the fuel system, the idle air control system or an ECM failure.

There may be DTCs set causing this condition. Solve the problems with the DTCs before performing the tests in this section. The DTCs that may be involved with starts, then stalls are:

- **Fuel injectors:** DTCs P0261, P0262, P0263 and P0264
- **Password problem:** DTC P1009
- **TPS:** DTCs P0122 and P0123
- **ECM errors:** DTCs P0603 and P0605
- **IAC errors:** DTCs P0506 and P0507

Diagnostic Tips

- The vehicle will stall if the jiffy stand is extended when the transmission is in gear.
- If this condition is fuel related, perform fuel pressure test.

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](#).

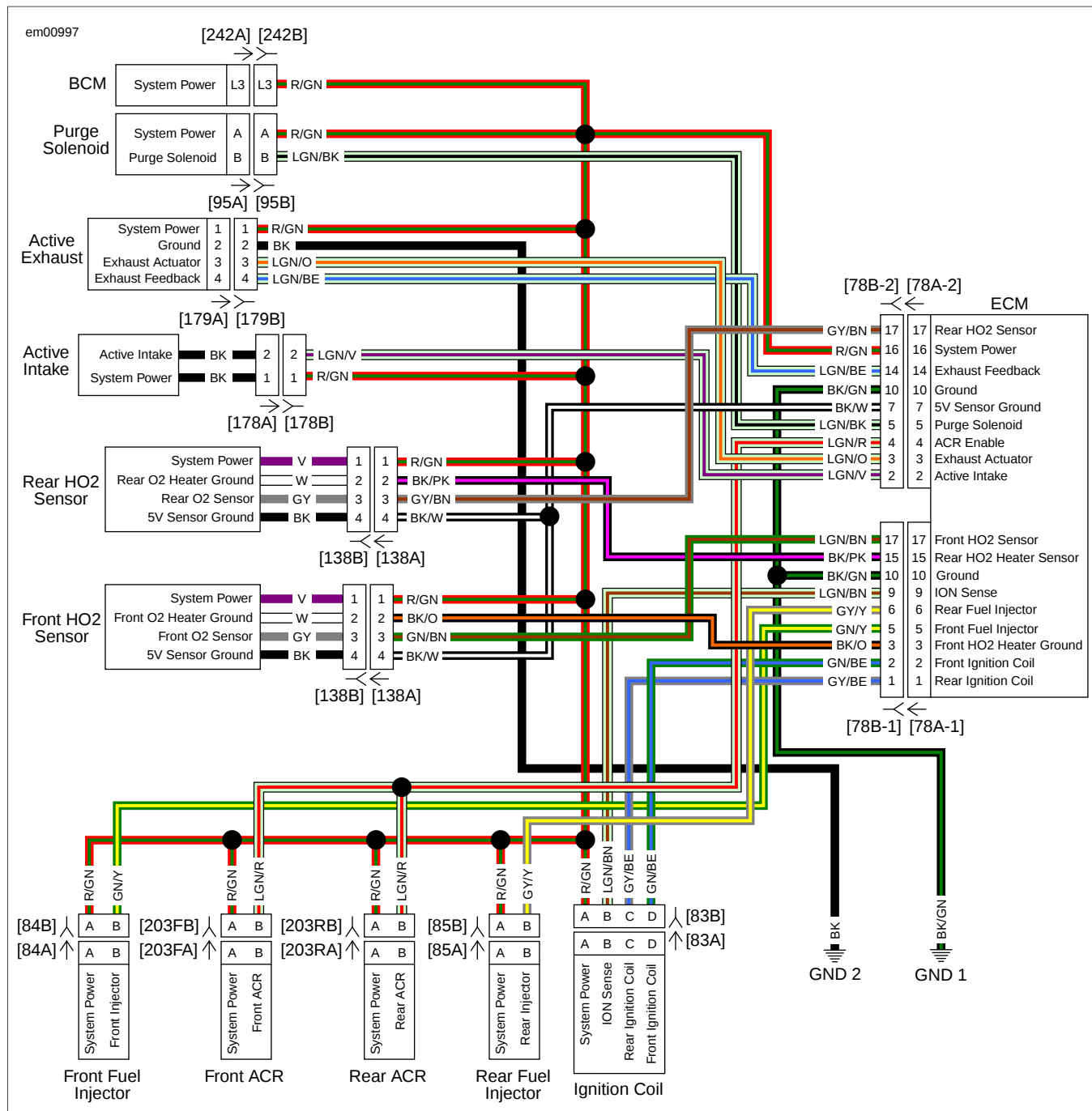


Figure 6-61. System Power Circuit

STARTS, THEN STALLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-78. Starts, Then Stalls Diagnostic Faults

POSSIBLE CAUSES
Fuel system malfunction
Idle air control system malfunction

1. Throttle Test

- Will engine start with the throttle partially opened and then stall when closed?
 - Yes.** See [6.15 DTC P0506, P0507](#) and perform IAC diagnostic procedure.
 - No.** [Go to Test 2.](#)

2. Fuel System Test

- Perform fuel pressure test.

- Is fuel pressure normal?
 - Yes.** If fuel injectors are okay, then continue with tests. [Go to Test 3.](#)
 - No.** Repair fuel pressure problem.

3. System Power Test

- Turn IGN OFF.
- Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
- Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
- Turn IGN ON.
- Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
- Is voltage present?
 - Yes.** Inspect connections at ECM. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#). If connections are good and wiggle test does not find intermittent, replace the ECM.
 - No.** Repair open in (R/GN) wire.

MISFIRE AT IDLE OR UNDER LOAD

6.29

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, use a known good part 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 [6.20 DTC P1353, P1356](#).

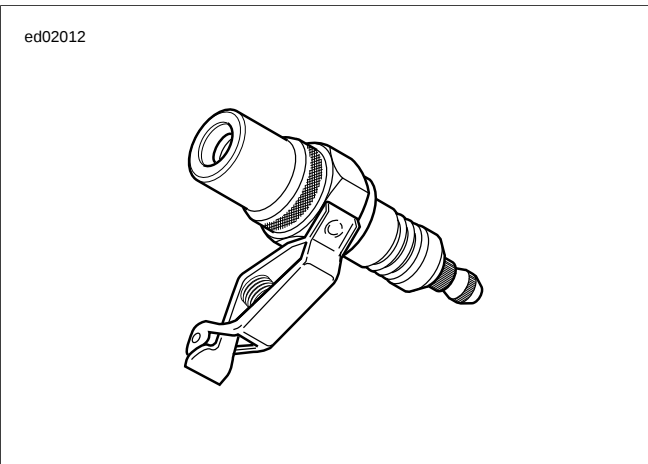


Figure 6-62. Spark Tester

IN-LINE SPARK TESTER

PART NUMBER	TOOL NAME
YA840	SNAP-ON IN-LINE SPARK TESTER

See [Figure 6-63](#). Using 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 wire and install SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) between spark plug wire 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

Use a SNAP-ON IN-LINE SPARK TESTER (Part No. YA840) and a load applying dynamometer to diagnose misfire under load.



Figure 6-63. 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](#).

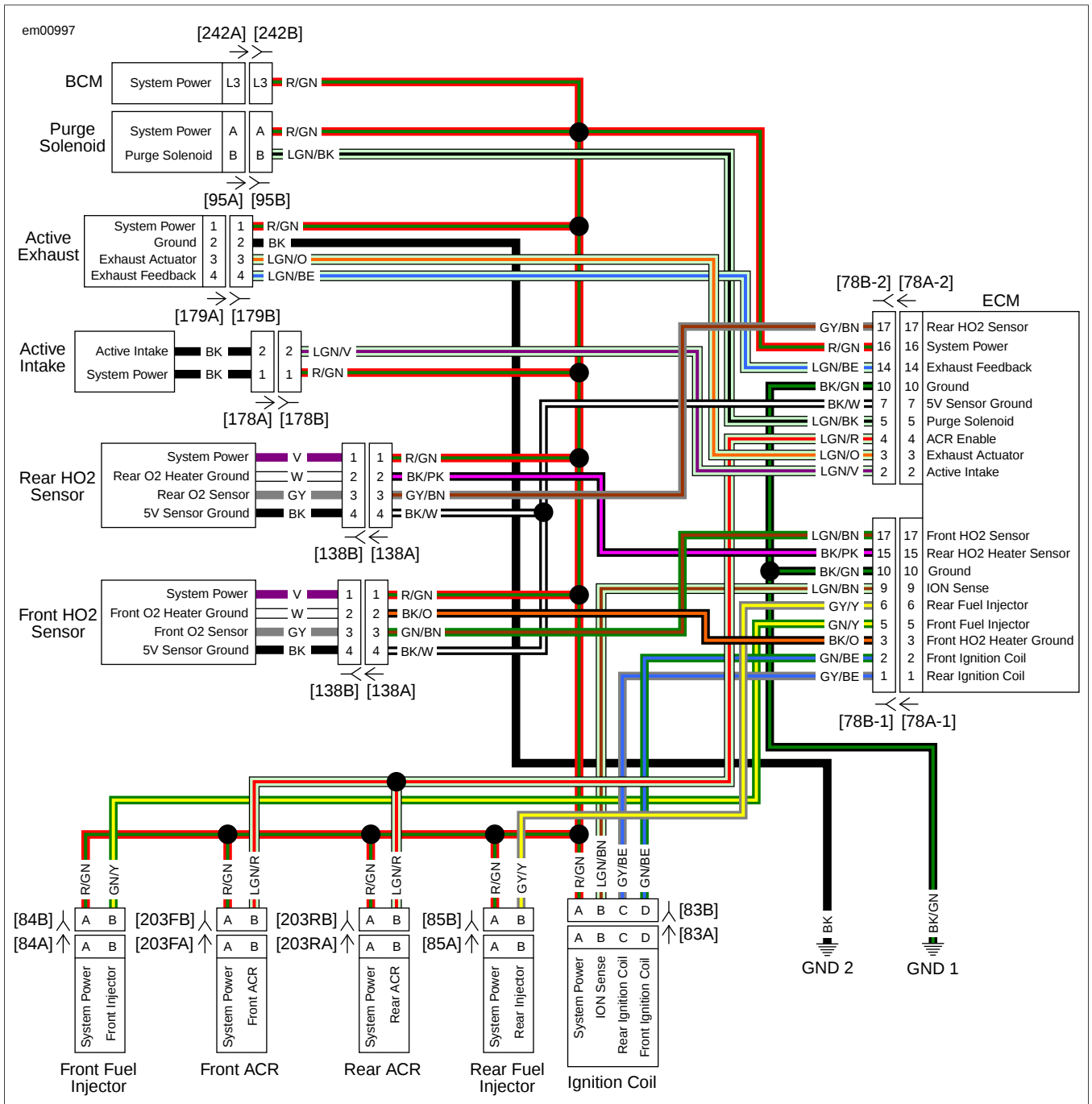


Figure 6-64. System Power Circuit

MISFIRE AT IDLE OR UNDER LOAD

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-79. 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. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and to ECM [78A-1] and [78A-2]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-1] terminal 10 and then [78-2] terminal 10 to ground.
5. Is continuity present?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** Repair open on (BK/GN) 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. 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 Wire Test

1. Turn IGN OFF.
2. Disconnect spark plug cables.
3. Test resistance of both spark plug cables.
4. Is resistance within specifications? Refer to [Table 1-5](#).
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace 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 previous test. 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. Disconnect ignition coil [83].
2. Disconnect BCM [242].
3. Test resistance between [242B] terminal L3 and [83B] terminal A (R/GN) wire. Wiggle connectors while measuring.
4. Is resistance continuously less than 0.5 Ohms?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair intermittent on (R/GN) wire.

6. Battery to Main Fuse Block Voltage Drop Test

1. Start engine.
2. Measure voltage drop between battery (+) and main fuse [64B] terminal A (R) wire.
3. Is voltage drop more than 1.0V?
 - a. **Yes.** Repair (R) wire between terminal A of [64B] and connection at battery including connections at starter.
 - b. **No.** Check for corrosion or damage at BCM [259].

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NOTES

ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION

7.1

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The ABS module Electronic Control Unit (ECU) controls brake application under extreme stopping conditions. The ABS system is activated when wheel slip is detected. When wheel slip is not detected, brake operation is no different than non-ABS systems.

The ABS consists of the following components:

- See [Figure 7-1](#) and [Figure 7-6](#). The ABS ECU module.
- See [Figure 7-2](#). The front HCU which contains a pump, accumulator, solenoids, apply and release valves.
- See [Figure 7-3](#). The rear HCU which contains a pump, accumulator, solenoids, apply and release valves.
- See [Figure 7-4](#). Front WSS.
- See [Figure 7-5](#) and [Figure 7-6](#). Rear WSS.

The ABS ECU responds to WSS inputs. The ABS ECU then controls the two HCUs. When one or both of the HCU units are activated, the solenoid valves decrease, hold or increase hydraulic fluid pressure to control the individual calipers of each wheel to prevent wheel slipping. However, the HCUs cannot increase hydraulic pressure beyond the pressure or force being applied to the brake pedal or lever by the rider.

ABS CAN Communication Functionality

The Right Hand Control Module (RHCM) has a front brake switch that supplies an applied signal on the CAN bus. This CAN communication signal is sent to the ABS ECU to indicate that the front brake is applied. The rear brake switch supplies a ground input to the BCM. The BCM sends a rear brake applied CAN communication signal to the ABS ECU.

Normal operation of the ABS system:

- A series of rapid HCU solenoid valve pulsations may be felt in either the front brake lever or rear brake pedal but only during initialization and anti-lock braking.
- A ticking or popping noise may be heard as the HCU solenoid valves cycle rapidly.
- During anti-lock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping.
- A normal ABS event must also see a front or rear brake switch or front brake switch CAN communication input to maximize performance, but an ABS event can still occur if no brake switch input is received based on WSS inputs.

Program replaced ABS ECUs with DIGITAL TECHNICIAN II (Part No. HD-48650).

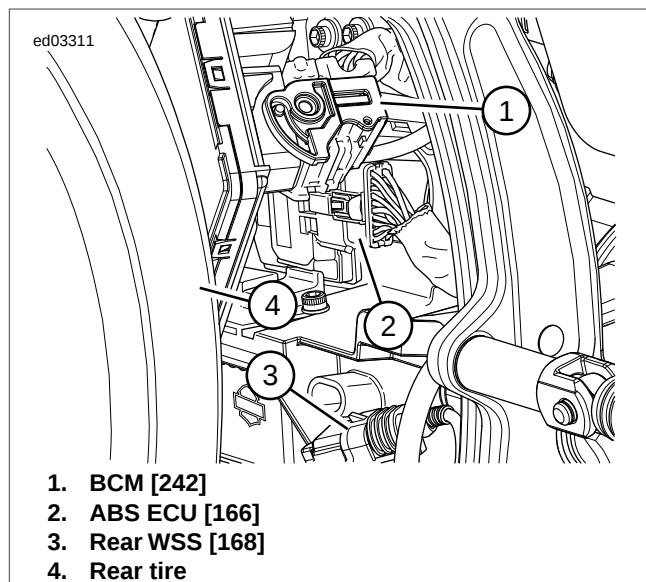


Figure 7-1. ABS [166]: Except FXSB

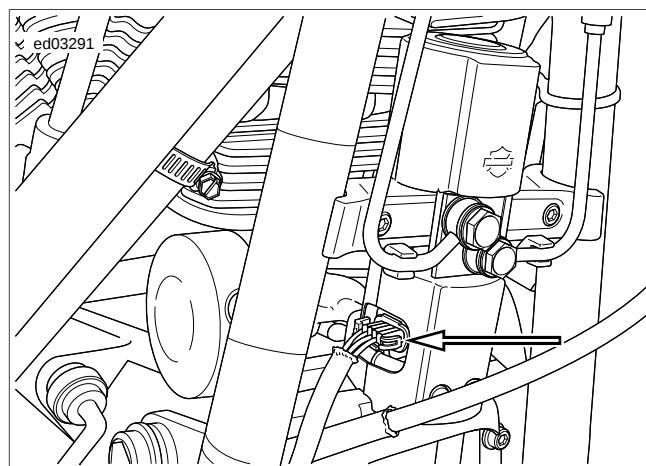


Figure 7-2. Front HCU [254]

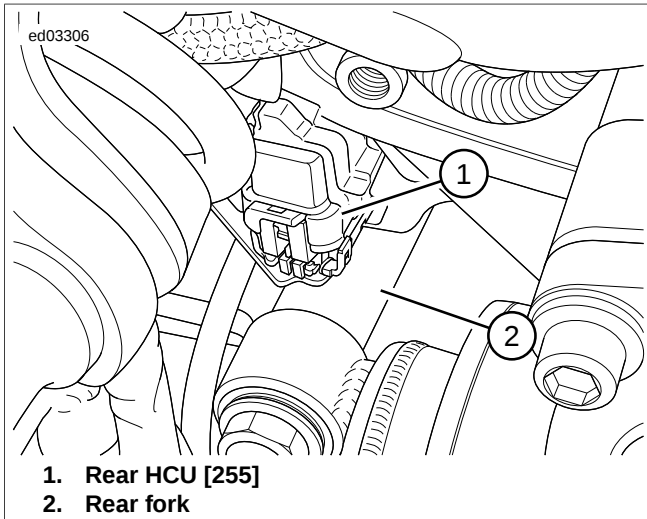


Figure 7-3. Rear HCU [255]

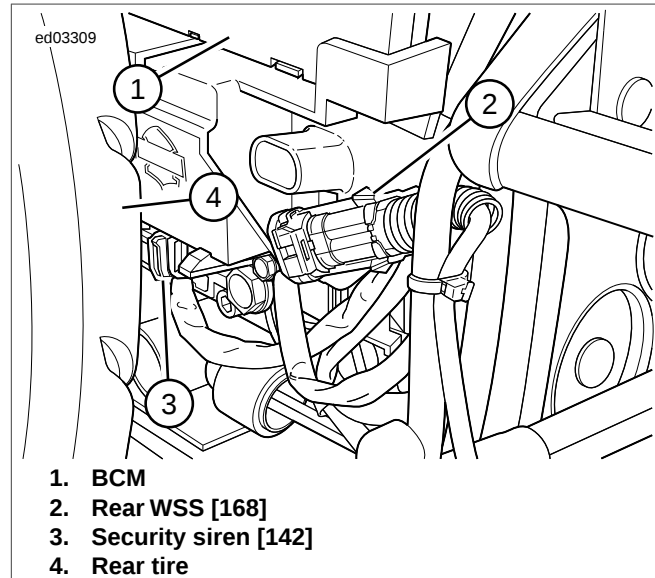


Figure 7-5. BCM: Except FXSB

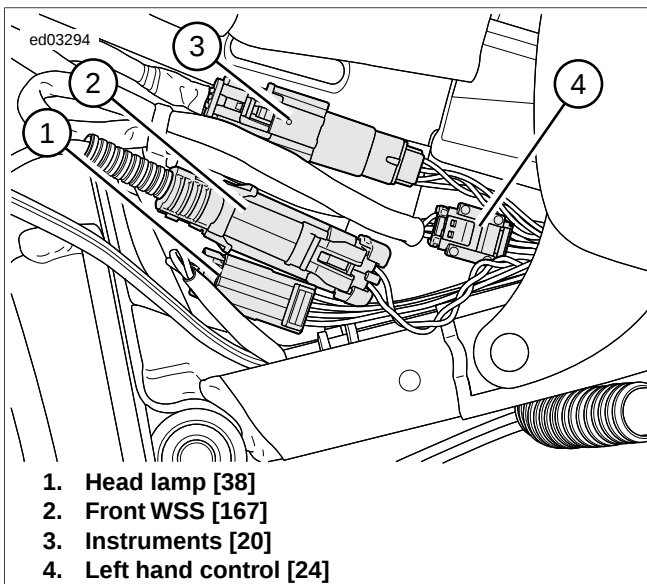


Figure 7-4. Under Fuel Tank Left Side

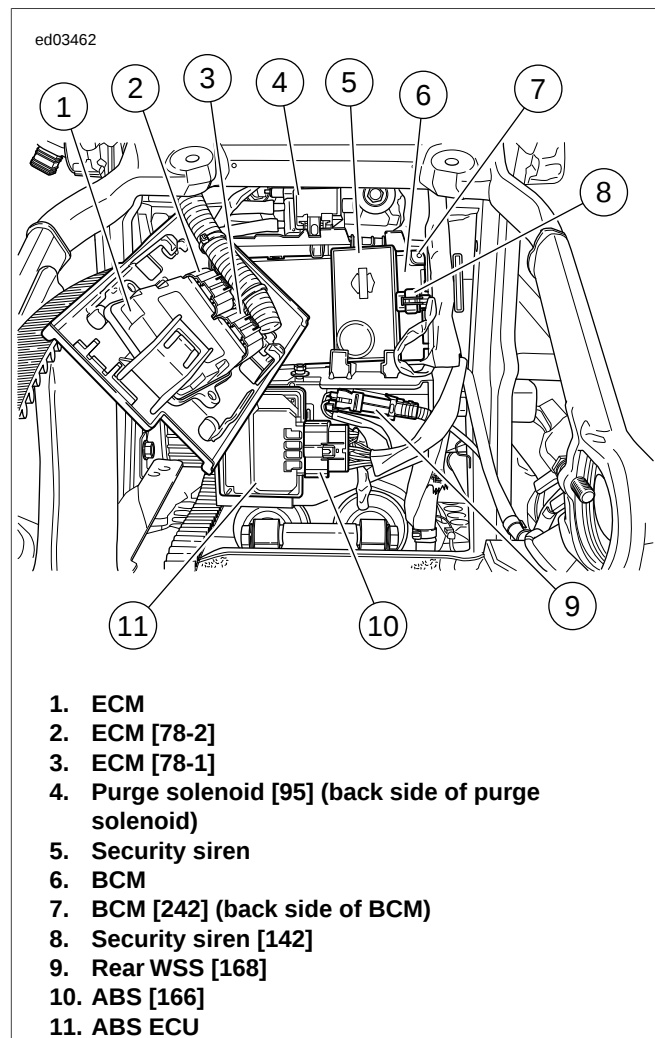


Figure 7-6. Electrical Panel: FXSB

Pressure Hold

The ABS ECU commands the appropriate HCU release and apply circuits to close the HCU valves. This holds the same constant pressure on the appropriate caliper as long as the current hydraulic pressure is the most effective pressure to stop the vehicle in the shortest amount of time without wheel slip.

Pressure Decrease

Sometimes the pressure being applied to the caliper is high enough for the ABS ECU to detect wheel slip. To control the wheel slip, the ABS ECU commands the appropriate HCU release circuit to open the release valve and the apply circuit to close the apply valve. This releases pressure on the appropriate caliper until wheel slip is no longer detected. The excess fluid is stored in the accumulator, until the pump can return the fluid to the master cylinder or fluid reservoir.

Pressure Increase

After the wheel slip is corrected during an ABS event, a pressure increase occurs. The ABS ECU commands the appropriate HCU release circuit to close the release valve and the apply circuit to open the apply valve. This increases the pressure applied to the caliper during deceleration in order to reduce the speed of the wheel. The increased pressure will not exceed the pressure being applied to the master cylinder by the rider.

Initialization Self-Test

The ABS ECU module performs one initialization test each ignition cycle. An ignition cycle consists of starting the vehicle after a complete shutdown with no CAN bus communication for more than 30 seconds. Clearing the DTCs will also reset the ignition cycle. The ABS ECU verifies CAN communication, internal circuitry and the WSS circuits.

As part of the initialization self-test, the ABS module also does a modulator test. This test consists of energizing the actuators and commanding the motor and solenoids on and off. The ABS ECU will run this test the first time the vehicle speed exceeds 5 mph (8 km/h) in an ignition cycle, or when all the following conditions are met for the first time in an ignition cycle:

- Brake is not applied.
- Engine is above 1000 rpm.
- No ABS event present.
- The ABS ECU is enabled.
- The ABS system is not communicating with DIGITAL TECHNICIAN II (Part No. HD-48650).

ABS Indicator

See [Figure 7-7](#). The speedometer illuminates the ABS indicator when the following occurs.

- The ABS ECU detects an ABS disabling malfunction. The ABS ECU sends a serial data message to the instrument requesting illumination.
- The speedometer performs a bulb check.
- The speedometer detects a loss of communication with the ABS ECU.
- The ABS light may flash when the IGN is turned on. This will continue until the vehicle is driven to verify WSS operation.

The ABS ECU sends a message to the instrument when a malfunction that disables ABS operation is detected. Depending on the fault, the ABS indicator may stay on even after the malfunction is corrected. The indicator will not go off until the vehicle is operated at speeds greater than 10 mph (16 km/h). It is important to verify that this is not the cause of an ABS indicator, which is illuminated when no DTCs are set, before attempting to diagnose other possible causes.

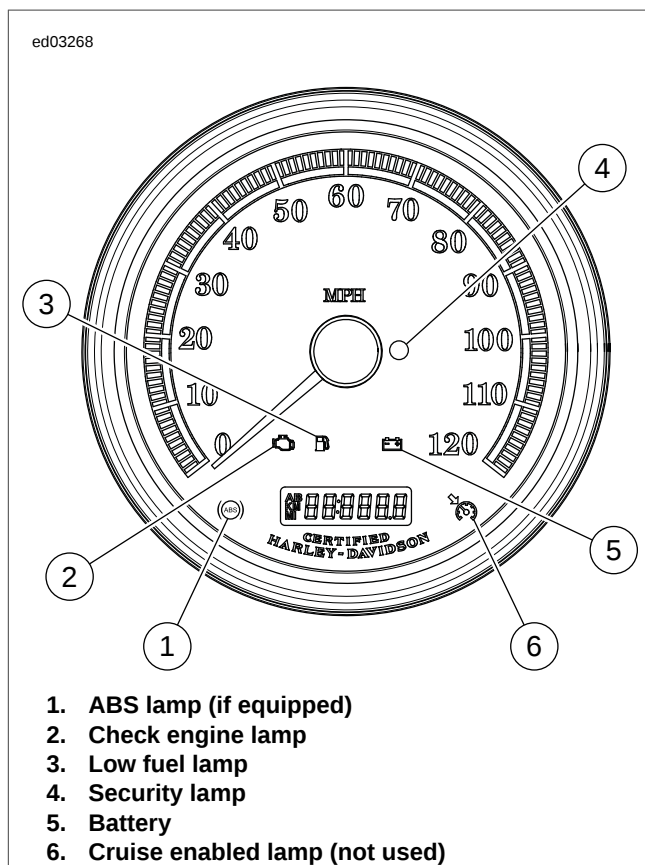


Figure 7-7. Indicator Lamps

DTC C1018, C1041, C1042, C1044, C1224, C1225

DESCRIPTION AND OPERATION

See [Figure 7-8](#), [Figure 7-9](#), [Figure 7-10](#) and [Figure 7-11](#). The ABS ECU monitors the power and ground circuits of the front and rear HCU through terminals B and D. These circuits supply the power and ground to the pump motor in the HCU. The ABS ECU controls the pump by turning on and off the power circuit to the pump motor.

Table 7-1. Code Description

DTC	DESCRIPTION
C1018	Front actuator circuit low/open
C1041	Rear actuator circuit low/open
C1042	Front actuator circuit open
C1044	Rear actuator circuit open
C1224	Front HCU power shorted high
C1225	Rear HCU power shorted high

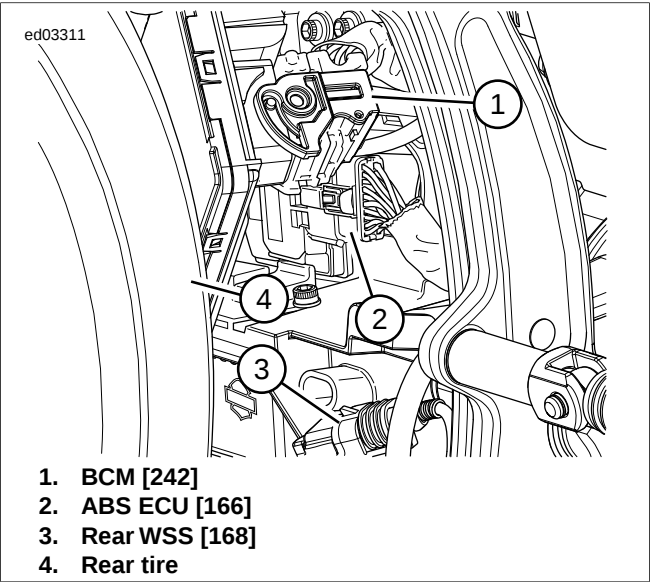


Figure 7-8. ABS [166]: Except FXSB

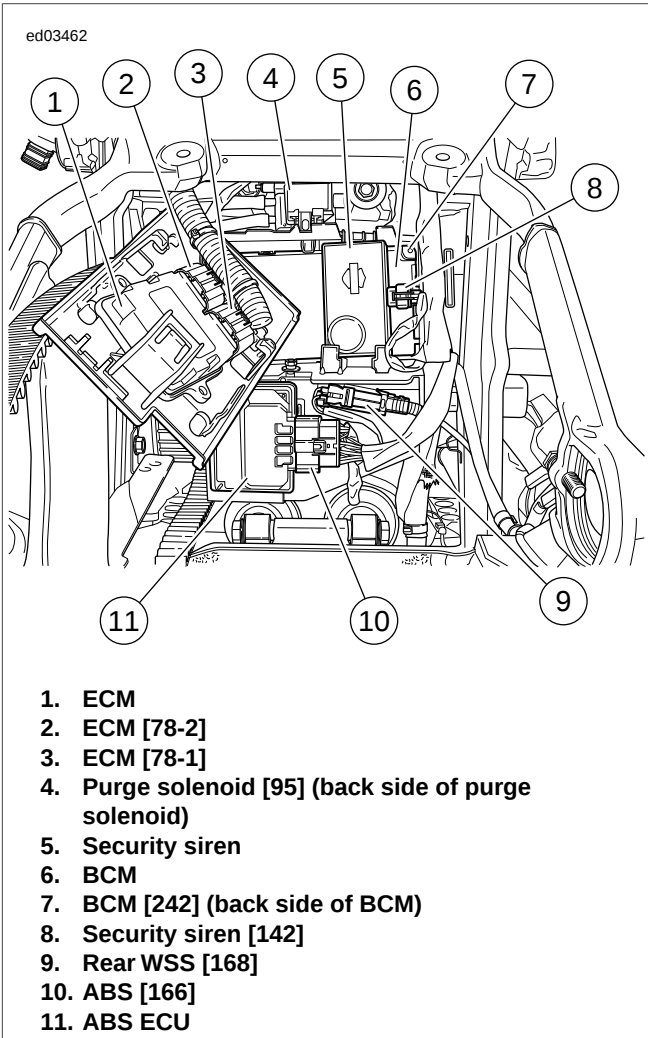


Figure 7-9. Electrical Panel: FXSB

Conditions for Setting the DTC

These DTCs can set if one of the following conditions exists in the HCU power or ground circuit:

- Open or high resistance on the HCU ground circuit.
- HCU fault or malfunction.
- ABS ECU fault or malfunction.
- Open or high resistance on the HCU power circuit.

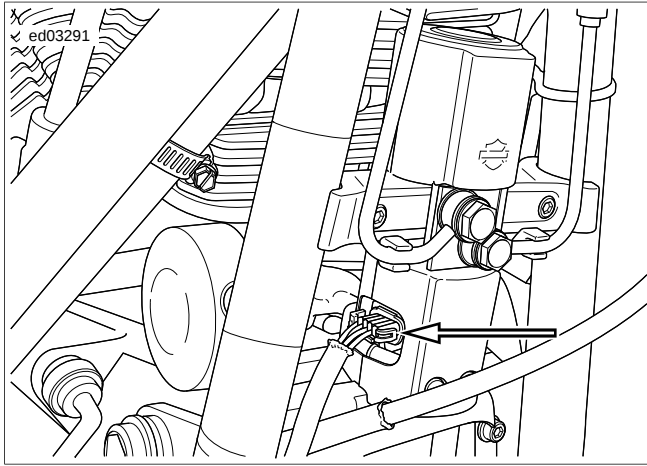


Figure 7-10. Front HCU [254]

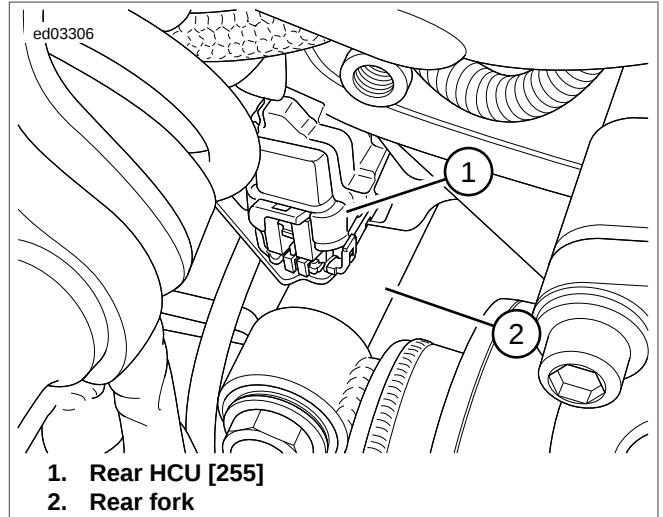


Figure 7-11. Rear HCU [255]

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

These DTCs are related to terminals B and D of the HCU, either internally in the ABS ECU or HCU or externally in the wiring or connectors. If a DTC is intermittent, it may be a connection problem at the HCU, the ABS ECU or GND 2.

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](#).

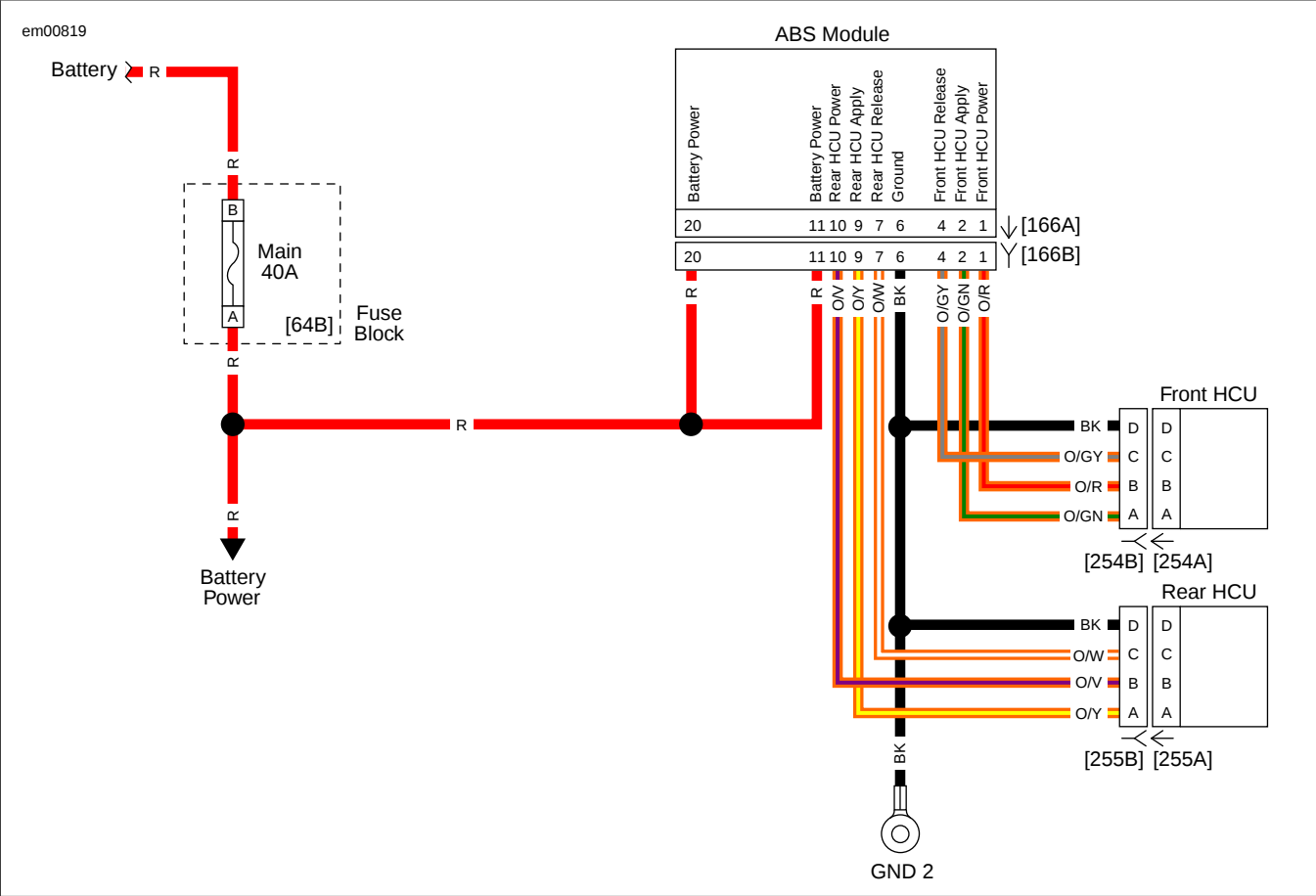


Figure 7-12. HCU Schematic

DTC C1018, C1042, C1224

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX

Table 7-2. DTC C1018, C1042, C1224 Diagnostic Faults

POSSIBLE CAUSES
Open or high resistance on the front HCU ground circuit
Open or high resistance on front HCU power circuit
Short to ground on the front HCU power circuit
Short to power on HCU circuit

1. Front HCU Internal Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect front HCU [254].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 1 and ground.

5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/R) wire.
 - b. **No.** [Go to Test 2](#).

2. Internal Power Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 1 and ground.
3. Is battery voltage present?
 - a. **Yes.** Repair short to voltage on (O/R) wire.
 - b. **No.** [Go to Test 3](#).

3. Ground Circuit Test

1. Turn IGN OFF.
2. Remove main fuse [64B].
3. Test resistance between [254B] terminal D (BK) wire and ground.
4. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 4](#).
 - b. **No.** Repair open or high resistance in (BK) wire.

4. Power Circuit Test

1. Test resistance between [254B] terminals B (O/R) wire and BOB terminal 1.
2. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open or high resistance in (O/R) wire.

5. Pump Motor Current Draw Test

1. Connect [254].
2. Select DC Amp on DMM in range to handle 10A.
3. Connect red lead of DMM to battery and black lead of DMM to BOB terminal 1.
4. Does HCU motor run drawing more than 0.5A?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Replace the HCU.

6. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for ABS initialization self-test. See [7.1 ANTI-LOCK BRAKE SYSTEM \(ABS\) GENERAL INFORMATION](#).
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC C1041, C1044, C1225

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX

Table 7-3. DTC C1041, C1044, C1225 Diagnostic Faults

POSSIBLE CAUSES
Open or high resistance on the rear HCU ground circuit
Open or high resistance on rear HCU power circuit
Short to ground on the rear HCU power circuit
Short to power on HCU circuit

1. Rear HCU Internal Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect rear HCU [255].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 10 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/V).
 - b. **No.** [Go to Test 2.](#)

2. Internal Power Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 10 and ground.
3. Is battery voltage present?
 - a. **Yes.** Repair short to voltage on (O/V) wire.
 - b. **No.** [Go to Test 3.](#)

3. Ground Circuit Test

1. Remove main fuse [64B].
2. Test resistance between [255B] terminal D (BK) wire and ground.
3. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open or high resistance in (BK) wire.

4. Power Circuit Test

1. Test resistance between [255B] terminal B (O/V) wire and BOB terminal 10.
2. Is resistance less than 0.5 Ohms?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open or high resistance in (O/V) wire.

5. Pump Motor Current Draw Test

1. Connect [255].
2. Select DC Amp on DMM in range to handle 10A.
3. Connect red lead of DMM to battery and black lead of DMM to BOB terminal 10.
4. Does HCU motor run drawing more than 0.5A?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Replace HCU.

6. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for initialization self-test. See [7.1 ANTI-LOCK BRAKE SYSTEM \(ABS\) GENERAL INFORMATION](#).
4. Check DTCs.

5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC C1021, C1023

DESCRIPTION AND OPERATION

The active WSS is supplied system voltage from the ABS module. The sensor then returns a 7 mA or 14 mA signal back to the ABS module.

Table 7-4. Code Description

DTC	DESCRIPTION
C1021	Front wheel speed sensor always = 0
C1023	Rear wheel speed sensor always = 0

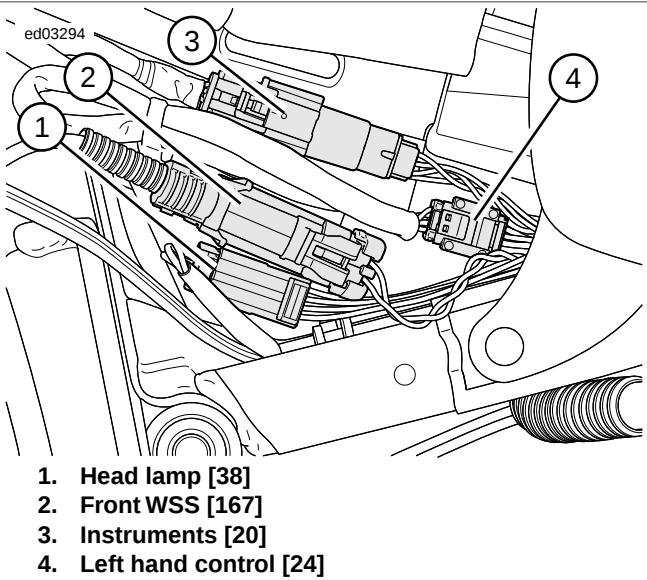


Figure 7-13. Under Fuel Tank Left Side

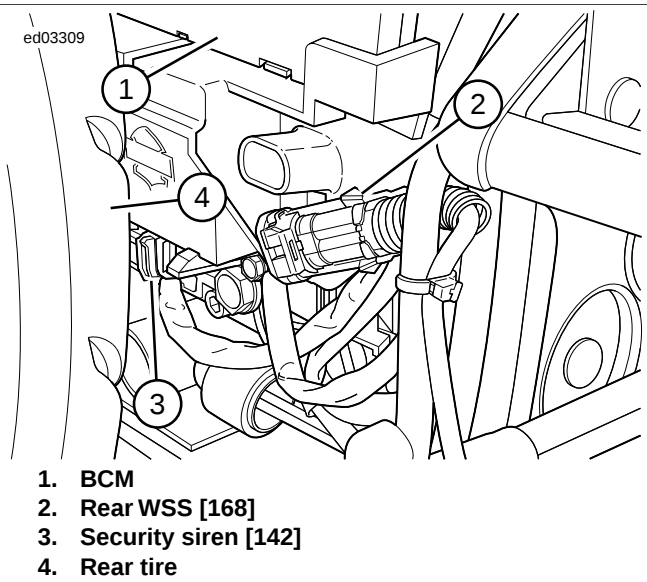


Figure 7-14. BCM: Except FXSB

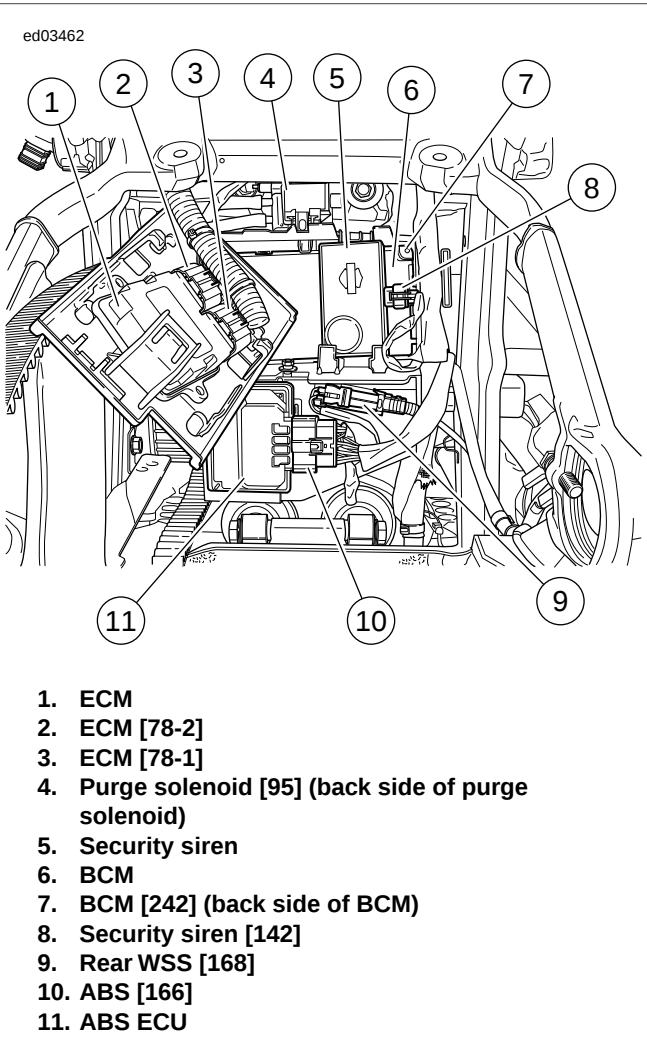


Figure 7-15. Electrical Panel: FXSB

Conditions for Setting the DTC

The DTC will set if the frequency of the wheel speed input goes above 2.5kHz for 20 milliseconds.

DTC C1021 or C1023 can set if the following conditions exist in the low WSS circuit:

- The wheel speed of one wheel is greater than 5 mph (8 km/h) for 2.5 seconds while the other wheel is 0 mph (0 km/h) with no brake switch input.
- Dynamometer testing.
- WSS fault or malfunction.
- ABS ECU fault or malfunction.
- Incorrect or worn bearing assembly.

Action Taken When the DTC Sets

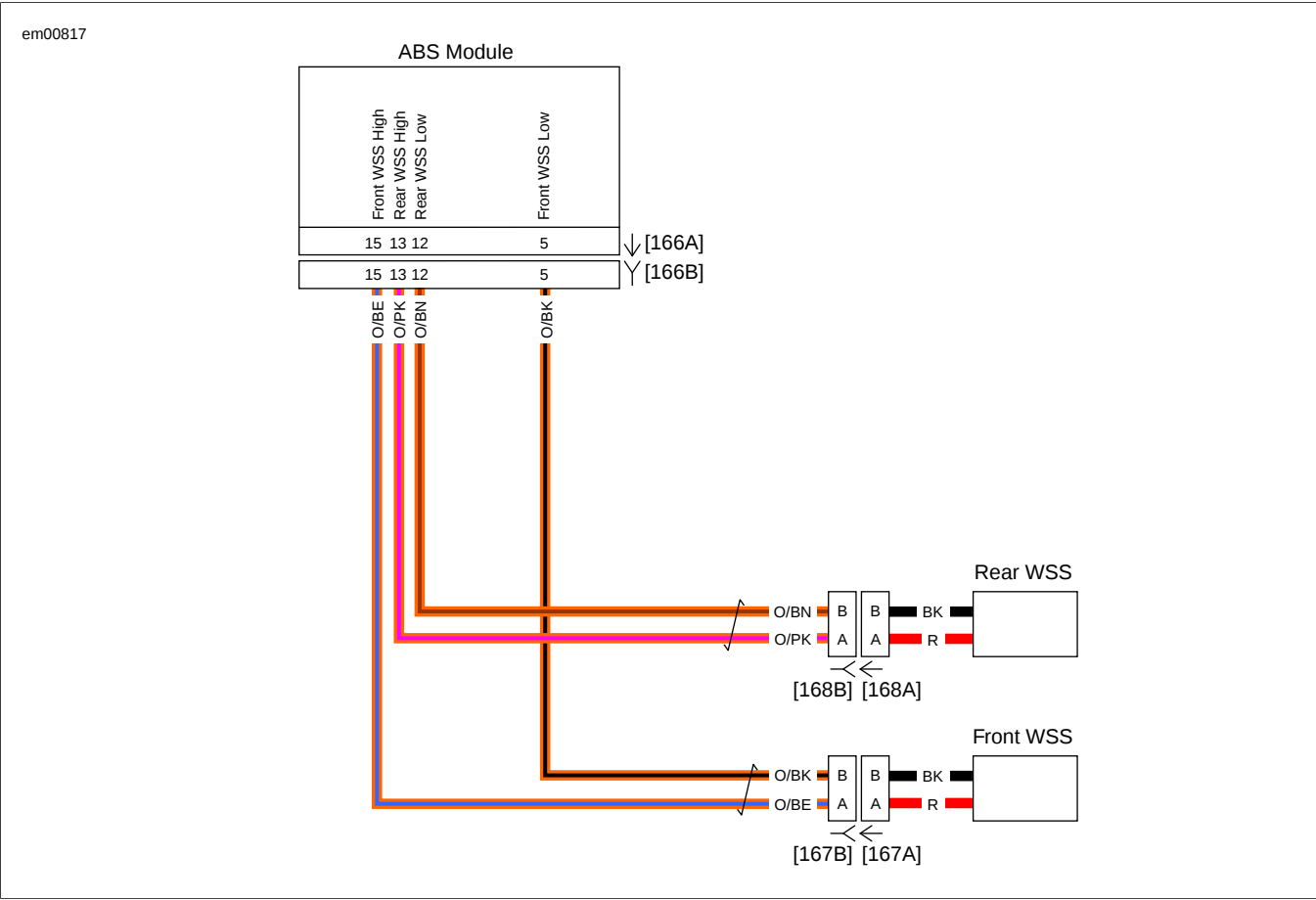
- The ABS module disables the ABS.
- The ABS indicator is illuminated.

Diagnostic Tips

A correctly installed ABS wheel bearing will have a tan seal facing outward. If the red seal is showing, the bearing is installed backward. If the seal is black, it is a non-ABS bearing and should be replaced with the correct bearing

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](#).



DTC C1021 (FRONT), C1023 (REAR)

Table 7-5. DTC C1021 (Front), C1023 (Rear) Diagnostic Faults

POSSIBLE CAUSES
Electrical interference
Poor connections
Intermittent open in WSS circuits
Faulty WSS
Worn bearing assembly

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the wheel speed sensors.
2. Electrical interference present?
 - a. **Yes.** Remove or relocate interference.
 - b. **No.** [Go to Test 2.](#)

2. Validation of Current DTC Test

1. Clear DTC.
2. Operate vehicle above 5 mph (8 km/h) for at least 30 seconds.
3. Did DTC reset?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** See diagnostic tips.

3. Worn or Damaged Components Test

1. Inspect for worn, damaged or incorrect bearing assembly.

NOTES

Check ABS bearing seal color to determine if bearing is properly installed.

- Tan seal faces outward when properly installed.
- Red seal visible indicates bearing is installed backward.
- Black seal visible indicates non-ABS bearings. Replace with correct ABS bearing.

2. Were worn, damaged or incorrect components found?
 - a. **Yes.** Repair as needed.
 - b. **No.** Replace with appropriate bearing assembly and WSS and retest.

DTC C1025, C1032, C1206

DESCRIPTION AND OPERATION

See [Figure 7-17](#) and [Figure 7-19](#). The active WSS is supplied system voltage from the ABS ECU. The sensor returns a 7mA or 14mA signal back to the ABS ECU.

- **Front WSS high circuit:** The ABS ECU module monitors ignition voltage from terminal 15 of the ABS ECU through terminal A of the front WSS.
- **Front WSS low circuit:** The ABS ECU monitors the signal from terminal B of the front WSS through terminal 5 of the ABS ECU.

Table 7-6. Code Description

DTC	DESCRIPTION
C1025	Front wheel speed signal intermittent
C1032	Front wheel speed sensor circuit open or shorted
C1206	Front wheel speed sensor frequency out of range

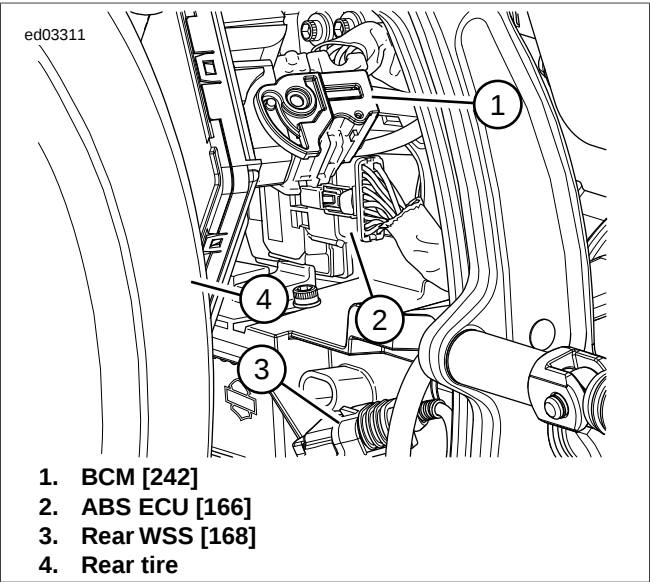


Figure 7-17. ABS [166]: Except FXSB

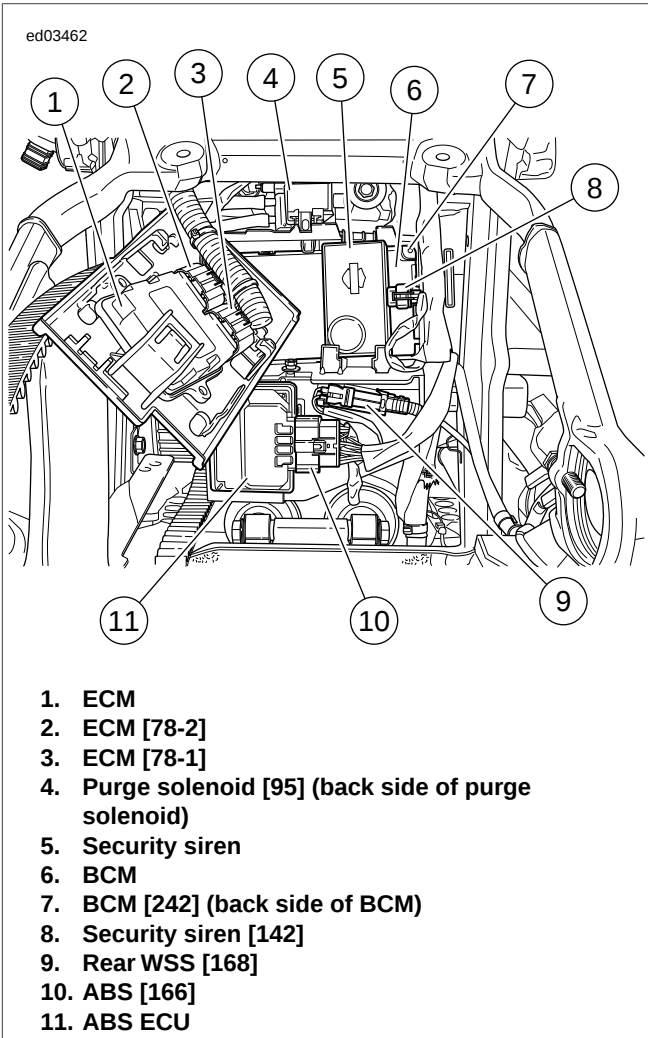


Figure 7-18. Electrical Panel: FXSB

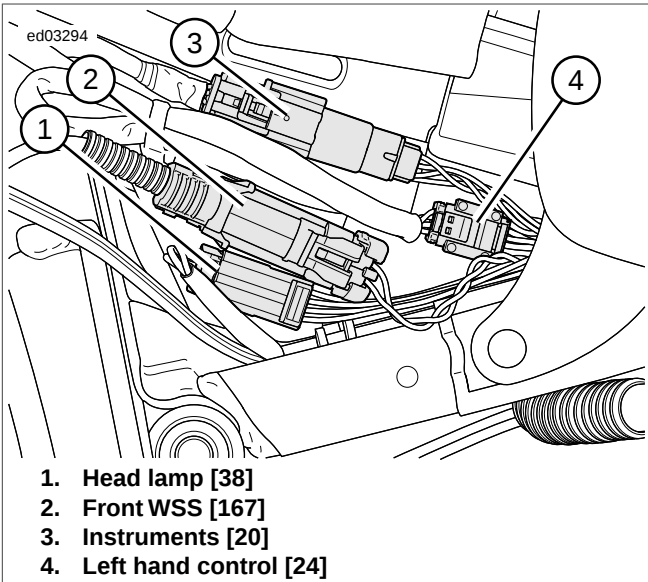


Figure 7-19. Under Fuel Tank Left Side

Conditions for Setting the DTC

DTC C1025 can set if the following conditions exist in the front WSS low circuit:

- One of the WSS sends a signal to the ABS ECU that the wheel speed has increased or decreased at a rate that is faster than physically possible without a brake switch input.
- ABS ECU fault or malfunction.
- Intermittent open in the front high or low WSS circuits.
- ABS ECU fault or malfunction.
- Incorrect or worn bearing assembly.
- Electrical interference.

DTC C1032 can set if one of the following conditions exist in the front high or low WSS circuit for longer than 0.02 seconds:

- Short to ground, short to battery, open or high resistance in the front high or low WSS circuits.
- WSS fault or malfunction.
- ABS ECU fault or malfunction.

DTC C1206 can set due to the following conditions:

- Electrical noise on the WSS circuit.
- Faulty WSS and bearing assembly.
- Faulty ABS ECU.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminals A and B of the front WSS, either internally in the ABS ECU or WSS, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal A or B of the WSS to the ABS ECU.

The following issues could affect the setting of these codes and should be inspected before part replacement.

- Mismatched or improperly sized tires.
- Worn suspension components.
- Riding over rough terrain.
- External or internal wheel speed circuit intermittent open.
- Electrical noise on the WSS wires.

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](#).

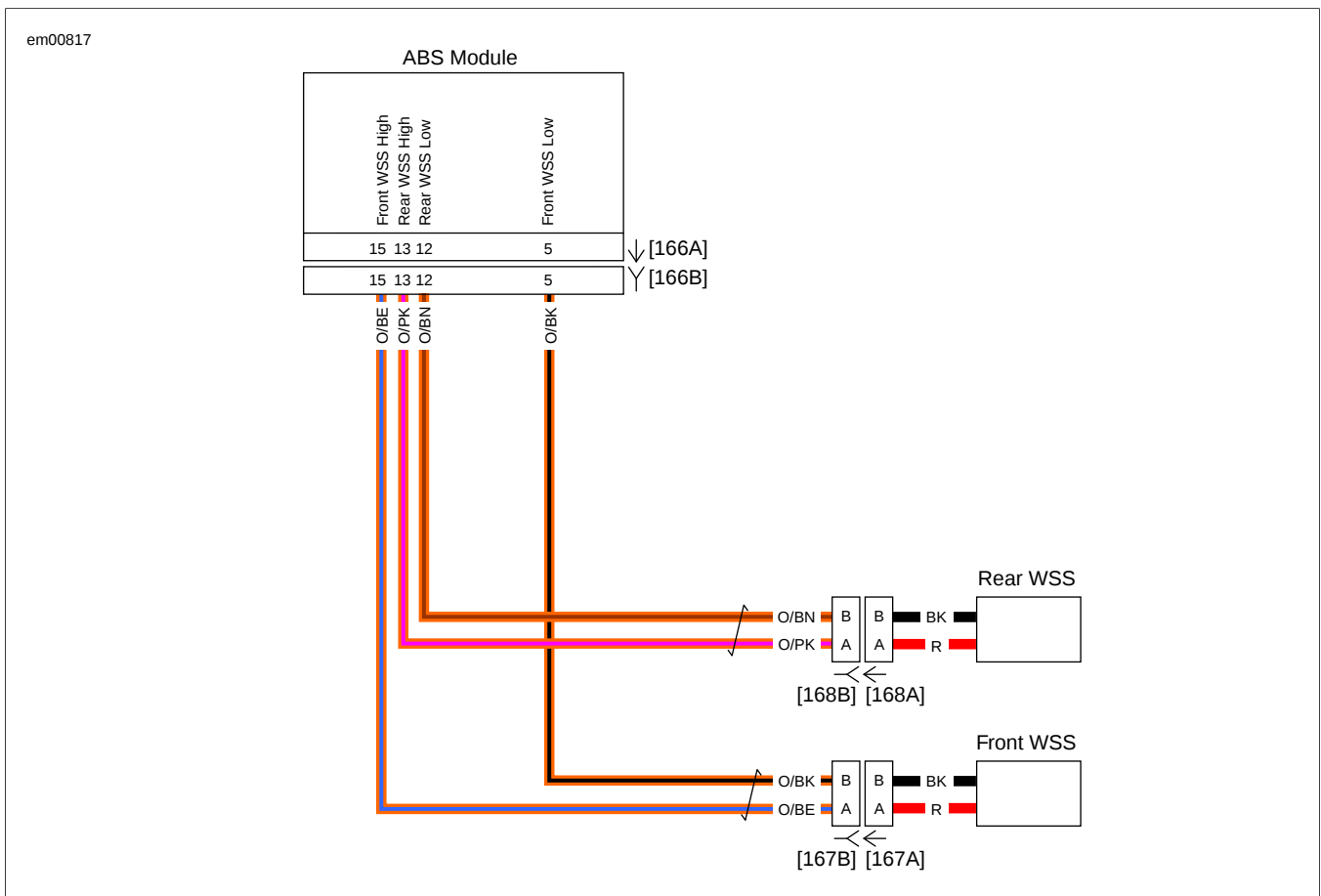


Figure 7-20. Wheel Speed Sensor Circuits

DTC C1025, C1032, C1206

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX
HD-50341	WHEEL SPEED SENSOR TEST LEAD

Table 7-7. DTC C1025, C1032, C1206 Diagnostic Faults

POSSIBLE CAUSES
The wheel speed of one wheel is greater than 5 mph (8 km/h) for 2.5 seconds while the other wheel is 0 mph (0 km/h) with no brake switch input
Dynamometer testing
WSS fault or malfunction
Worn bearing assembly
One of the WSSs sends a signal to the ABS ECU that the wheel speed has increased or decreased at a rate that is faster than physically possible without a brake switch input
Intermittent open in the front high or low WSS circuits
Electrical interference
Short to ground, short to battery, open or high resistance in the front high or low WSS circuits

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the WSS.
2. Inspect the front wheel bearing.
3. Is electrical interference or wheel bearing malfunction present?
 - a. **Yes.** Remove or relocate interference or correct wheel bearing issues.
 - b. **No.** [Go to Test 2.](#)

2. Loose or Damaged Connections Test

1. Turn IGN OFF.
2. See [Figure 7-2](#) and [Figure 7-3](#). Inspect for loose or damaged connections on WSS circuits.
3. Were poor connections found?
 - a. **Yes.** Repair connections and circuits.
 - b. **No.** [Go to Test 3.](#)

3. Front WSS Test

1. Turn IGN OFF.
2. Disconnect front WSS [167].
3. Connect WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) between [167B] terminals A and B. See [1.2 DIAGNOSTIC TOOLS](#).
4. Clear DTCs.
5. Cycle IGN OFF, ON, wait 10 seconds for ABS to complete initialization test.

6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace front WSS.

4. (O/BK) Open Test

1. Turn IGN OFF.
2. Connect ABS BREAKOUT BOX (Part No. HD-48642) between wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Remove sensor test lead.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 5 and [167B] terminal B (O/BK) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (O/BK) wire.

5. (O/BE) Open Test

1. Test continuity between BOB terminal 15 and [167B] terminal A (O/BE) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (O/BE) wire.

6. Shorted Wires Test

1. Test continuity between BOB terminals 5 and 15.
2. Is continuity present?
 - a. **Yes.** Repair short between (O/BE) and (O/BK) wires.
 - b. **No.** [Go to Test 7.](#)

7. (O/BK) Ground Test

1. Test continuity between BOB terminal 5 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/BK) wire.
 - b. **No.** [Go to Test 8.](#)

8. (O/BE) Ground Test

1. Test continuity between BOB terminal 15 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/BE) wire.
 - b. **No.** [Go to Test 9.](#)

9. (O/BK) Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 5 and ground.
3. Is voltage present?
 - a. **Yes.** Repair short to voltage on (O/BK) wire.
 - b. **No.** Replace ABS module.

DTC C1027, C1034, C1208

7.5

DESCRIPTION AND OPERATION

See [Figure 7-21](#). The active WSS is supplied system voltage from the ABS ECU. The sensor returns a 7mA or 14mA signal back to the ABS ECU.

- **Rear WSS high circuit:** The ABS ECU monitors ignition voltage from terminal 13 of the ABS ECU through terminal A of the rear WSS.
- **Rear WSS low circuit:** The ABS ECU monitors the frequency signal from terminal B of the rear WSS through terminal 12 of the ABS ECU.

Table 7-8. Code Description

DTC	DESCRIPTION
C1027	Rear wheel speed signal intermittent
C1034	Rear wheel speed sensor circuit open or shorted
C1208	Rear wheel speed sensor frequency out of range

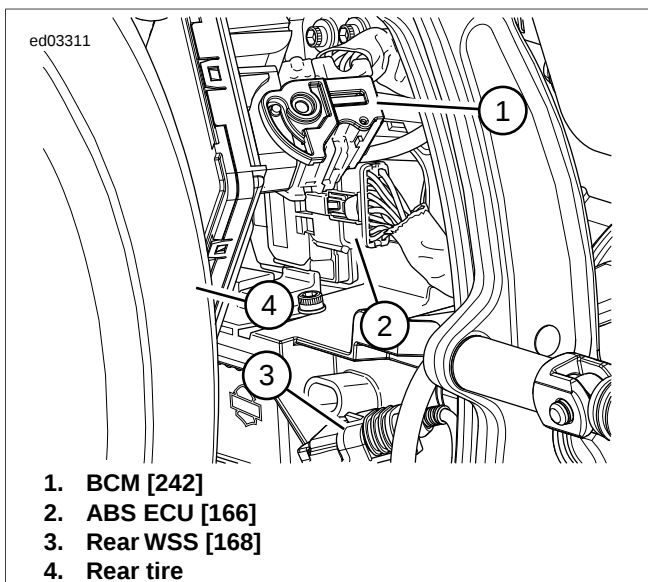


Figure 7-21. ABS [166]: Except FXSB

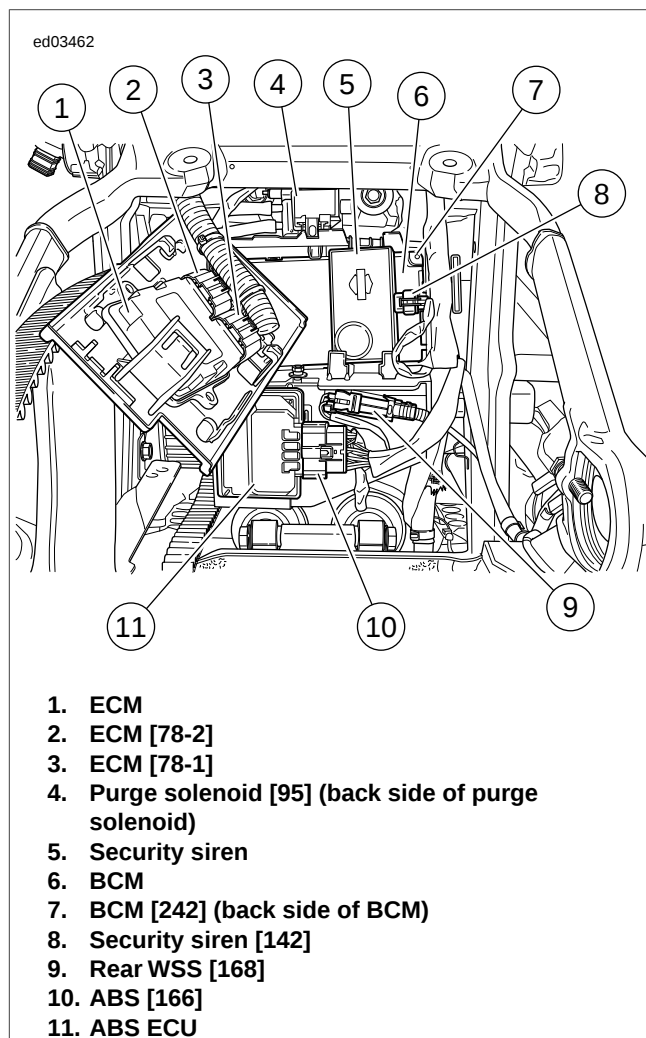


Figure 7-22. Electrical Panel: FXSB

Conditions for Setting the DTC

DTC C1027 can set if the following conditions exist in the rear WSS low circuit:

- One of the WSSs sends a signal to the ABS ECU that the wheel speed has increased or decreased at a rate that is faster than physically possible without a brake switch input.
- ABS ECU fault or malfunction.
- Intermittent open in the rear high or low WSS circuits.
- Incorrect or worn bearing assembly.
- Electrical interference.

DTC C1034 can set if one of the following conditions exist in the rear high or low WSS circuit for longer than 0.02 seconds:

- Short to ground, short to battery, open or high resistance in the rear high or low WSS circuits.
- WSS fault or malfunction.
- ABS ECU fault or malfunction.

DTC C1208 can set due to the following conditions:

- Electrical noise on the WSS circuit.
- Faulty WSS and bearing assembly.
- Faulty ABS ECU.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminals A and B of the rear WSS either internally in the ABS ECU or

WSS, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal A or B of the WSS to the ABS ECU.

The following issues could affect the setting of these codes and should be inspected before part replacement.

- Mismatched or improperly sized tires.
- Worn suspension components.
- Riding over rough terrain.

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](#).

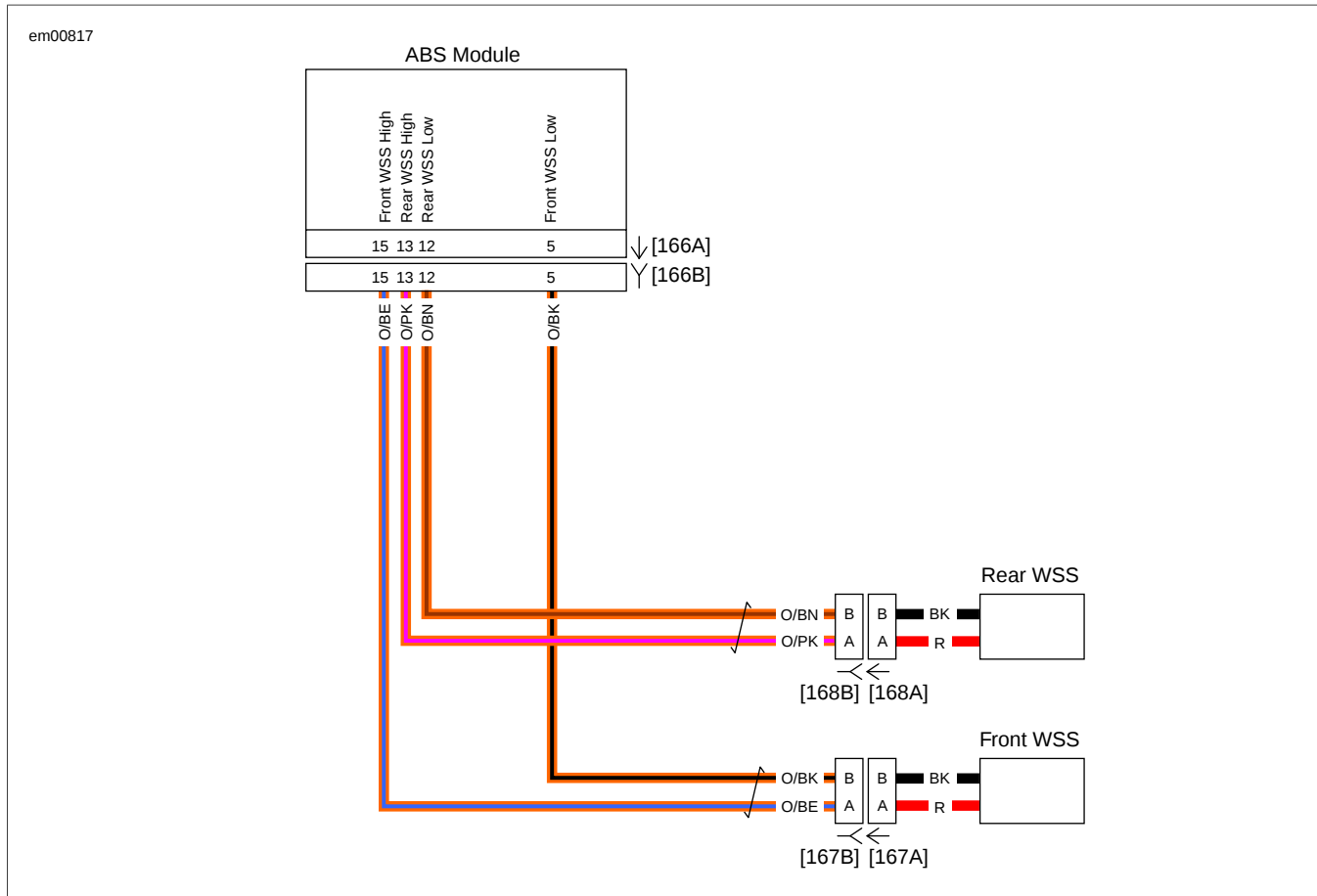


Figure 7-23. Wheel Speed Sensor Circuits

DTC C1027, C1034, C1208

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX
HD-50341	WHEEL SPEED SENSOR TEST LEAD

Table 7-9. DTC C1027, C1034, C1208 Diagnostic Faults

POSSIBLE CAUSES
The wheel speed of one wheel is greater than 5 mph (8 km/h) for 2.5 seconds while the other wheel is 0 mph (0 km/h) with no brake switch input
Dynamometer testing
WSS fault or malfunction
Worn bearing assembly
One of the wheel speed sensors sends a signal to the ABS ECU that the wheel speed has increased or decreased at a rate that is faster than physically possible without a brake switch input
Intermittent open in the rear high or low WSS circuits
Electrical interference
Short to ground, short to battery, open or high resistance in the rear high or low WSS circuits

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the WSS.
2. Inspect the rear wheel bearing.
3. Is electrical interference or wheel bearing malfunction present?
 - a. **Yes.** Remove or relocate interference or correct wheel bearing issues.
 - b. **No.** [Go to Test 2.](#)

2. Loose or Damaged Connections Test

1. Turn IGN OFF.
2. See [Figure 7-2](#) or [Figure 7-3](#). Inspect for loose or damaged connections on WSS circuits.
3. Were poor connections found?
 - a. **Yes.** Repair connections and circuits.
 - b. **No.** [Go to Test 3.](#)

3. Rear WSS Test

1. Turn IGN OFF.
2. Disconnect rear WSS [168].
3. Connect WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) between [168B] terminals A and B. See [1.2 DIAGNOSTIC TOOLS](#).
4. Clear DTCs.

5. Cycle IGN OFF, ON, wait 10 seconds for ABS to complete initialization test.
6. Check DTCs.
7. Did DTC reset?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Replace front WSS.

4. (O/BN) Open Test

1. Turn IGN OFF.
2. Connect ABS BREAKOUT BOX (Part No. HD-48642) between wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Remove sensor test lead.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 12 and [168B] terminal B (O/BN) wire.
5. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (O/BN) wire.

5. (O/PK) Open Test

1. Test continuity between BOB terminal 13 and [168B] terminal A (O/PK) wire.
2. Is continuity present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in (O/PK) wire.

6. Shorted Wires Test

1. Test continuity between BOB terminals 12 and 13.
2. Is continuity present?
 - a. **Yes.** Repair short between (O/BN) and (O/PK) wires.
 - b. **No.** [Go to Test 7.](#)

7. (O/BN) Ground Test

1. Test continuity between BOB terminal 12 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/BN) wire.
 - b. **No.** [Go to Test 8.](#)

8. (O/PK) Ground Test

1. Test continuity between BOB terminal 13 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/PK) wire.
 - b. **No.** [Go to Test 9.](#)

9. (O/BN) Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 12 and ground.

3. Is voltage present?
 - a. **Yes.** Repair short to voltage on (O/BN) wire.
 - b. **No.** Replace ABS module.

DTC C1052, C1102

7.6

DESCRIPTION AND OPERATION

See [Figure 7-24](#) and [Figure 7-26](#).

The ABS ECU monitors current flowing through terminal B of the rear HCU power circuit. This circuit supplies the power to the pump motor in the HCU. The ABS ECU controls the pump by turning on and off the power circuit to the pump motor.

Table 7-10. Code Description

DTC	DESCRIPTION
C1052	Rear actuator circuit high
C1102	Rear acutator motor stalled

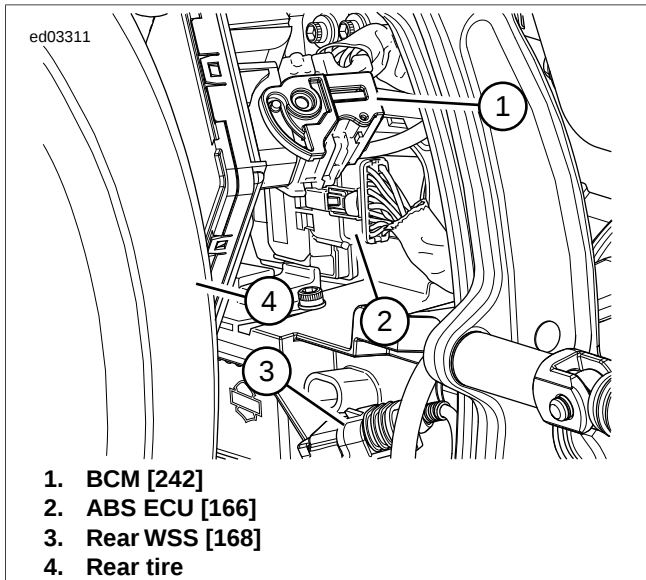


Figure 7-24. ABS [166]: Except FXSB

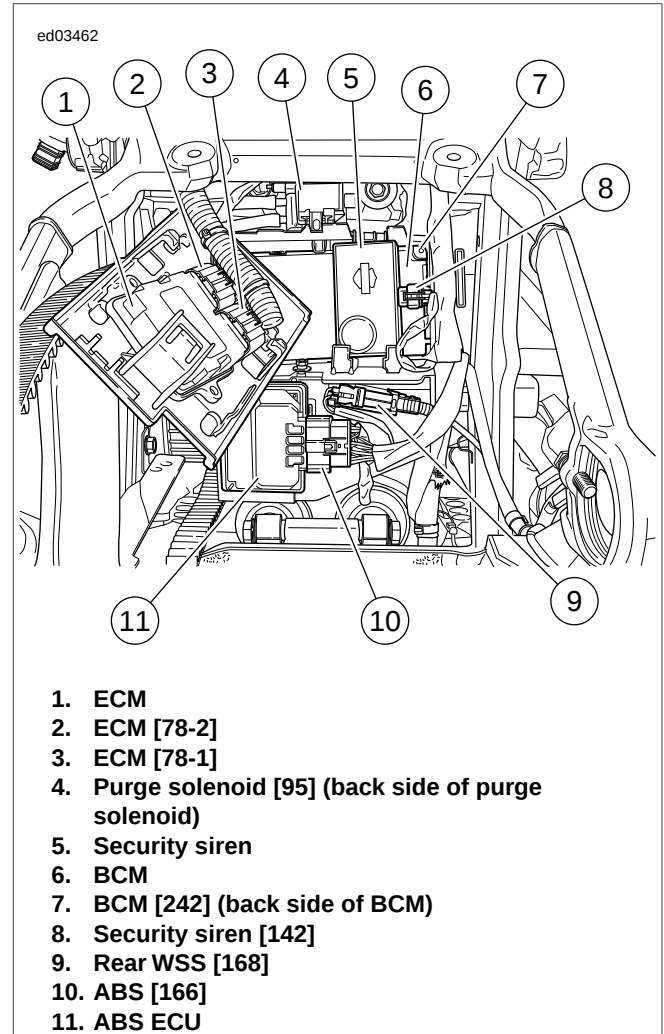


Figure 7-25. Electrical Panel: FXSB

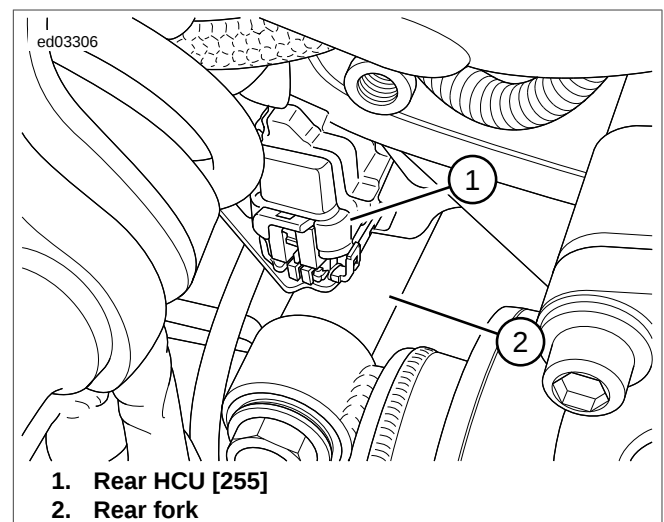


Figure 7-26. Rear HCU [255]

Conditions for Setting the DTC

DTC C1052 and C1102 can set if one of the following conditions exists in the rear HCU power circuit:

- Short to ground on the rear HCU power circuit.
- HCU fault or malfunction.
- ABS ECU fault or malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminal B of the rear HCU, either internally in the ABS ECU or HCU, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal B of the rear HCU to the ABS ECU.

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](#).

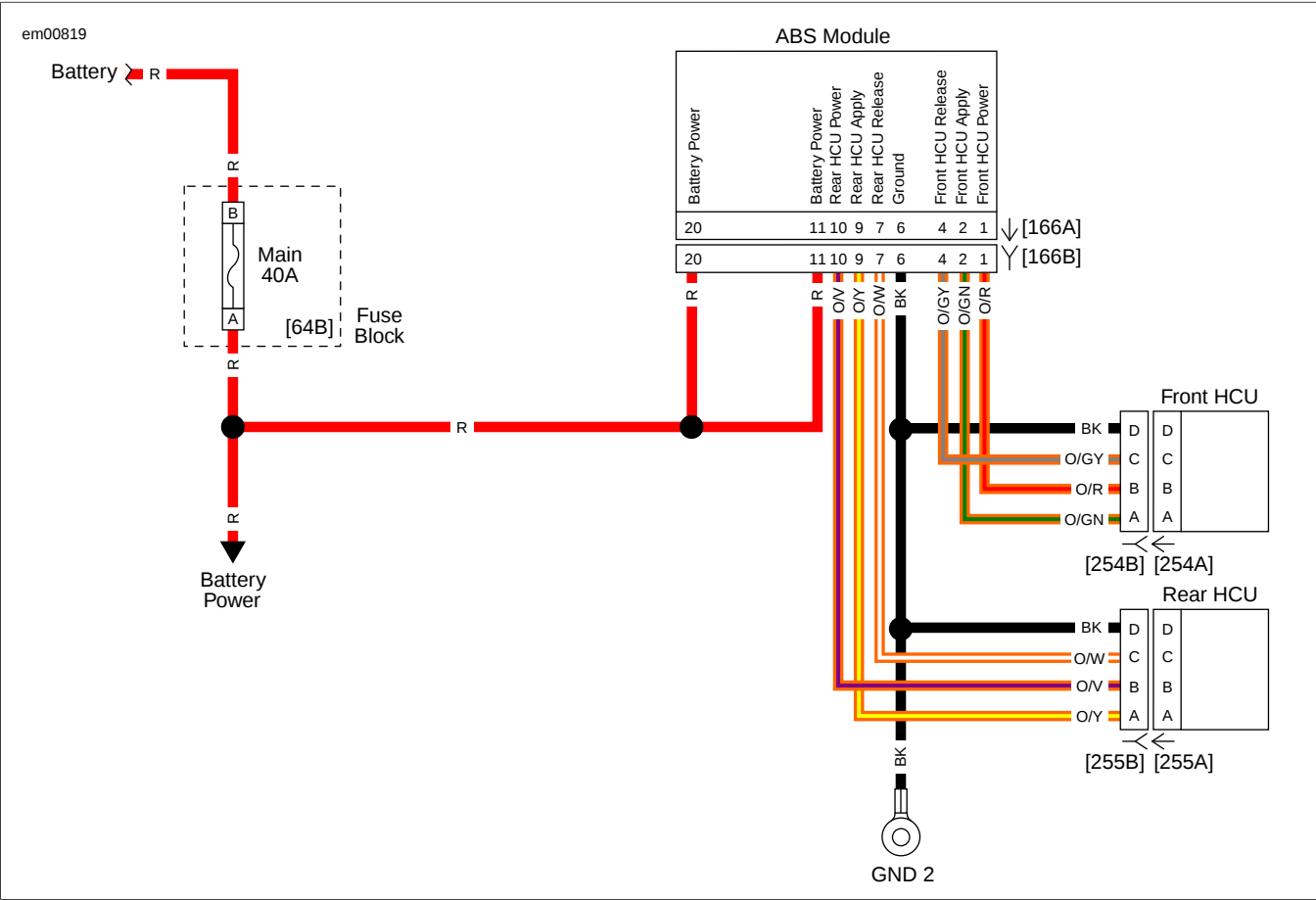


Figure 7-27. HCU Schematic

DTC C1052, C1102

PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE
HD-48642	ABS BREAKOUT BOX

Table 7-11. DTC C1052, C1102 Diagnostic Faults

POSSIBLE CAUSES
HCU fault or malfunction
Short to ground on the rear HCU power circuit

1. Rear HCU Internal Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect rear HCU [255].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Test continuity between BOB terminal 10 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/V).
 - b. **No.** [Go to Test 2.](#)

2. Pump Motor Current Draw Test

1. Connect [255].
2. Connect jumper wire to BOB terminal 10.
3. Using FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) or equivalent, install clamp around jumper.
4. Connect other end of jumper to battery positive terminal.
5. Does HCU motor draw more than 7A?
 - a. **Yes.** Replace HCU.
 - b. **No.** [Go to Test 3.](#)

3. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for initialization self-test. See [7.1 ANTI-LOCK BRAKE SYSTEM \(ABS\) GENERAL INFORMATION](#).
4. Check DTCs.
5. Did the DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC C1055

DESCRIPTION AND OPERATION

Circuit Description

The ABS module monitors the voltage level available for system operation. A low voltage condition prevents the system from operating properly. The ABS module also performs several self-tests for internal problems which may affect proper operation.

Table 7-12. Code Description

DTC	DESCRIPTION
C1055	ABS ECU internal fault

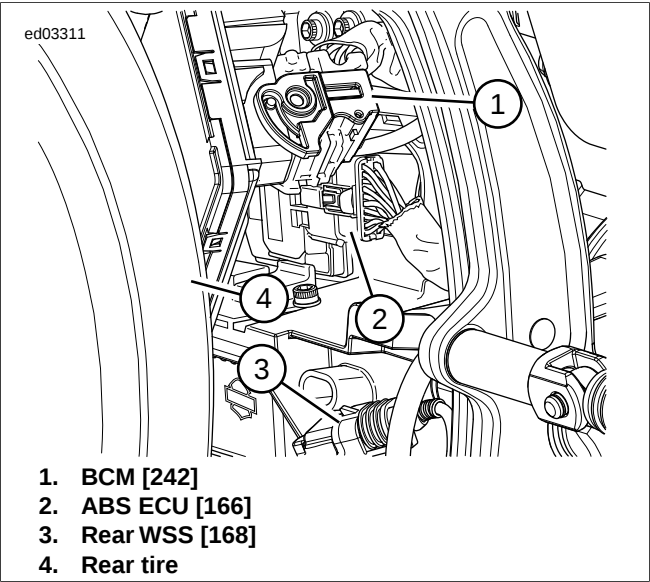


Figure 7-28. ABS [166]: Except FXSB

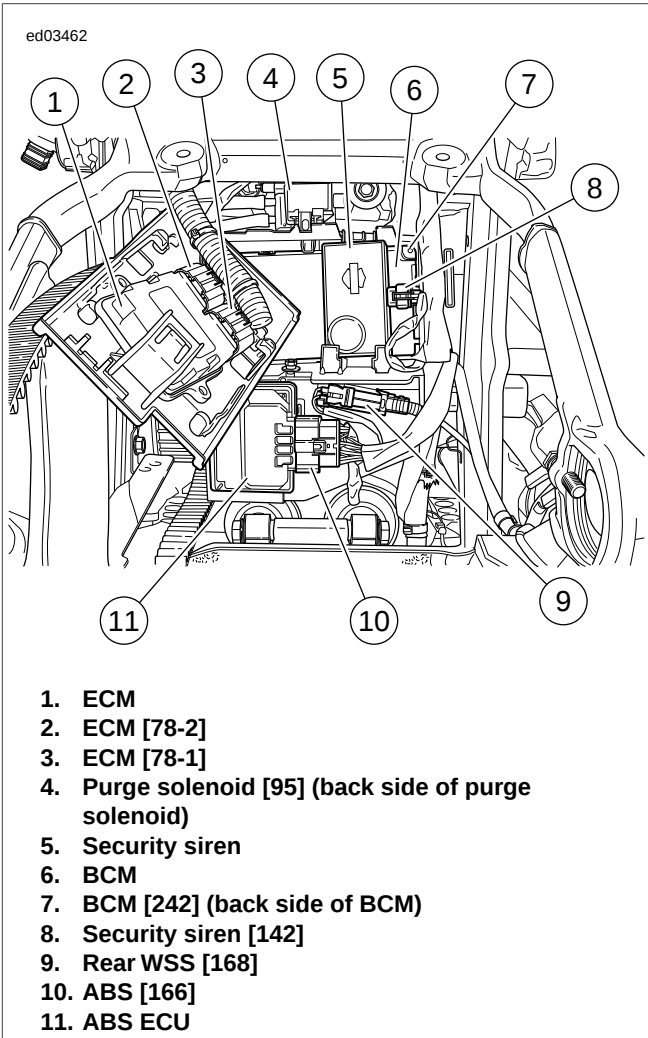


Figure 7-29. Electrical Panel: FXSB

Conditions for Setting the DTC

The ABS module detects an internal malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

If improper voltage is supplied to the ABS ECU, this code may set. Using an improper or high voltage charger on the vehicle may cause this code to inadvertently set when there is nothing wrong with the ABS system.

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](#).

em00992

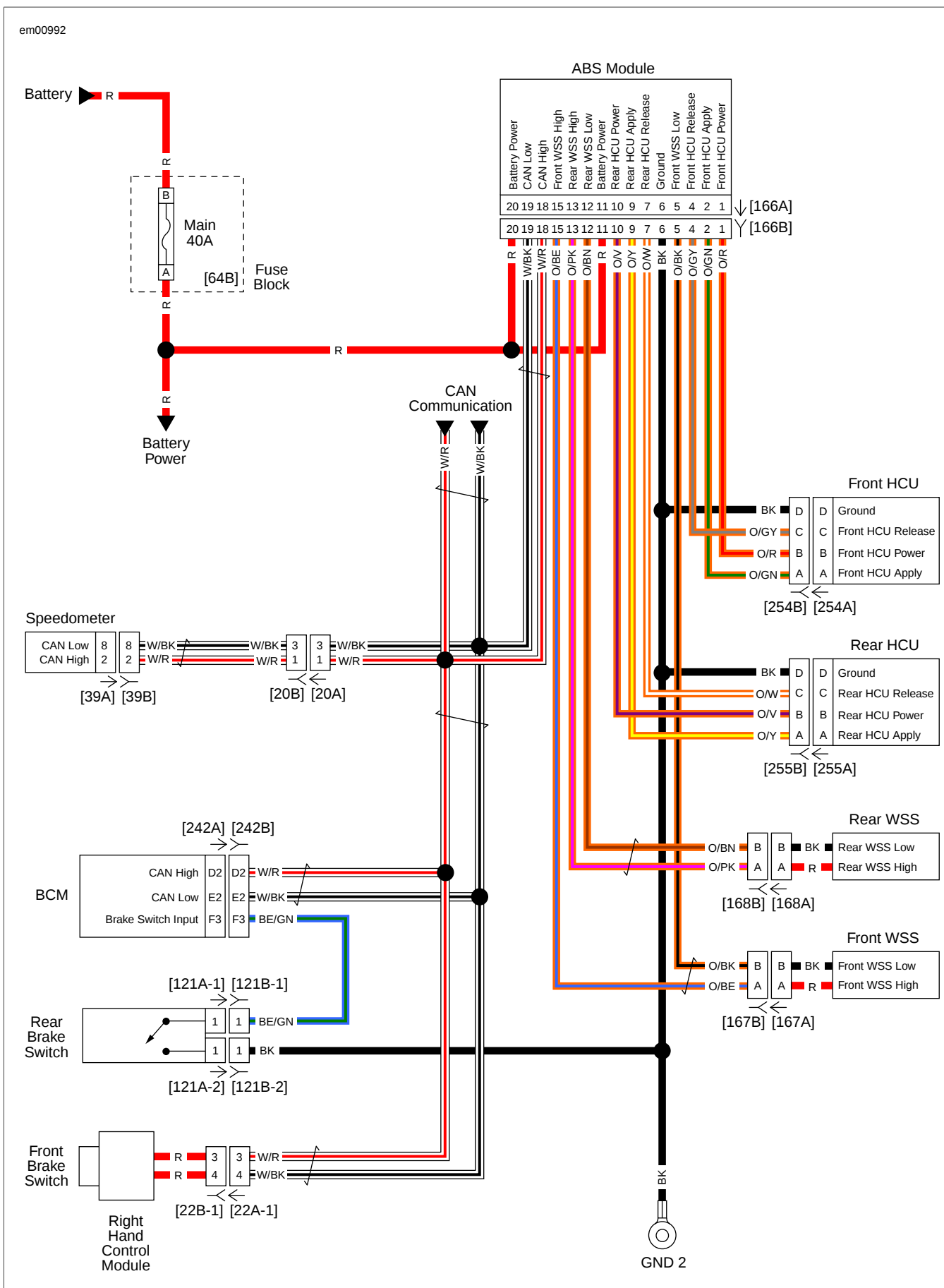


Figure 7-30. ABS Schematic

DTC C1055

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX

Table 7-13. DTC C1055 Diagnostic Faults

POSSIBLE CAUSES
Internal system malfunction
A faulty system voltage supply to the module
A faulty system ground

1. Battery Circuit Voltage Test

1. Turn IGN OFF.
2. Connect ABS BREAKOUT BOX (Part No. HD-48642) between wire harness [166B] and ABS module [166A]. See [1.2 DIAGNOSTIC TOOLS](#).
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 20 and 11 and ground.

5. Is voltage between 10.5-17V?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** [Go to Test 2.](#)

2. Battery Power Circuit Resistance Test

1. Turn IGN OFF.
2. Disconnect main fuse [64B].
3. Test resistance between BOB terminals 11 and 20, and [64B] socket terminal A.
4. Is resistance greater than 1 Ohm?
 - a. **Yes.** Repair circuit.
 - b. **No.** Inspect battery and charging system. See [3.6 CHARGING SYSTEM](#).

3. Ground Circuit Resistance Test

1. Test resistance between BOB terminal 6 and ground.
2. Is high resistance or open present?
 - a. **Yes.** Repair high resistance or open condition on ground circuit.
 - b. **No.** Replace ABS ECU module.

DTC C1094

DESCRIPTION AND OPERATION

The ABS module monitors the brake switch inputs. When the front brake is applied, the ABS module receives a CAN signal from the RHCM.

When the rear brake is applied, the BCM receives input from the rear brake switch and sends a CAN signal to the ABS module. The ABS uses these brake signals to enhance the ABS performance and operation.

Table 7-14. Code Description

DTC	DESCRIPTION
C1094	Brake switch always on

Conditions for Setting the DTC

The DTC will set if all of the following conditions exist for 2 seconds:

- The ABS ECU sees a front or rear brake input.
- The vehicle speed exceeds 25 mph (40 km/h).
- The vehicle acceleration exceeds 5 mph (8 km/h) per second.

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Diagnostic Tips

The following conditions are possible causes for this fault:

- Front brake switch stuck closed or applied during acceleration.
- Rear brake switch stuck closed or applied during acceleration.
- Brake switches may be applied when unintended.

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](#).

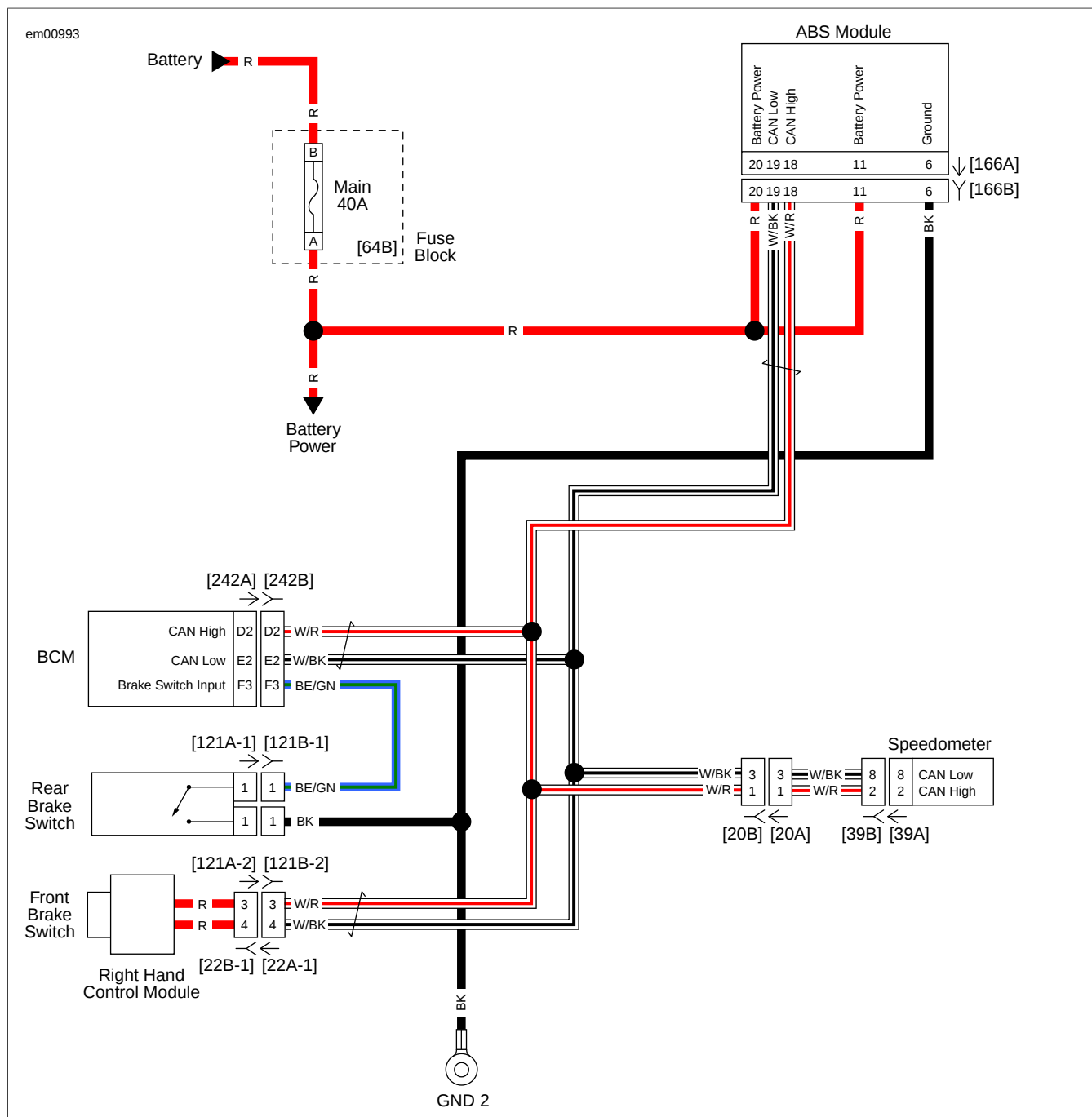


Figure 7-31. Brake Switches Schematic

DTC C1094

Table 7-15. DTC C1094 Diagnostic Faults

POSSIBLE CAUSES
Front brake switch malfunction
Rear brake switch malfunction

1. Validation of Current DTC Test

1. Clear DTC.
2. Perform test ride above 25 mph (40 km/h) with acceleration meeting or above the conditions for setting.

3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See diagnostic tips.

2. Brake Lamp Operation Test

1. Observe brake lamp.
2. Is brake lamp always on?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace ABS ECU.

3. BCM DTC Test

1. Check for BCM DTCs.
2. Is BCM showing B2262 or B2223?
 - a. **Yes.** See diagnostic for appropriate BCM code.
 - b. **No.** Inspect front and rear brake switches for proper adjustment and operation. Repair as needed.

DTC C1151, C1153

7.9

DESCRIPTION AND OPERATION

The ABS module activates the valve relay to supply voltage to the valve solenoids. This voltage is referred to as the system voltage. The ABS module microprocessor activates individual valve solenoids by grounding the valve solenoid control circuits.

Table 7-16. Code Description

DTC	DESCRIPTION
C1151	Front wheel release too long
C1153	Rear wheel release too long

Conditions for Setting the DTC

The DTC will set if all of the following conditions exist.

- The ABS ECU is commanding a pressure release from the front wheel release valve.
- The front wheel speed is below 3 mph (5 km/h) for more than 1 second.
- The ABS ECU is commanding a pressure release from the rear wheel release valve.
- The rear wheel speed is below 3 mph (5 km/h) for more than 1 second.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

The following conditions are possible causes for this fault:

- An intermittent WSS.
- A stuck or seized caliper or bald tires could contribute to this code setting.
- Contaminated brake system.
- Excessive brake drag or high resistance in hydraulic system.
- Aggressive driving.
- Dynamometer.

DTC C1151

Table 7-17. DTC C1151 Diagnostic Faults

POSSIBLE CAUSES
Internal ABS ECU problem in the release solenoid
Internal problem in the front HCU
Brake system malfunction

1. Validation of Current DTC Test

1. Clear DTCs.
2. Perform test ride.
3. Check for DTCs.

4. Are any front WSS DTCs currently set or did an unwanted ABS event occur?
 - a. **Yes, WSS DTCs set.** See the appropriate WSS diagnostic procedure.
 - b. **Yes, an unwanted ABS event occurred.** See WSS = 0 diagnostics.
 - c. **No, only DTC C1151 set.** [Go to Test 2.](#)
 - d. **No. No DTCs set.** Concern is intermittent. See diagnostic tips.

2. Brake System Test

1. Inspect hydraulic brake system and suspension for wear or improper operation.
2. Were any issues found?
 - a. **Yes.** Repair as needed.
 - b. **No.** [Go to Test 3.](#)

3. ABS ECU Test

1. Disconnect front HCU [254].
2. Clear DTCs.
3. Start engine and wait 10 seconds for the ABS ECU to perform an initialization test.
4. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Replace front HCU.

DTC C1153

Table 7-18. DTC C1153 Diagnostic Faults

POSSIBLE CAUSES
Internal ABS ECU problem in the release solenoid
Internal problem in the rear HCU
Brake system malfunction

1. Validation of Current DTC Test

1. Clear DTCs.
2. Perform test ride.
3. Check DTCs.
4. Are any rear WSS DTCs currently set or did an unwanted ABS event occur?
 - a. **Yes, WSS DTCs set.** See appropriate WSS diagnostic procedure.
 - b. **Yes, unwanted ABS event no DTCs.** See WSS = 0 diagnostics.
 - c. **No, only DTC C1153 set.** [Go to Test 2.](#)
 - d. **No. No DTCs set.** Concern is intermittent. See diagnostic tips.

2. Brake System Test

1. Inspect hydraulic brake system and suspension for wear or improper operation.
2. Were any issues found?
 - a. **Yes.** Repair as needed.
 - b. **No.** [Go to Test 3.](#)

3. ABS ECU Test

1. Disconnect the rear HCU [255].
2. Clear DTCs.
3. Start engine and wait 10 seconds for ABS ECU to perform an initialization test.
4. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Replace rear HCU.

DTC C1158, C1178, C1184

7.10

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The ABS ECU is calibrated to maximize ABS performance. If the correct calibration is not in the module the ABS may not perform correctly. The ECM and ABS modules also compare VINs to verify the correct ABS module is installed. These VINs must match before the ABS will operate properly.

Table 7-19. Code Description

DTC	DESCRIPTION
C1158	Calibration not programmed
C1178	No VIN received from ECM
C1184	VIN does not match ABS ECU calibration fault

Conditions for Setting the DTC

The ABS module determines final calibration is not completed or that the VIN does not match calibration.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

These codes will usually appear after replacing the ECM or the ABS ECU. The **new** modules must be programmed using DIGITAL TECHNICIAN II (Part No. HD-48650). After the parts are programmed and matched correctly for the specific vehicle, clear the codes.

DTC C1158

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 7-20. DTC C1158 Diagnostic Faults

POSSIBLE CAUSES
An ABS ECU that is not calibrated correctly or has an internal fault
All replacement ABS modules will have this DTC set
Any ABS ECU calibration or update will cause code to set

1. Validation of Current DTC Test

1. Clear DTC.
2. Start engine and wait 10 seconds for ABS to complete initialization test.

3. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See diagnostic tips.

2. Perform ABS Service Test

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650), perform ABS service feature found in Vehicle Set Up.
2. Clear DTCs.
3. Did DTC reset?
 - a. **Yes.** Replace ABS ECU module.
 - b. **No.** Calibration complete.

DTC C1178, C1184

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 7-21. DTC C1178, C1184 Diagnostic Faults

POSSIBLE CAUSES
An ABS ECU that is not calibrated correctly or has an internal fault
All replacement ABS modules will have this DTC set
Any ABS ECU calibration or update will cause code to set

1. Validation of Current DTC Test

1. Clear DTC.
2. Start engine and wait 10 seconds for ABS to complete initialization test.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See diagnostic tips.

2. Successful Calibration Test

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650), attempt to calibrate ABS ECU using ABS service feature found in Vehicle Set Up.
2. Clear DTCs.
3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Calibration complete.

3. Speedometer Test

1. Turn IGN ON.

2. Does speedometer display VINERR?
 - a. **Yes.** Replace ECM.
 - b. **No.** Replace ABS ECU.

DTC C1192, C1193

DESCRIPTION AND OPERATION

See [Figure 7-32](#), [Figure 7-33](#) and [Figure 7-34](#).

The ABS ECU module monitors current flowing through terminal B of the front HCU power circuit. This circuit supplies the power to the pump motor in the HCU. The ABS ECU controls the pump by turning on and off the power circuit to the pump motor.

Table 7-22. Code Description

DTC	DESCRIPTION
C1192	Front actuator circuit high
C1193	Front actuator motor stalled

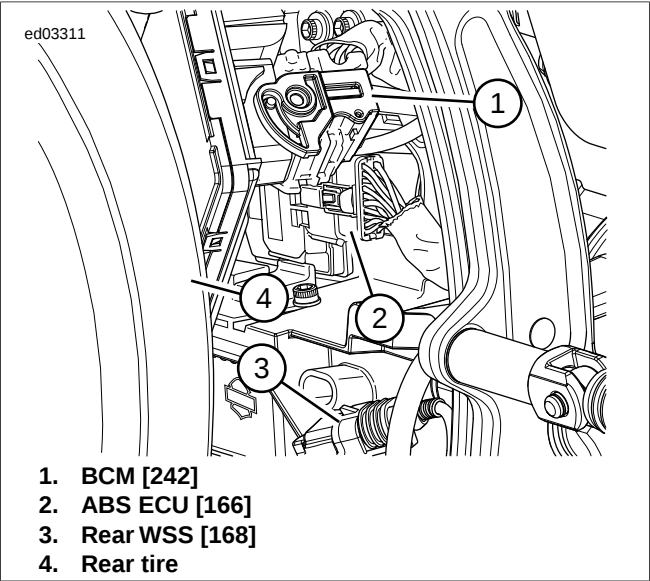


Figure 7-32. ABS [166]: Except FXSB

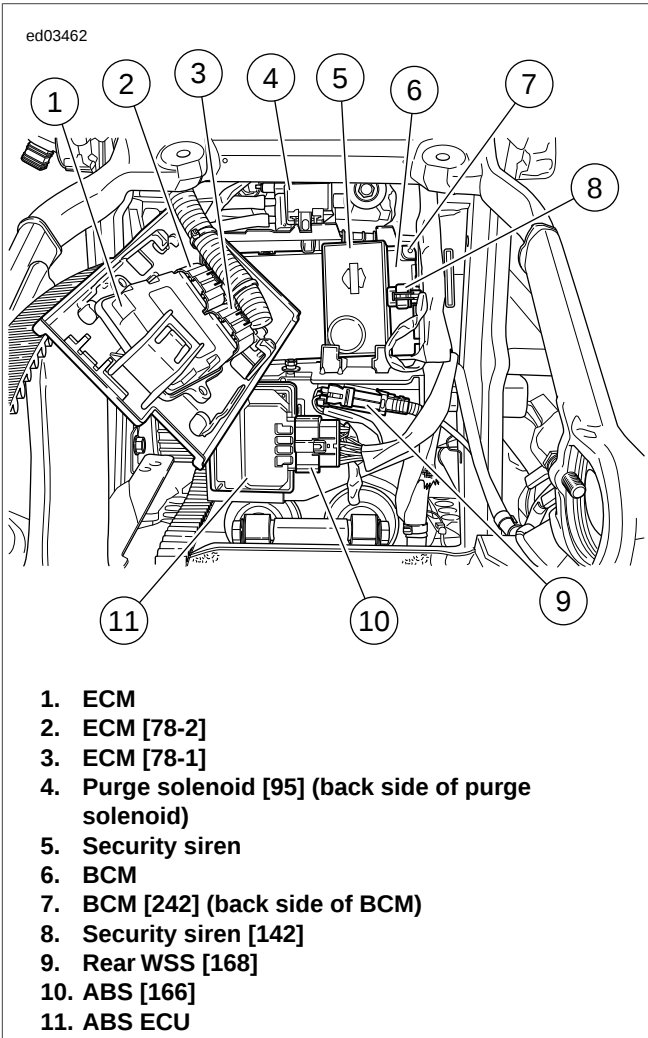


Figure 7-33. Electrical Panel: FXSB

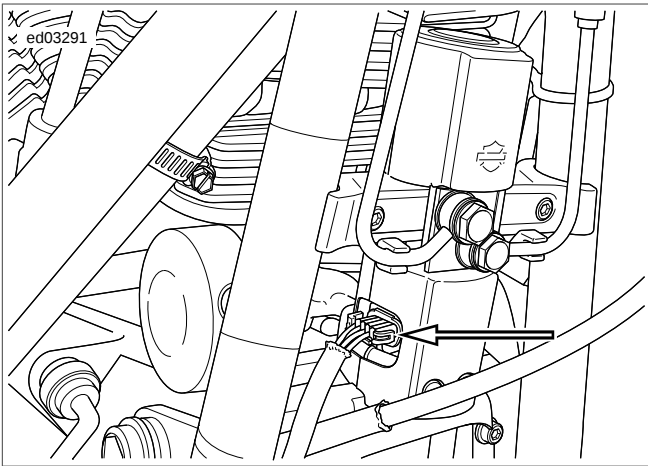


Figure 7-34. Front HCU [254]

Conditions for Setting the DTC

DTC C1192 and C1193 can set if one of the following conditions exists in the front HCU power circuit:

- Short to ground on the front HCU power circuit.
- HCU fault or malfunction.
- ABS ECU fault or malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminal B of the front HCU, either internally in the ABS ECU or HCU, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal B of the front HCU to the ABS ECU.

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](#).

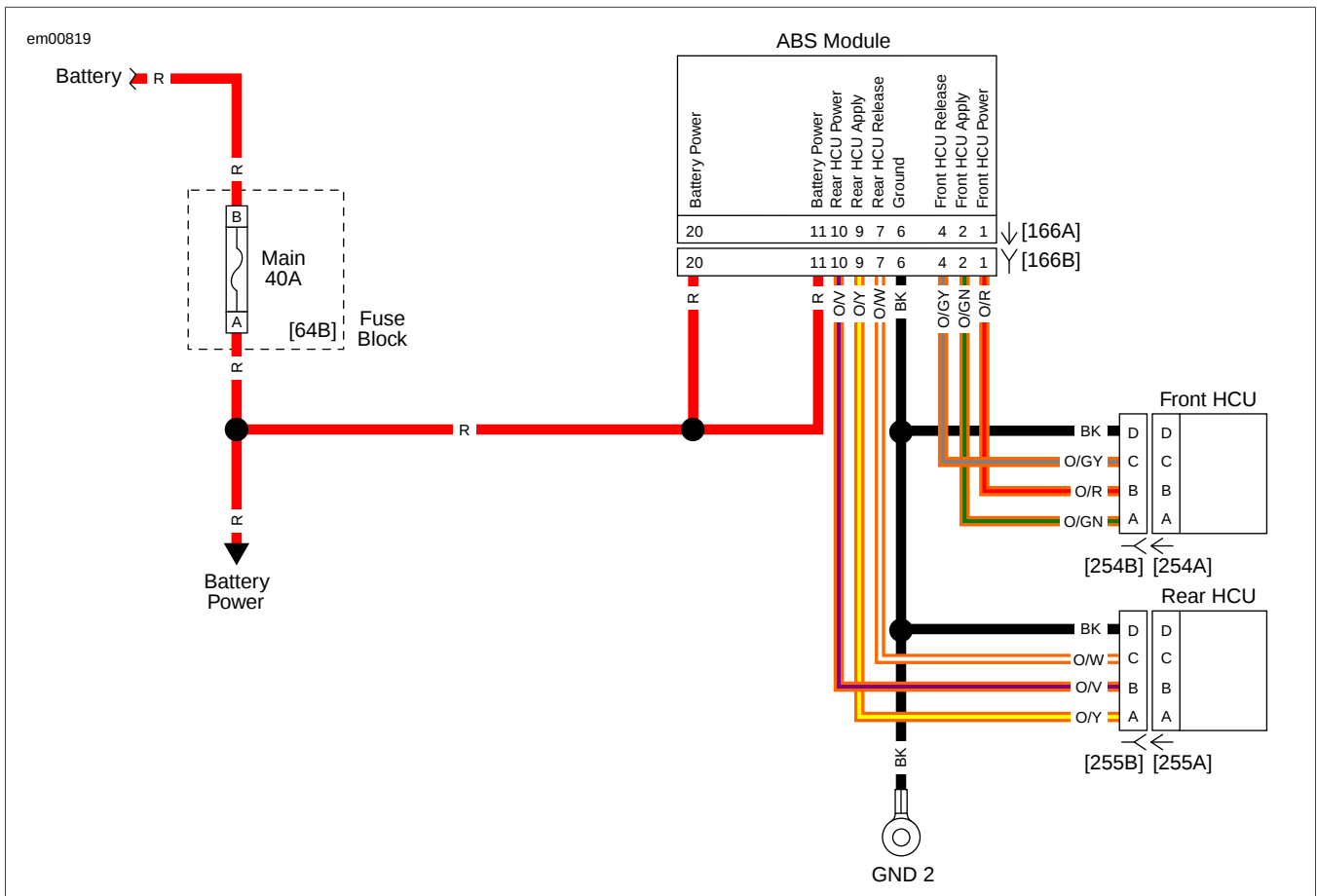


Figure 7-35. HCU Schematic

DTC C1192, C1193

PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE
HD-41404	HARNESS CONNECTOR TEST KIT
HD-48642	ABS BREAKOUT BOX

Table 7-23. DTC C1192, C1193 Diagnostic Faults

POSSIBLE CAUSES
HCU fault or malfunction
Short to ground on the front HCU power circuit

1. Front HCU Internal Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect front HCU [254].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal 1 and ground.

5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/R) wire.
 - b. **No.** [Go to Test 2.](#)

2. Pump Motor Current Draw Test

1. Connect [254].
2. Connect jumper wire to BOB terminal 1.
3. Using FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) or equivalent, install clamp around jumper.
4. Connect other end of jumper to battery positive terminal.
5. Does HCU motor draw more than 7A?
 - a. **Yes.** Replace HCU.
 - b. **No.** [Go to Test 3.](#)

3. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for initialization self-test. See [7.1 ANTI-LOCK BRAKE SYSTEM \(ABS\) GENERAL INFORMATION](#).
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC C1212

7.12

DESCRIPTION AND OPERATION

The ABS module monitors the brake switch inputs. When the front brake is applied, the ABS module receives a CAN signal from the RHCM.

When the rear brake is applied, the BCM receives input from the rear brake switch and sends a CAN signal to the ABS module. The ABS uses these brake signals to enhance the ABS performance and operation.

Table 7-24. Code Description

DTC	DESCRIPTION
C1212	Front or rear brake not applied on deceleration

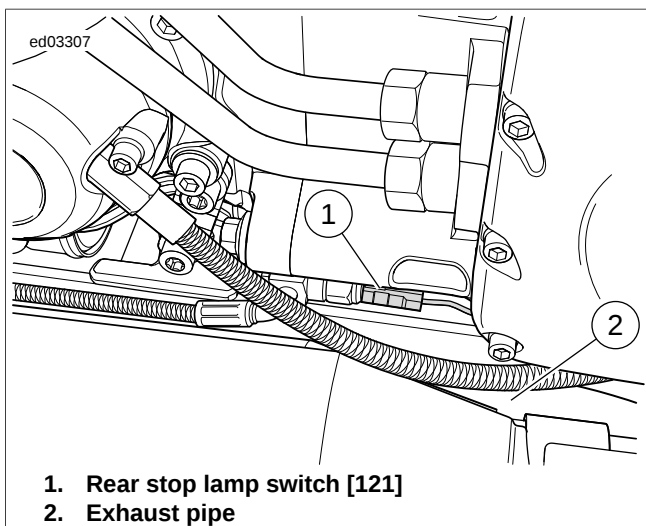


Figure 7-36. Rear Stop Lamp Switch [121]

Conditions for Setting the DTC

The DTC will set if all the following conditions exist. The first four conditions have to occur four times.

- The front or rear brake is not applied.
- There is no current ABS event in progress.
- Vehicle speed exceeds 15 mph (24 km/h).
- Vehicle decelerates at a rate greater than 10 mph (18 km/h) per second for more than two seconds.
- Vehicle speed drops below 15 mph (24 km/h).

Action Taken When the DTC Sets

No action is taken when this code is set. The ABS indicator does not illuminate and the ABS is still active.

Diagnostic Tips

The following conditions are possible causes for this fault:

- A short or open on the brake switch input circuit to the BCM module.
- Downshifting up a steep hill without using the brakes four consecutive times could cause this code.

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](#).

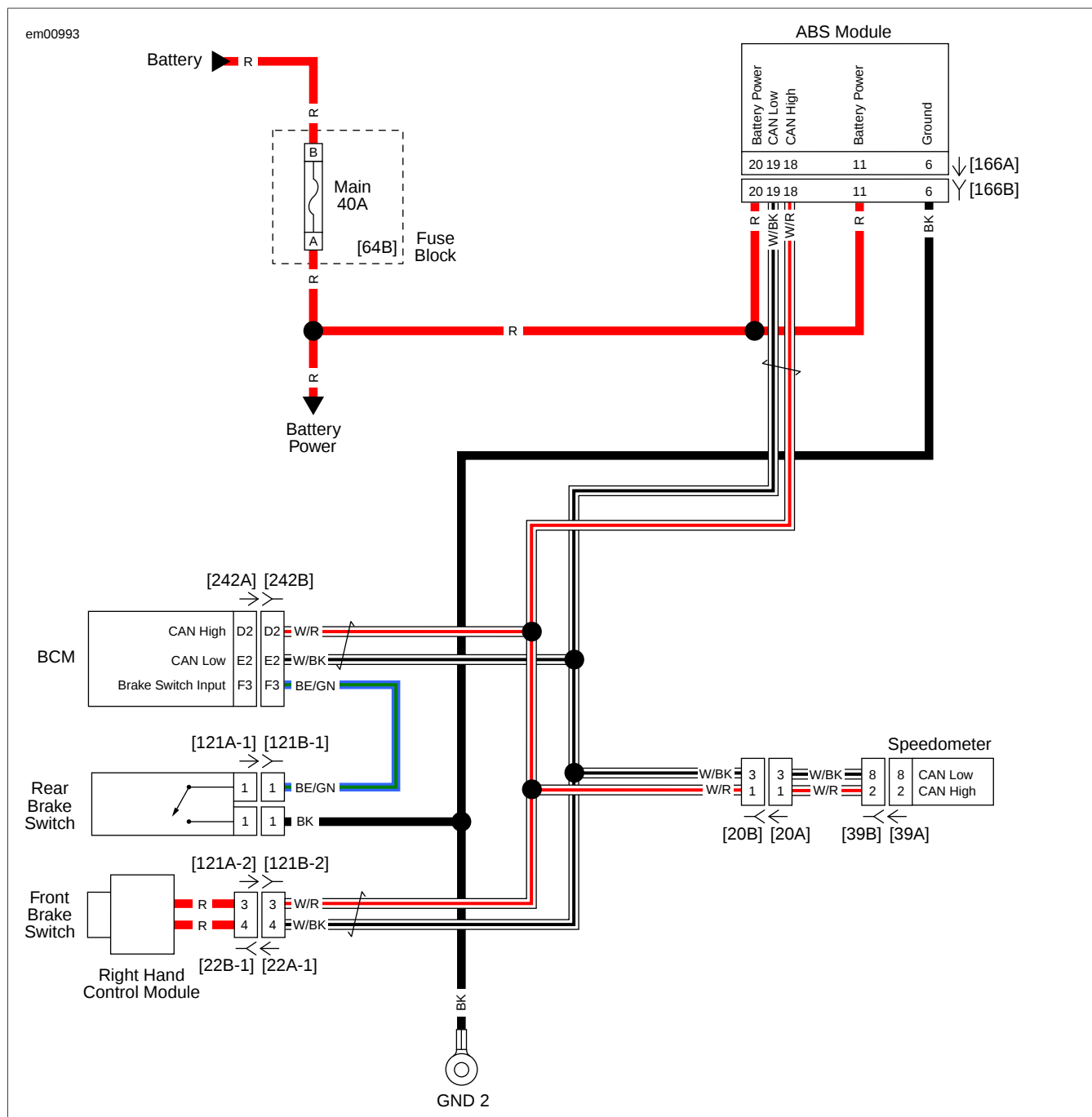


Figure 7-37. Brake Switches Schematic

DTC C1212

Table 7-25. DTC C1212 Diagnostic Faults

POSSIBLE CAUSES
Front brake switch malfunction
Rear brake switch malfunction

1. Validation of Current DTC Test

1. Clear DTC.
2. Perform test ride above 25 mph (40 km/h) with acceleration meeting or above the conditions for setting.

3. Check DTCs.
4. Did DTC reset?
 - a. **Yes.** [Go to Test 2.](#)
 - b. **No.** See diagnostic tips.

2. Brake Lamp Operation Test

1. Observe brake lamp.

NOTE

The lamp should illuminate without excessive travel in the brake lever or brake pedal.

2. Does brake lamp illuminate with either of the brakes applied without excessive travel in the brake lever or pedal?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** [Go to Test 3.](#)

3. BCM DTC Test

1. Check for BCM DTCs.
2. Is BCM showing B2262 or B2223?
 - a. **Yes.** See diagnostic for appropriate BCM code.
 - b. **No.** Inspect front and rear brake switches for proper adjustment and operation. Repair as needed.

DTC C1561, C1562, C1563, C1564, C1565

7.13

DESCRIPTION AND OPERATION

See [Figure 7-38](#), [Figure 7-39](#) and [Figure 7-40](#).

The ABS ECU module monitors current flowing through the front HCU apply or release circuits and internal solenoids. These circuits supply the ground to the front apply and release solenoids in the HCU. The ABS ECU controls the solenoids by controlling the ground side of the solenoid coils.

Table 7-26. Code Description

DTC	DESCRIPTION
C1561	Front apply solenoid circuit open or high resistance
C1562	Front apply solenoid circuit shorted low
C1563	Front solenoid circuit shorted high
C1564	Front release solenoid circuit open or high resistance
C1565	Front release solenoid circuit shorted low

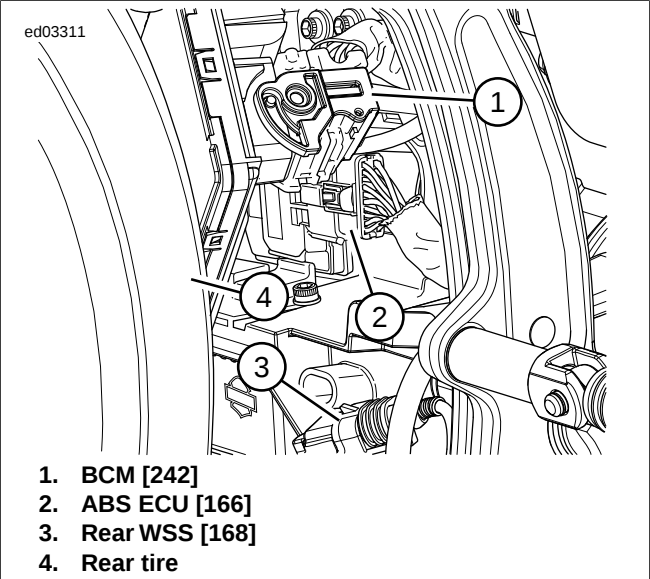


Figure 7-38. ABS [166]: Except FXSB

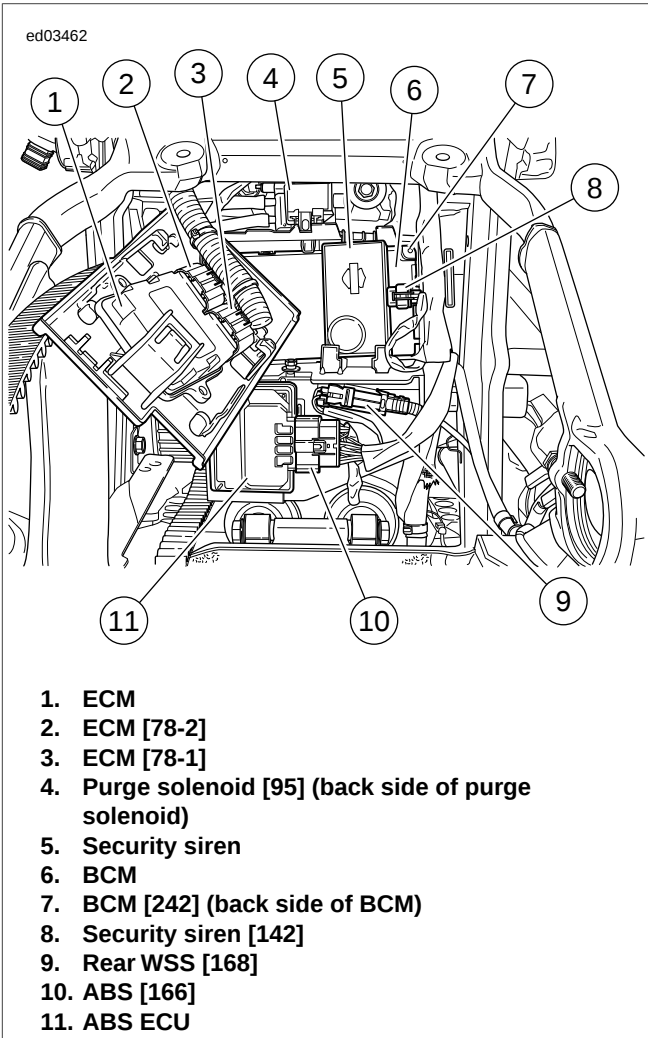


Figure 7-39. Electrical Panel: FXSB

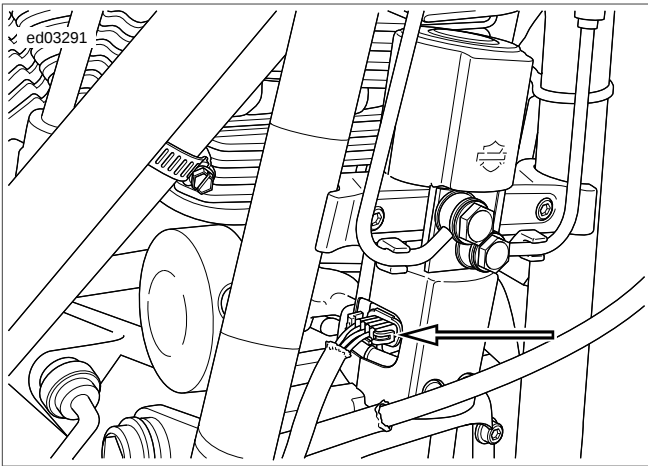


Figure 7-40. Front HCU [254]

Conditions for Setting the DTC

DTC C1561-C1565 can set if one of the following conditions exist in the front HCU solenoid circuits:

- Short to ground, short to battery, open or high resistance in the front HCU apply or release circuit.
- HCU fault or malfunction.
- ABS ECU fault or malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminals A and C of the front HCU, either internally in the ABS ECU or HCU, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal A or C to the ABS ECU.

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](#).

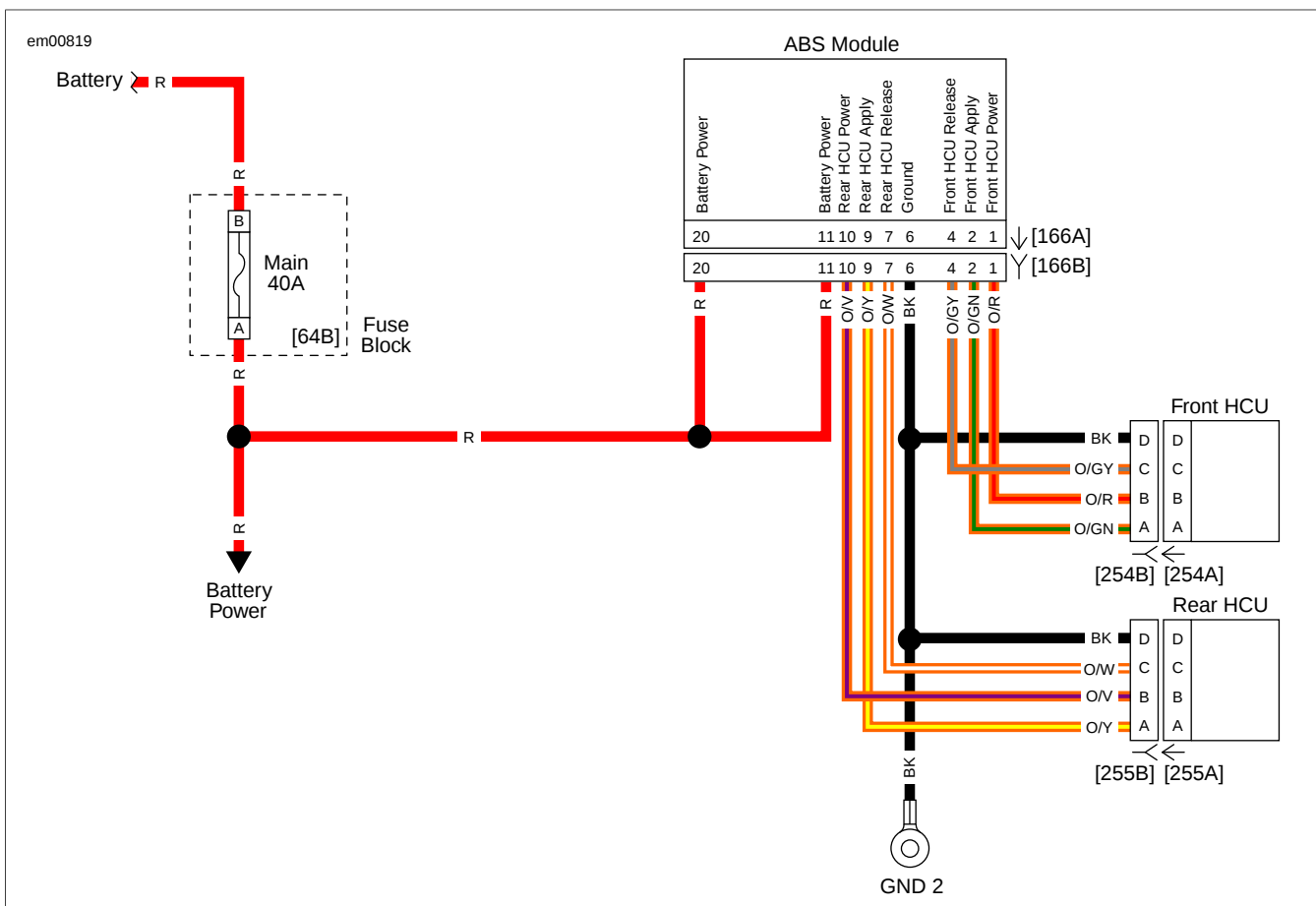


Figure 7-41. HCU Schematic

DTC C1561-C1565

PART NUMBER	TOOL NAME
HD-48642	ABS BREAKOUT BOX

Table 7-27. DTC C1561-C1565 Diagnostic Faults

POSSIBLE CAUSES
Open or high resistance on the front HCU ground circuit
Open or high resistance on front HCU power circuit
Short to ground on the front HCU power circuit
Short to power on HCU circuit

1. Front HCU Apply Solenoid Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect front HCU [254].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Test continuity between BOB terminal 2 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/GN) wire.
 - b. **No.** [Go to Test 2.](#)

2. Release Solenoid Circuit Short to Ground Test

1. Test continuity between BOB terminal 4 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/GY) wire.
 - b. **No.** [Go to Test 3.](#)

3. HCU Apply Solenoid Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 2 and ground.
3. Is voltage present?
 - a. **Yes.** Repair short to voltage on (O/GN) wire.
 - b. **No.** [Go to Test 4.](#)

4. Release Solenoid Circuit Short to Voltage Test

1. Test voltage between BOB terminal 4 and ground.
2. Is voltage present?
 - a. **Yes.** Repair short to ground on (O/GY) wire.
 - b. **No.** [Go to Test 5.](#)

5. HCU Apply Circuit Resistance Test

1. Turn IGN OFF.
2. Remove main fuse [64B].
3. Test resistance between BOB terminal 2 and [254B] terminal A (O/GN) wire.
4. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open or high resistance in (O/GN) ground wire.

6. HCU Release Circuit Resistance Test

1. Test resistance between BOB terminal 4 and [254B] terminal C (O/GY) wire.
2. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open or high resistance in (O/GY) wire.

7. HCU Apply and Release Circuits Test

1. Test continuity between BOB terminals 2 and 4.

2. Is continuity present?
 - a. **Yes.** Repair short between (O/GN) and (O/GY) wires.
 - b. **No.** [Go to Test 8.](#)

8. HCU Apply and Release Solenoid Test

1. Connect [254].
2. Test resistance between BOB terminals 2 and 4.
3. Is resistance between 5-13 Ohms?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Replace front HCU.

9. HCU Diode Test A

1. Set DMM to diode test.
2. Connect DMM positive (red) test lead to BOB terminal 1 and negative (black) test lead to BOB terminal 2.
3. Test voltage.
4. Is voltage greater than 0.2V?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No.** Replace front HCU.

10. HCU Diode Test B

1. Reverse probes, connect DMM positive (red) test lead to breakout box terminal 2 and negative (black) test lead to breakout box terminal 1.
2. Is OL displayed?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Replace the front HCU.

11. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for initialization self-test. See [7.1 ANTI-LOCK BRAKE SYSTEM \(ABS\) GENERAL INFORMATION](#).
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DTC C1567, C1568, C1571, C1572, C1573

7.14

DESCRIPTION AND OPERATION

See [Figure 7-42](#), [Figure 7-43](#) and [Figure 7-44](#).

The ABS ECU monitors current flowing through the rear HCU apply or release circuits and internal solenoids. These circuits supply the ground to the front apply and release solenoids in the HCU. The ABS ECU controls the solenoids by controlling the ground side of the solenoid coils.

Table 7-28. Code Description

DTC	DESCRIPTION
C1567	Rear apply solenoid circuit open or high resistance
C1568	Rear apply solenoid circuit shorted low
C1571	Rear solenoid circuit shorted high
C1572	Rear release solenoid circuit open or high resistance
C1573	Rear release solenoid circuit shorted low

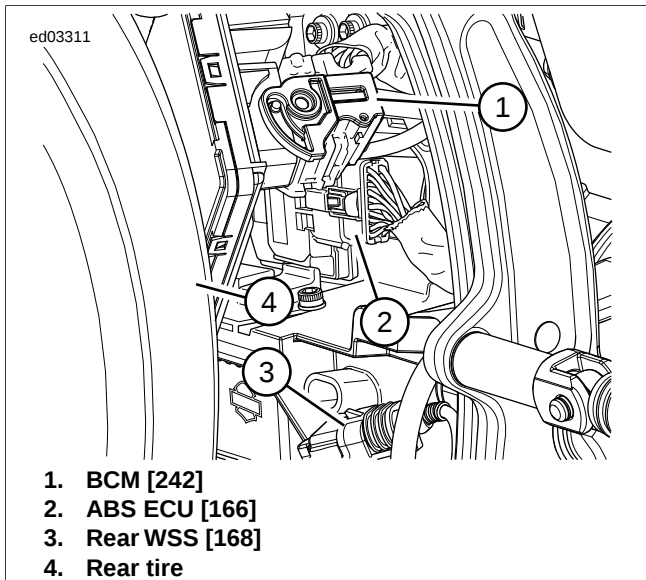


Figure 7-42. ABS [166]: Except FXSB

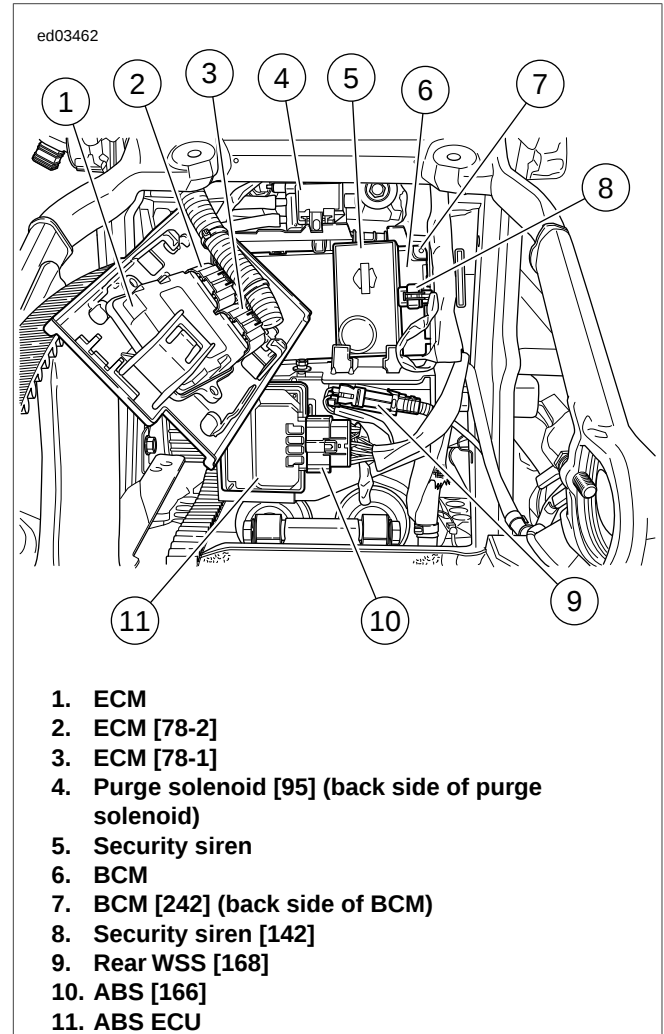


Figure 7-43. Electrical Panel: FXSB

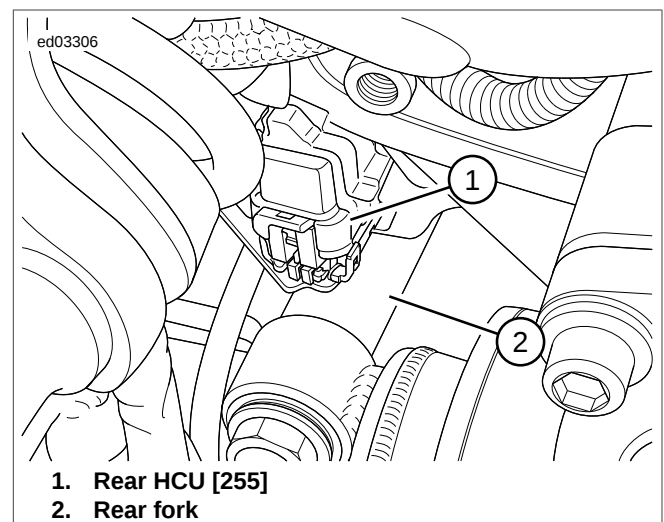


Figure 7-44. Rear HCU [255]

Conditions for Setting the DTC

DTC C1567, C1568, C1571, C1572, C1573 can set if one of the following conditions exist in the rear HCU solenoid circuits:

- Short to ground, short to battery, open or high resistance in the rear HCU apply or release circuit.
- HCU fault or malfunction.
- ABS ECU fault or malfunction.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

All the DTCs that set in this diagnostic are related to terminals A and C of the rear HCU, either internally in the ABS ECU or HCU, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal A or C to the ABS ECU.

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](#).

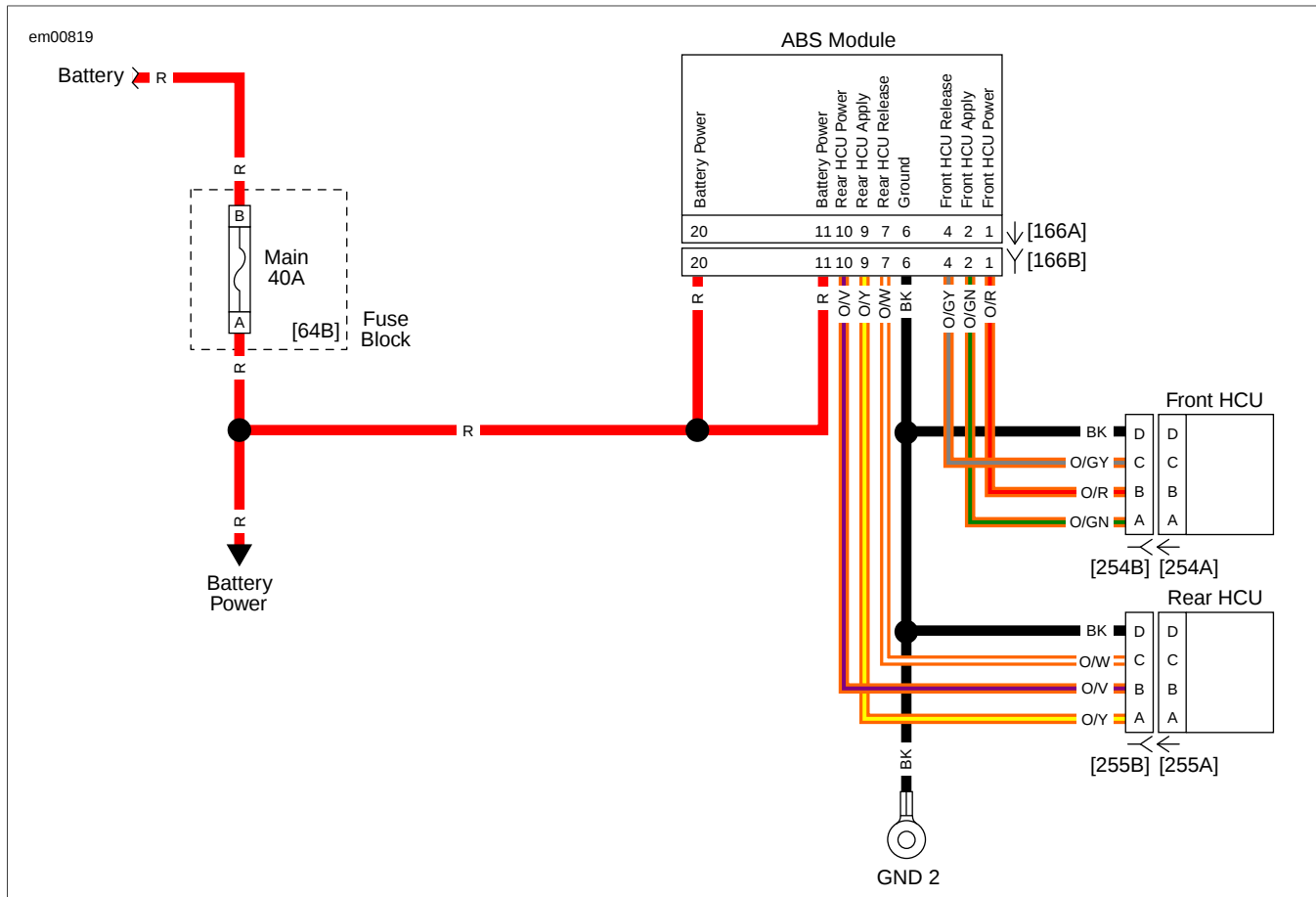


Figure 7-45. HCU Schematic

DTC C1567, C1568, C1571, C1572, C1573

PART NUMBER	TOOL NAME
HD-48642	ABS BREAKOUT BOX

Table 7-29. DTC C1567, C1568, C1571, C1572, C1573 Diagnostic Faults

POSSIBLE CAUSES
Open or high resistance on the front HCU ground circuit
Open or high resistance on rear HCU power circuit
Short to ground on the rear HCU power circuit
Short to power on rear HCU circuit

1. Rear HCU Apply Solenoid Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect rear HCU [255].
3. Connect ABS BREAKOUT BOX (Part No. HD-48642) to wire harness [166B], leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
4. Test continuity between BOB terminal 9 and ground.
5. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/Y) wire.
 - b. **No.** [Go to Test 2.](#)

2. Rear Release Solenoid Circuit Short to Ground Test

1. Test continuity between BOB terminal 7 and ground.
2. Is continuity present?
 - a. **Yes.** Repair short to ground on (O/W) wire.
 - b. **No.** [Go to Test 3.](#)

3. HCU Apply Solenoid Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 9 and ground.
3. Is voltage present?
 - a. **Yes.** Repair short to voltage on (O/Y) wire.
 - b. **No.** [Go to Test 4.](#)

4. Release Solenoid Circuit Short to Voltage Test

1. Test voltage between BOB terminal 7 and ground.
2. Is voltage present?
 - a. **Yes.** Repair short to ground on (O/W) wire.
 - b. **No.** [Go to Test 5.](#)

5. HCU Apply Circuit Resistance Test

1. Turn IGN OFF.

2. Remove main fuse [64B].
3. Test resistance between BOB terminal 9 and [255B] terminal A (O/Y) wire.
4. Is resistance less than 0.5 Ohm?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open or high resistance in (O/Y) wire.

6. HCU Release Circuit Resistance Test

1. Test resistance between BOB terminal 7 and [255B] terminal C (O/W) wire.
2. Is resistance less than 0.5 Ohms?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open or high resistance in (O/W) wire.

7. HCU Apply and Release Circuits Test

1. Test continuity between BOB terminals 7 and 9.
2. Is continuity present?
 - a. **Yes.** Repair short between (O/W) and (O/Y) wires.
 - b. **No.** [Go to Test 8.](#)

8. HCU Apply and Release Solenoid Test

1. Connect [255].
2. Test resistance between BOB terminals 7 and 9.
3. Is resistance between 5-13 Ohms?
 - a. **Yes.** [Go to Test 9.](#)
 - b. **No.** Replace rear HCU.

9. HCU Diode Test A

1. Set DMM to diode test.
2. Connect DMM positive (red) test lead to breakout box terminal 10 and negative (black) test lead to breakout box terminal 9.
3. Test voltage.
4. Is voltage greater than 0.2V?
 - a. **Yes.** [Go to Test 10.](#)
 - b. **No.** Replace rear HCU.

10. HCU Diode Test B

1. Reverse probes, connect DMM positive (red) test lead to breakout box terminal 9 and negative (black) test lead to breakout box terminal 10.
2. Is OL displayed?
 - a. **Yes.** [Go to Test 11.](#)
 - b. **No.** Replace rear HCU.

11. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.

3. Start vehicle. Operate in parameters for initialization self-test.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

DESCRIPTION AND OPERATION

See [Figure 7-46](#). The speedometer illuminates the ABS indicator by supplying ground to the lamp. The ABS module sends a message on the CAN bus to the speedometer in order to command the indicator ON or OFF.

The ABS indicator will normally illuminate and then begin to flash when the vehicle is turned ON. It will continue to flash until the ABS ECU sees at least 8 mph (10 km/h) to verify proper operation.

Diagnostic Tips

The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement.

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](#).

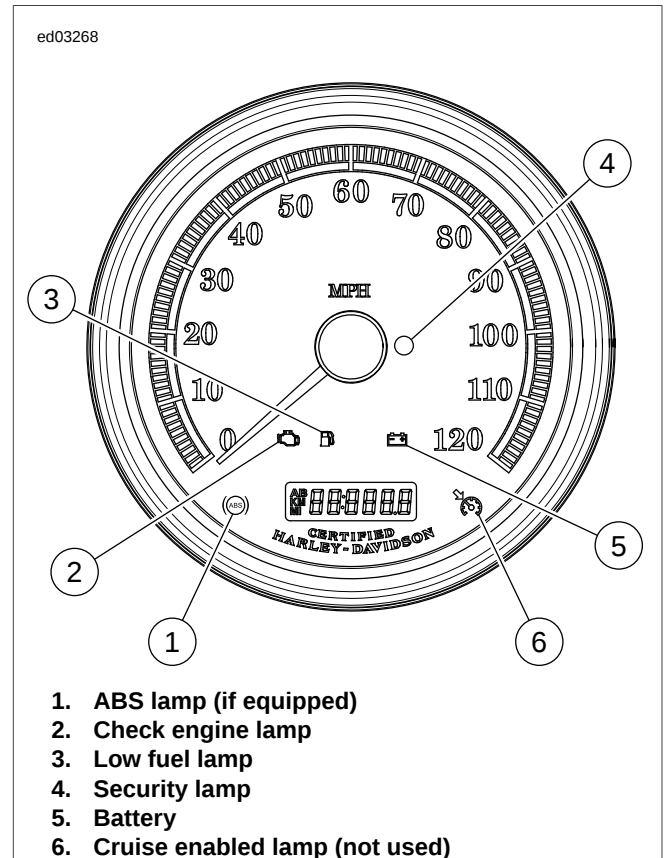


Figure 7-46. Indicator Lamps

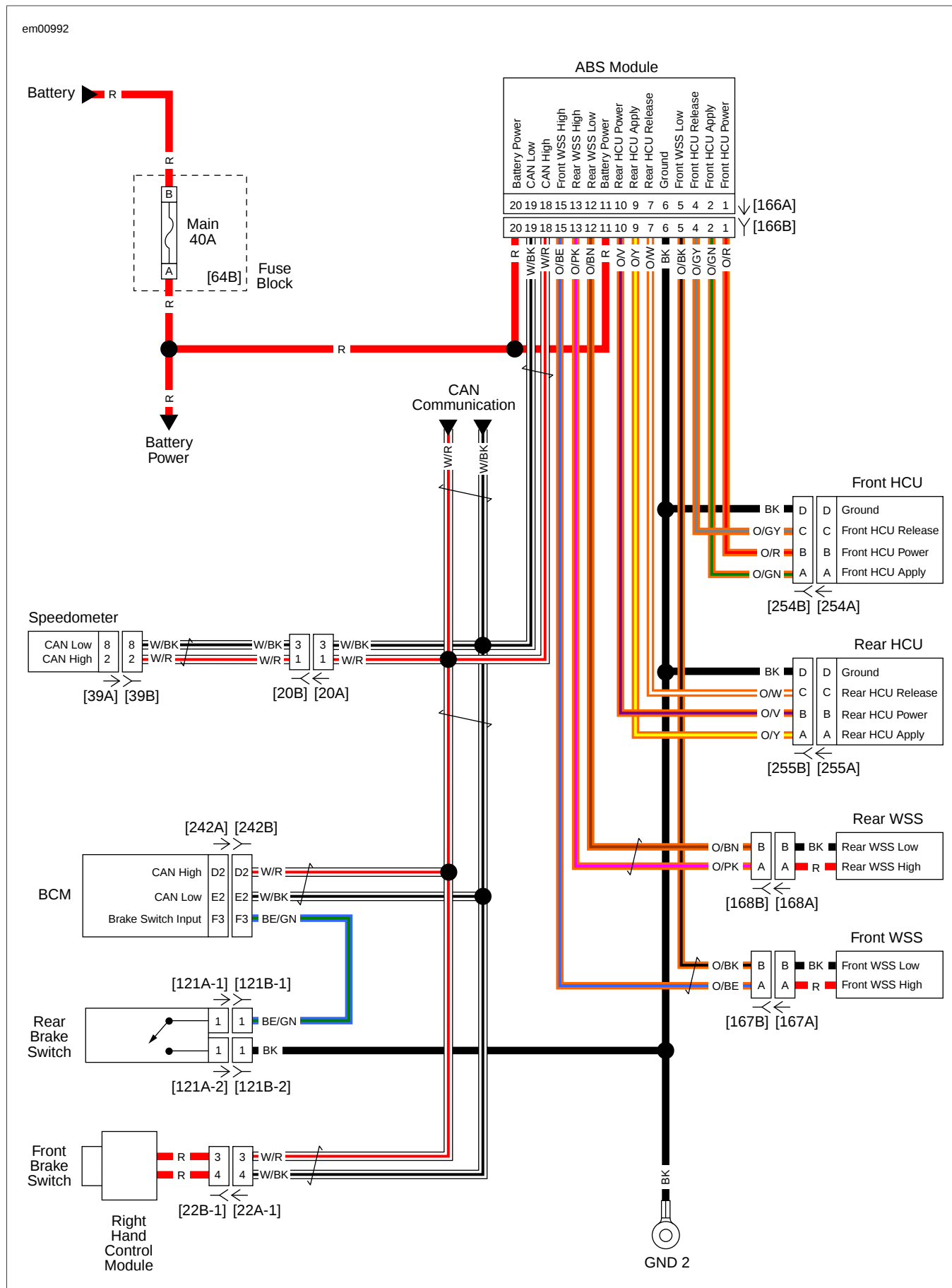


Figure 7-47. ABS Schematic

ABS INDICATOR ALWAYS ON OR INOPERATIVE

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-45325	JUMPER HARNESS
HD-48642	ABS BREAKOUT BOX

Table 7-30. ABS Indicator Always On or Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open battery circuit
Open ground circuit
Short to ground in battery circuit

1. DTC Test

1. Verify vehicle is equipped with ABS and has the appropriate speedometer.
2. Clear DTCs.
3. Turn IGN OFF.
4. Check DTCs.
5. Did DTCs set?
 - a. **Yes.** See appropriate diagnostic procedure.
 - b. **No.** [Go to Test 2.](#)

2. ABS Lamp Function Test

1. Perform a "WOW" test. See [2.1 INITIAL DIAGNOSTICS](#).
2. Does ABS lamp function properly during the "WOW" test?
 - a. **Yes.** [Go to Test 3.](#)
 - b. **No.** Replace speedometer. **(6020)**

3. CAN High Circuit Continuity Test

1. Turn IGN OFF.
2. Connect ABS BREAKOUT BOX (Part No. HD-48642) between wire harness [166B] leaving ABS module [166A] disconnected. See [1.2 DIAGNOSTIC TOOLS](#).
3. Connect BREAKOUT BOX (Part No. HD-42682) and JUMPER HARNESS (Part No. HD-45325) between wire

harness [39B] and IM [39A]. See [1.2 DIAGNOSTIC TOOLS](#).

4. Test for continuity between ABS BOB terminal 18 and speedometer BOB terminal 2.
5. Is continuity present?
 - a. **Yes.** [Go to Test 4.](#)
 - b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test for continuity between ABS BOB terminal 19 and speedometer BOB terminal 8.
2. Is continuity present?
 - a. **Yes.** [Go to Test 5.](#)
 - b. **No.** Repair open in (W/BK) wire.

5. ABS Power Circuit Test

1. Test voltage between BOB terminal 11 and 20 to ground.
2. Is battery voltage present?
 - a. **Yes.** [Go to Test 6.](#)
 - b. **No.** Repair open in ABS module battery circuit. **(5041)**

6. ABS Ground Circuit Test

1. Test continuity between BOB terminal 6 and ground.
2. Is continuity present?
 - a. **Yes.** [Go to Test 7.](#)
 - b. **No.** Repair open in ABS ECU ground circuit. **(5041)**

7. ABS ECU Test

1. Remove BOB and connect [166].
2. Clear DTCs.
3. Start vehicle. Operate in the parameters for initialization self-test.
4. Check DTCs.
5. Did DTC reset?
 - a. **Yes.** Replace ABS ECU.
 - b. **No.** Concern is intermittent. See [1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test](#).

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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.

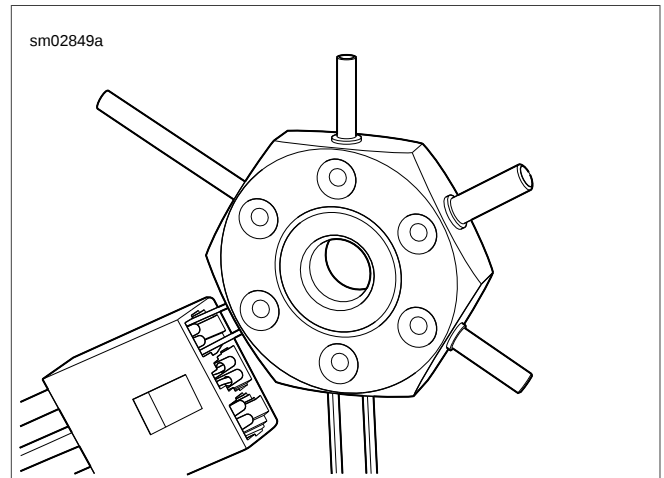


Figure A-1. Removing Autofuse Unsealed Terminal from Ignition Switch

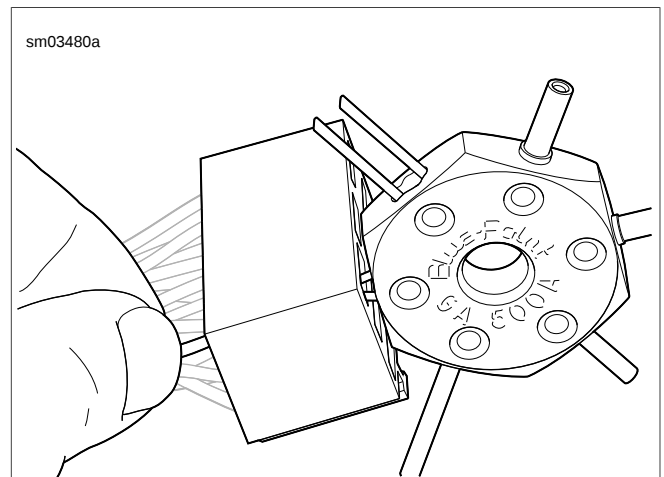


Figure A-2. Removing Autofuse Unsealed Terminal from Fuse Block

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 and TMAP sensors.

Housings

Separate: Snap back the secondary lock. Press on the latch while pulling the socket connector from the sensor.

Join: Align the sockets and press the housings together until the latch snaps. Snap in the secondary lock.

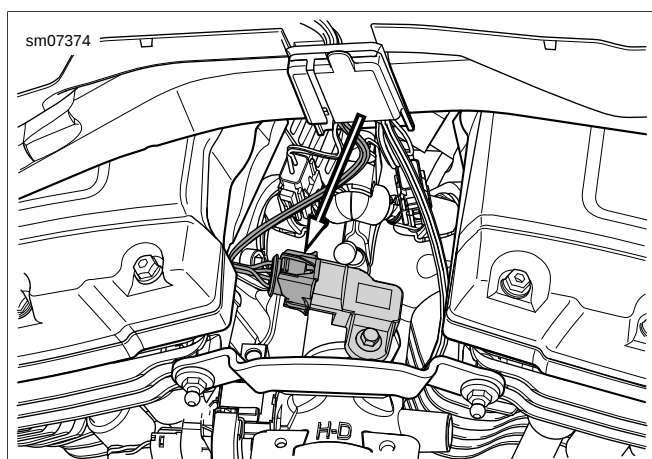


Figure A-3. Bosch Compact 1.1M Connector

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.

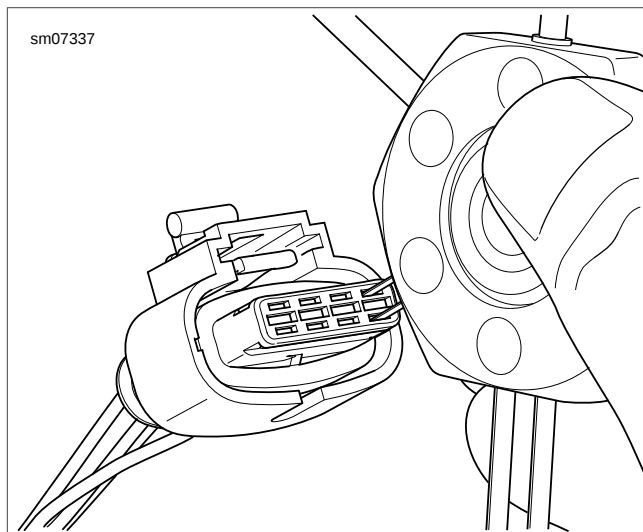


Figure A-4. Terminal Removal: Bosch Compact 1.1M Connector

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.

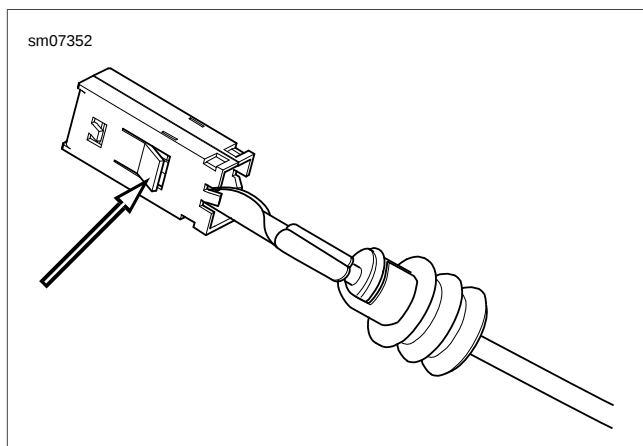


Figure A-5. Tangs: Bosch Compact 1.1M Socket Terminal

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.

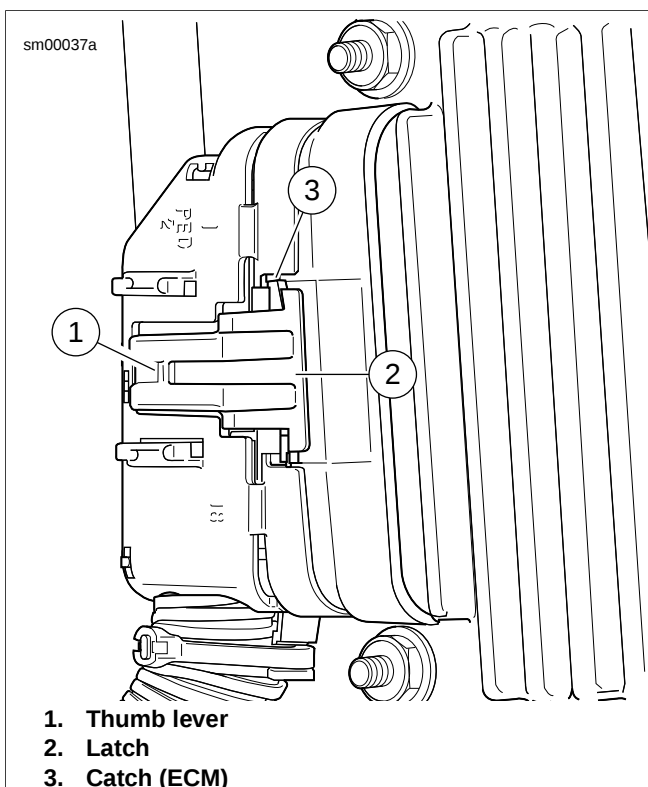


Figure A-6. Delphi 100W Micro-Pack Sealed Connector to ECM

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.

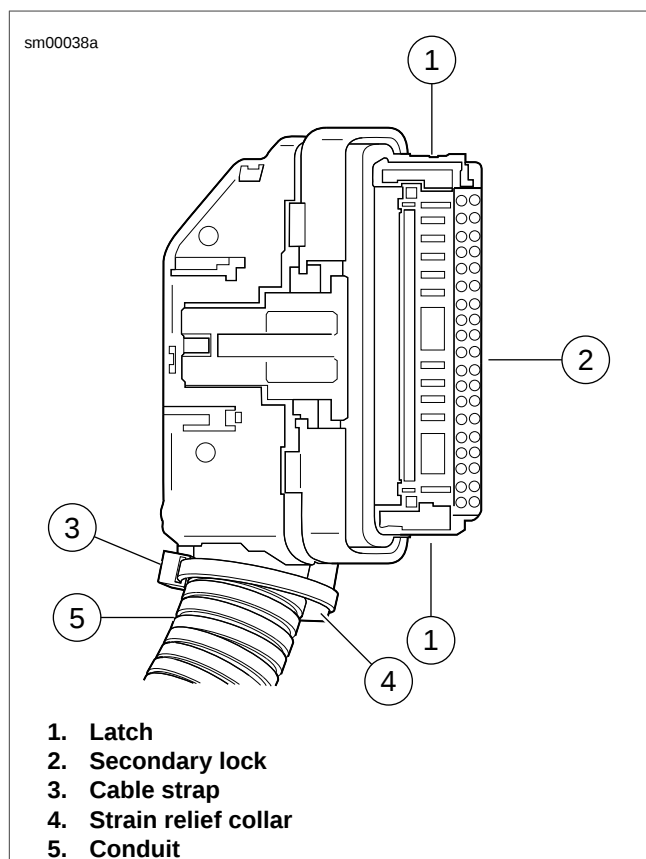


Figure A-7. Delphi 100W Micro-Pack Sealed Connector

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.

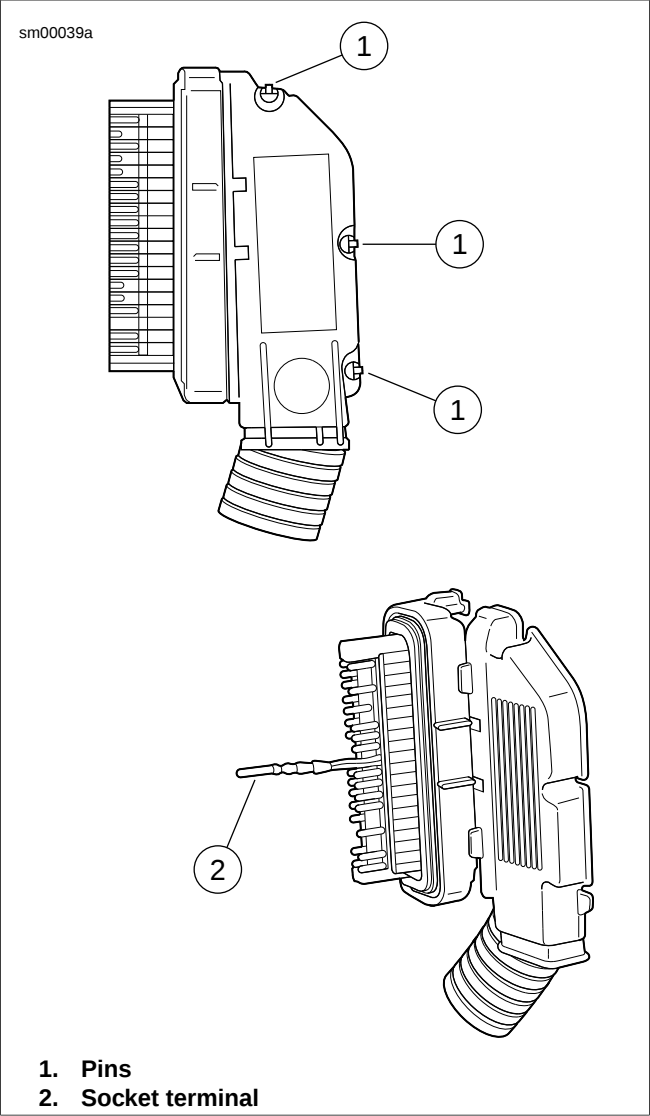


Figure A-8. Delphi 100W Micro-Pack Sealed Connector:
Separate Halves of Socket Housing

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

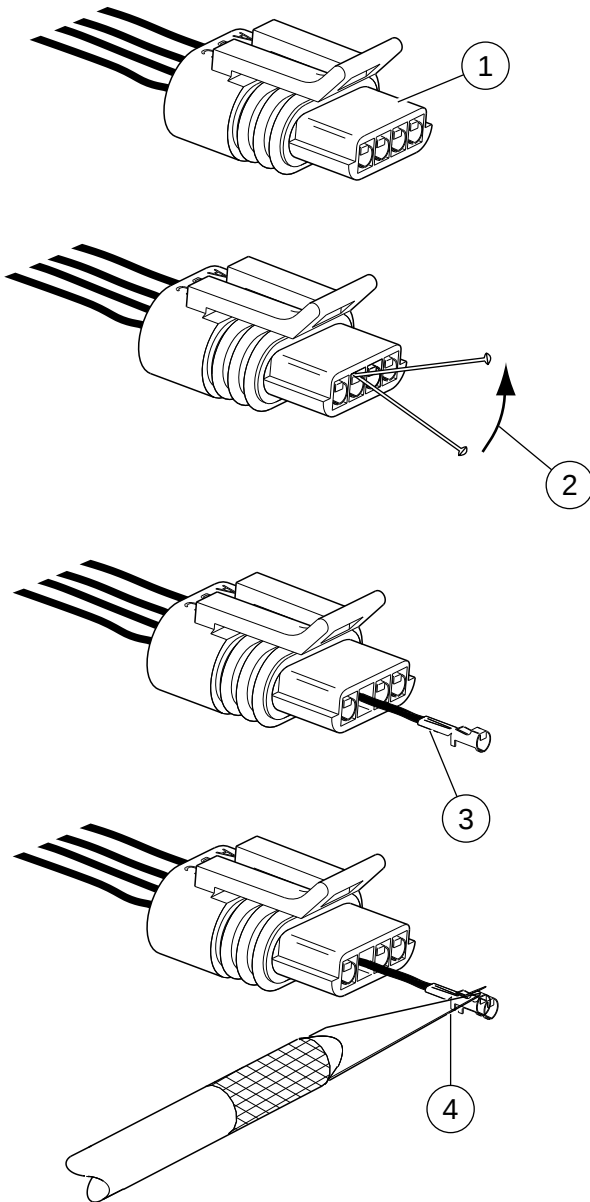
NOTE

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.

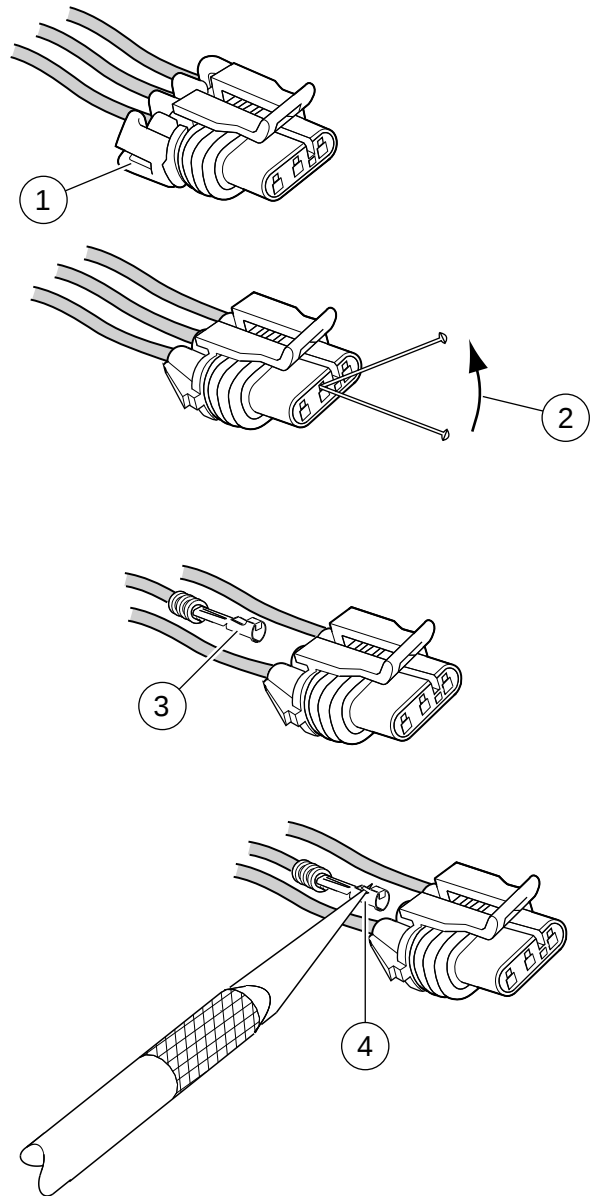
sm00027a



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**

sm00028a



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**

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.

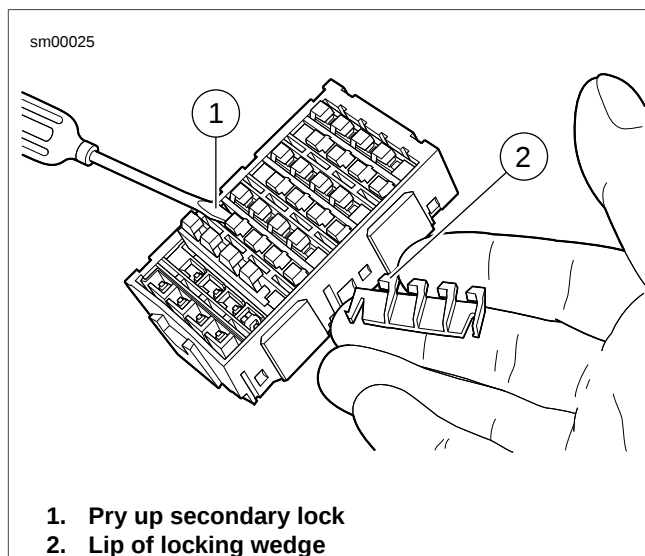


Figure A-11. Fuse Block: Remove Secondary Locks

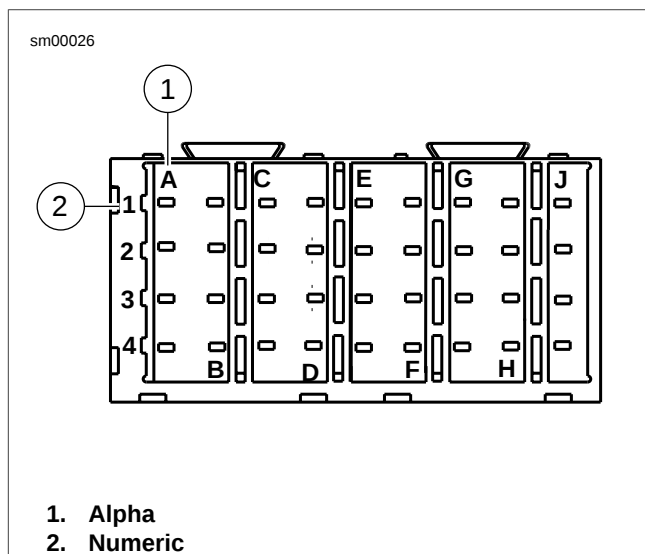


Figure A-12. Fuse Block: Coordinates (typical)

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

- 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.
- 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.
- Pivot the end of the pin toward the terminal body to press the tang.
- Remove the pin and then pull terminal out of the wire end of connector housing.
- If necessary, crimp **new** terminals on wires. See [A.9 DELPHI METRI-PACK TERMINAL REPAIR](#).

Installing Socket Terminals

- Carefully bend the tang outward away from the terminal body.
- 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.

- Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
- 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.

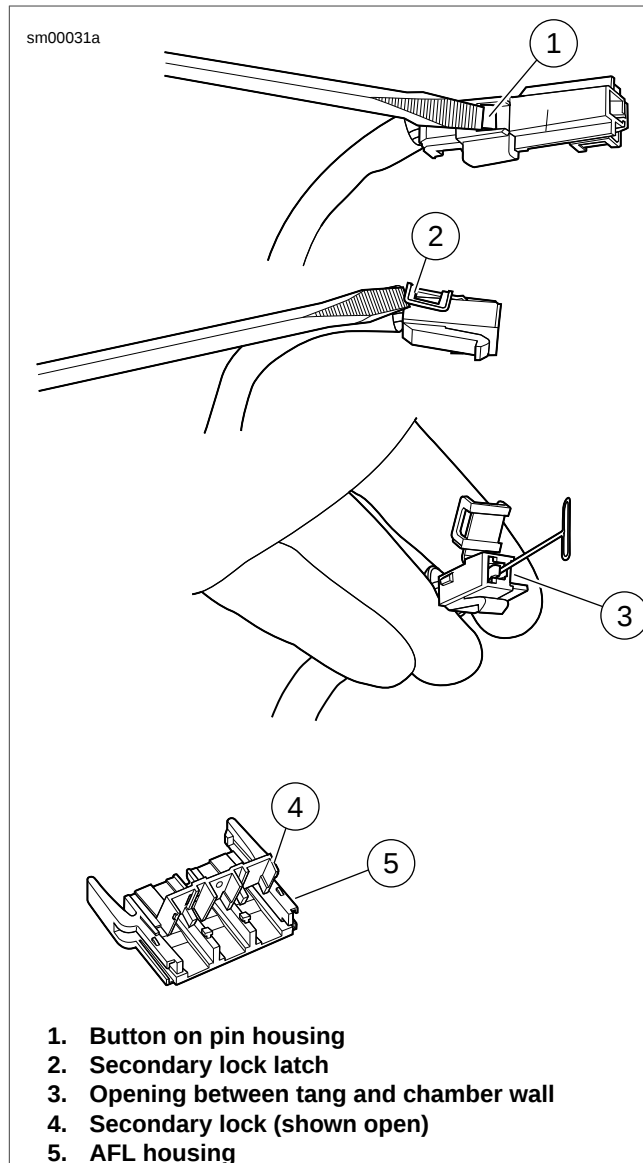


Figure A-13. Delphi 480 Metri-Pack Unsealed Connector: Remove Socket Terminal

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.

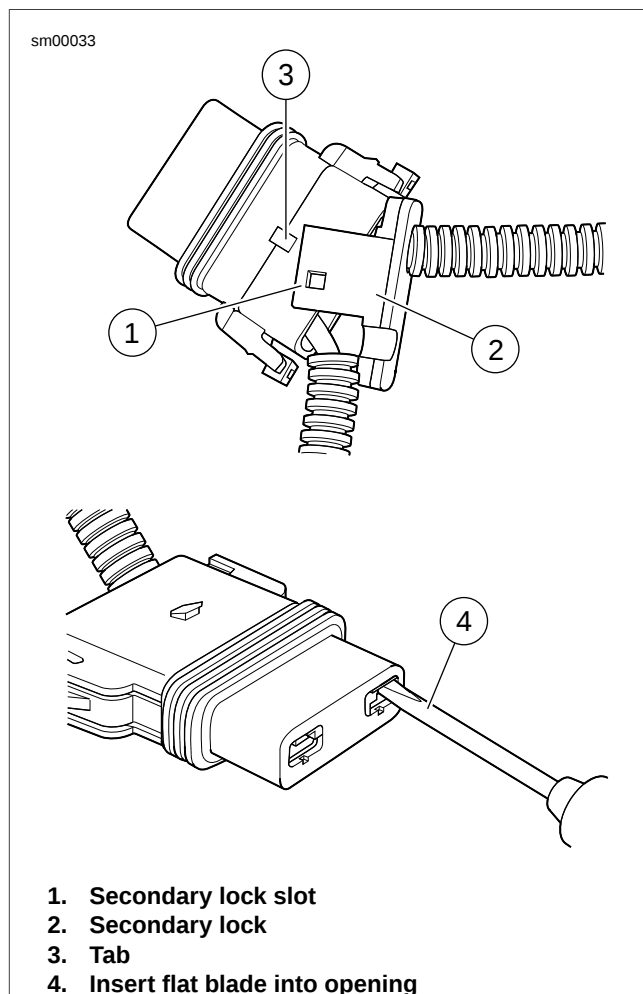


Figure A-14. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Remove Socket Terminals

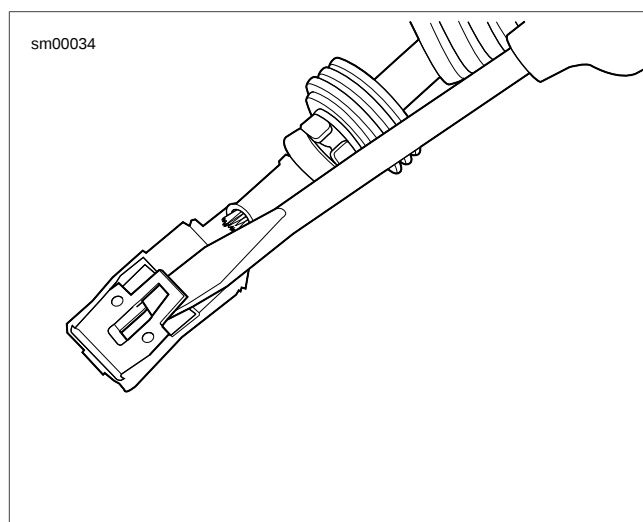


Figure A-15. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Bend Tang

DELPHI METRI-PACK TERMINAL REPAIR

A.9

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.

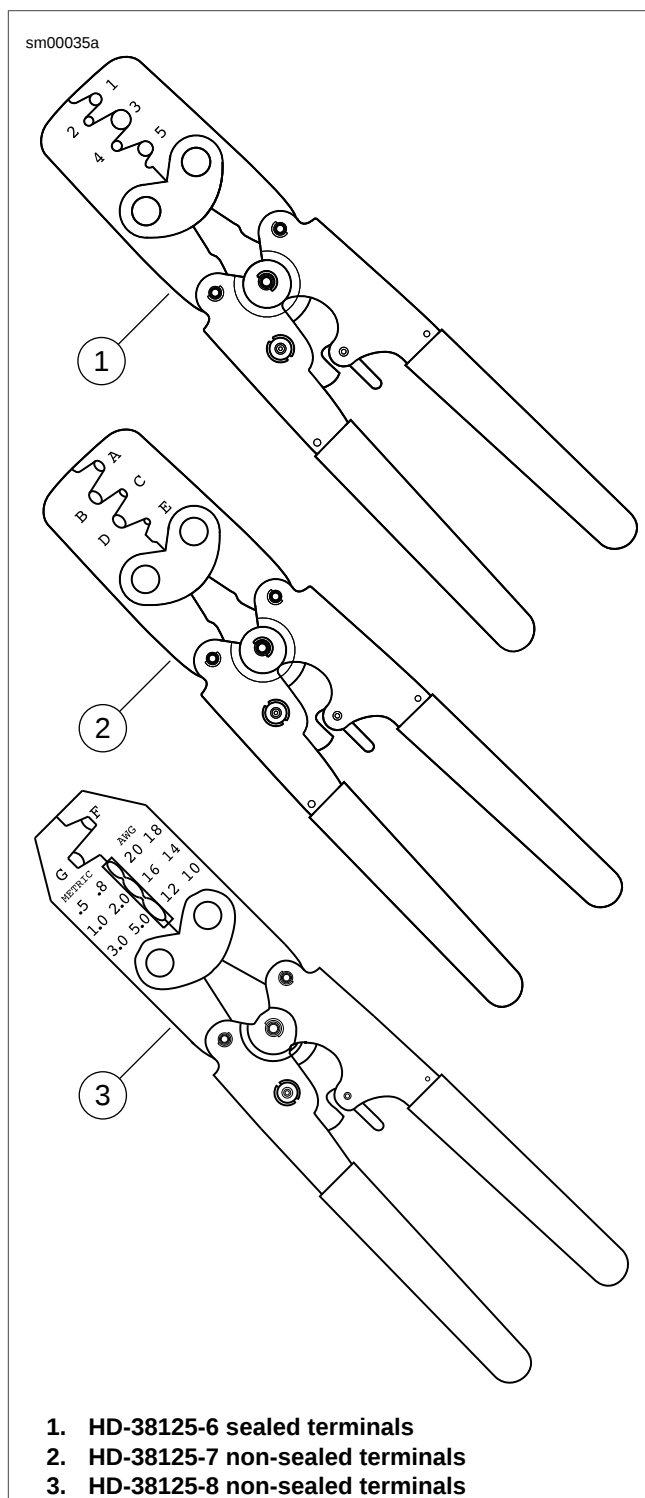


Figure A-16. Metri-Pack Terminal Crimp Tools

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.

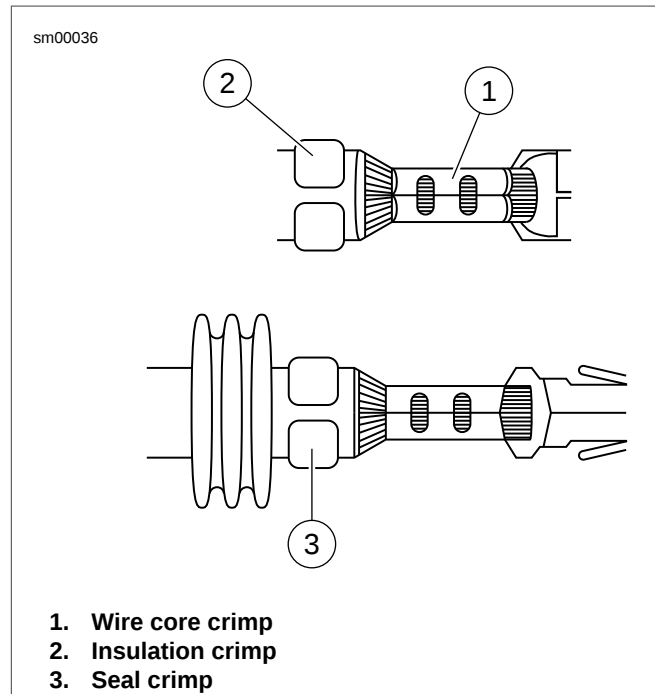


Figure A-17. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

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.

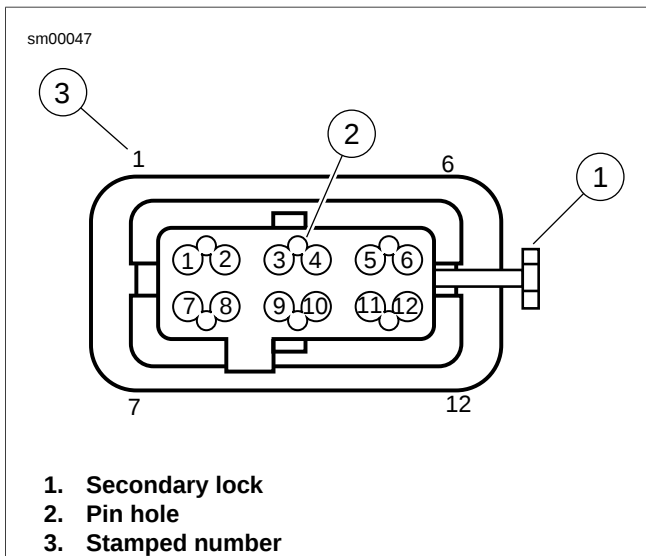


Figure A-18. Delphi Micro-64 Sealed Connector: Housing

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)

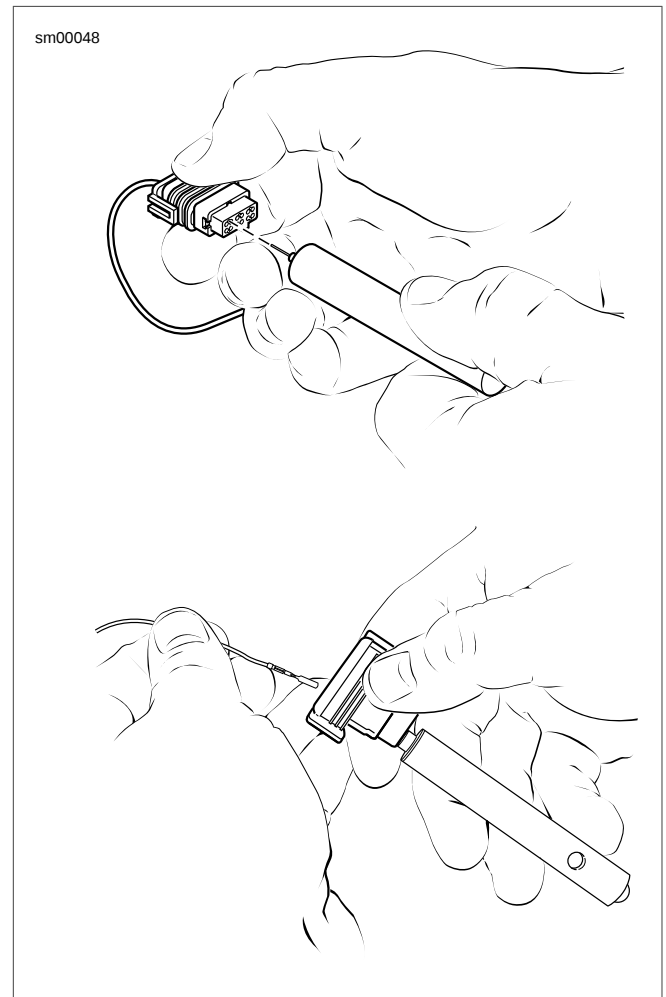


Figure A-20. Delphi Micro-64 Sealed Connector: Insert Tool and Remove Terminal

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.

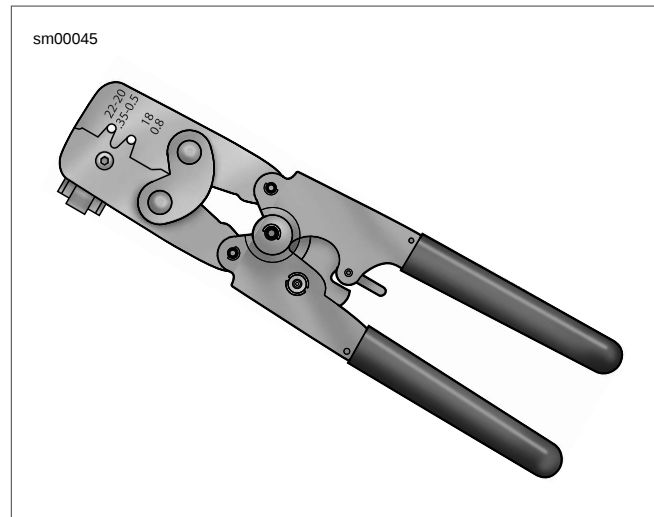


Figure A-21. Terminal Crimper (HD-45929)



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.

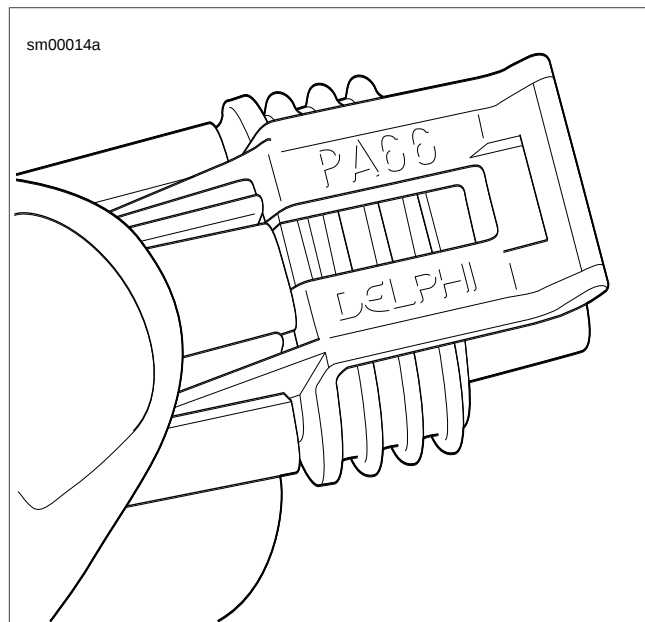


Figure A-23. Delphi GT 150 Sealed Connector: Socket Housing Latch

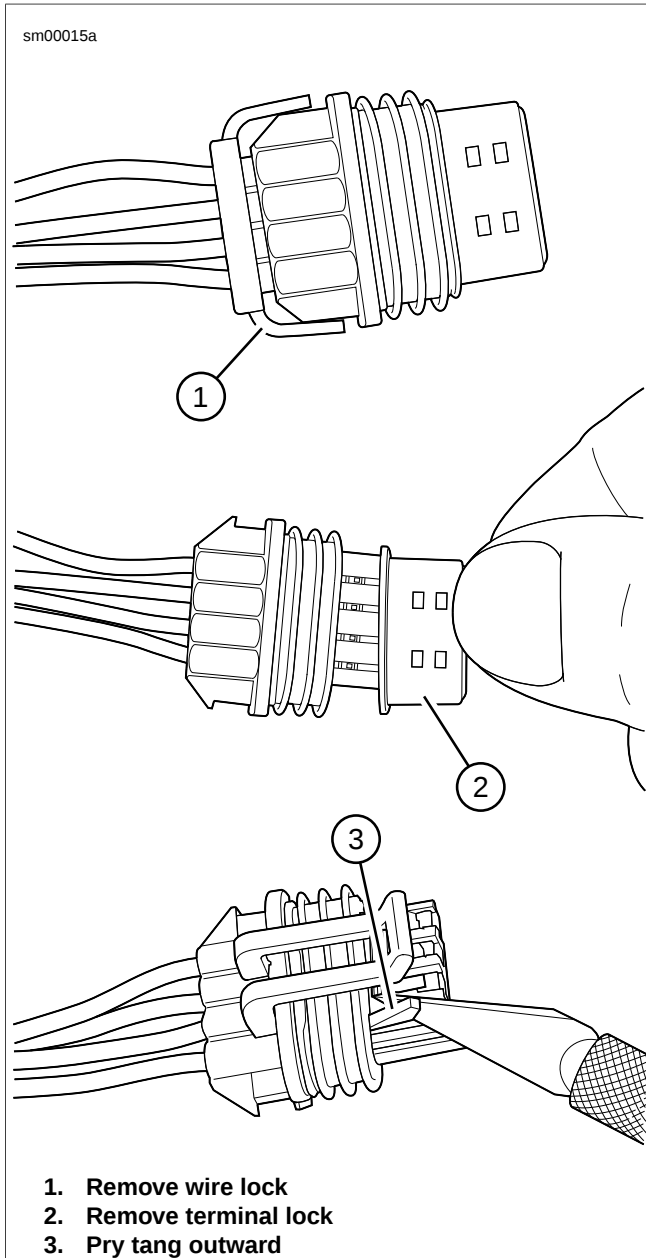


Figure A-24. Delphi GT 150 Sealed Connector: Removing Socket Terminals

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.

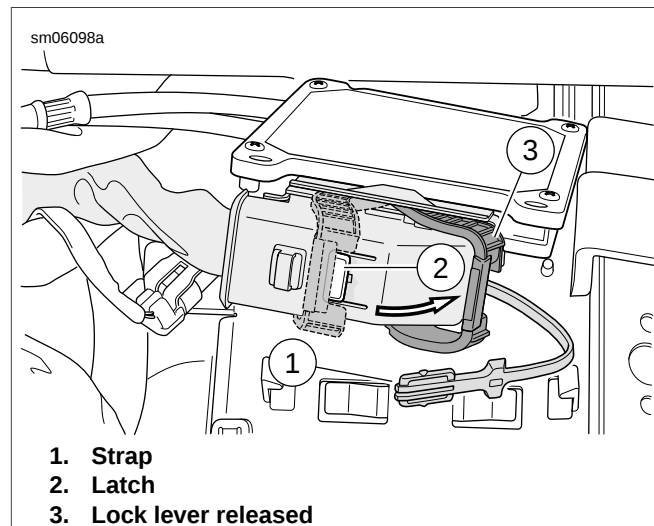


Figure A-25. Unlatch ECM Connector

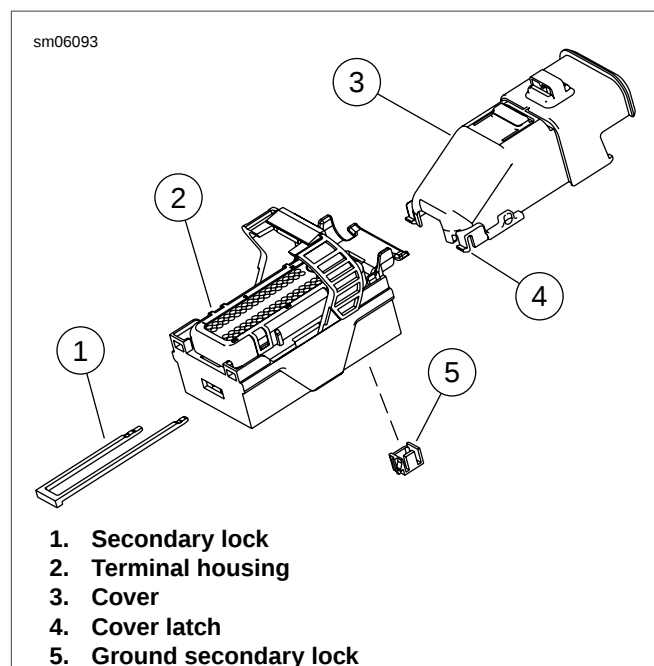


Figure A-26. Delphi 73-Terminal ECM Connector

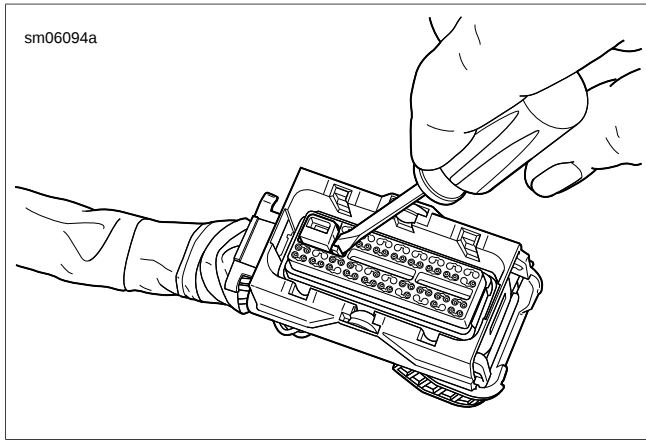


Figure A-27. Remove Ground Secondary Lock

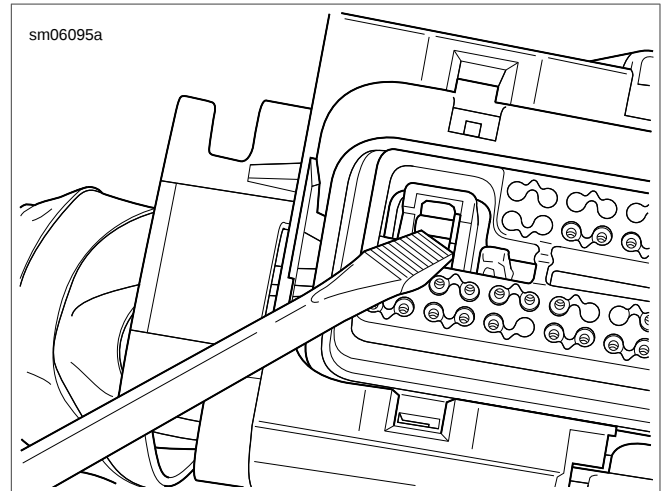


Figure A-28. Remove ECM Ground Terminal

DEUTSCH DT SEALED 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**.

NOTES

- 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.

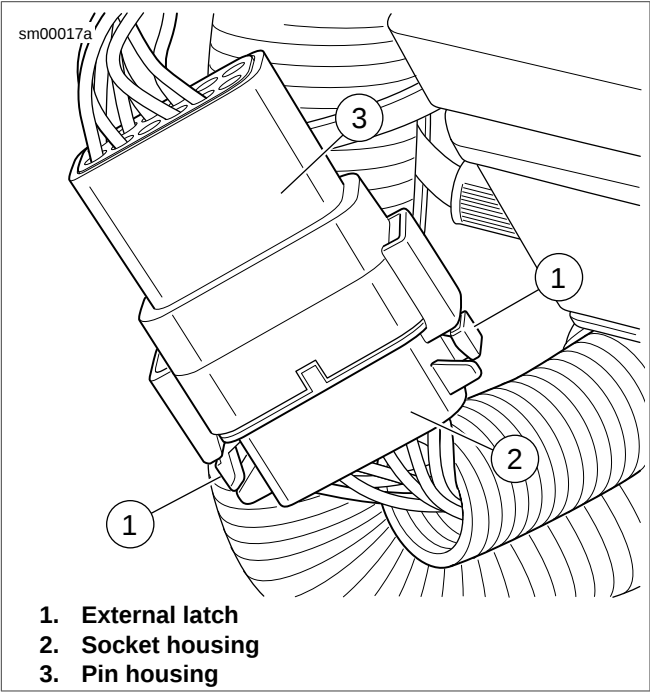


Figure A-29. Deutsch DT Sealed Connector

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.

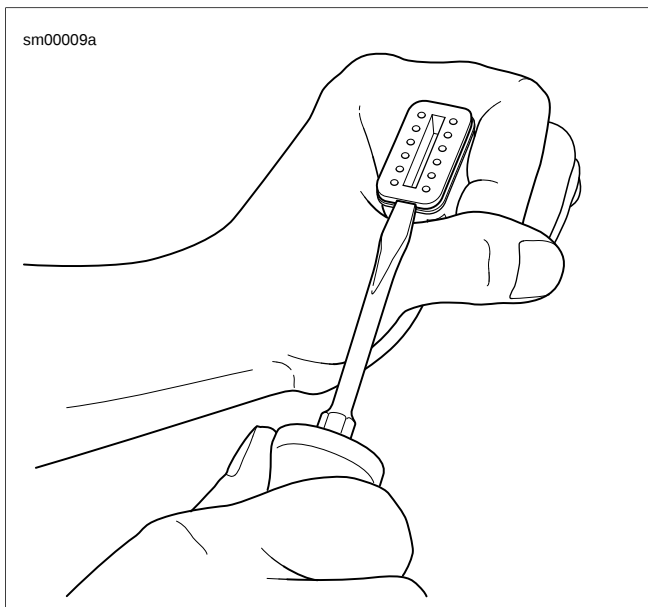


Figure A-30. Deutsch DT Sealed Connector: Remove Secondary Locking Wedge

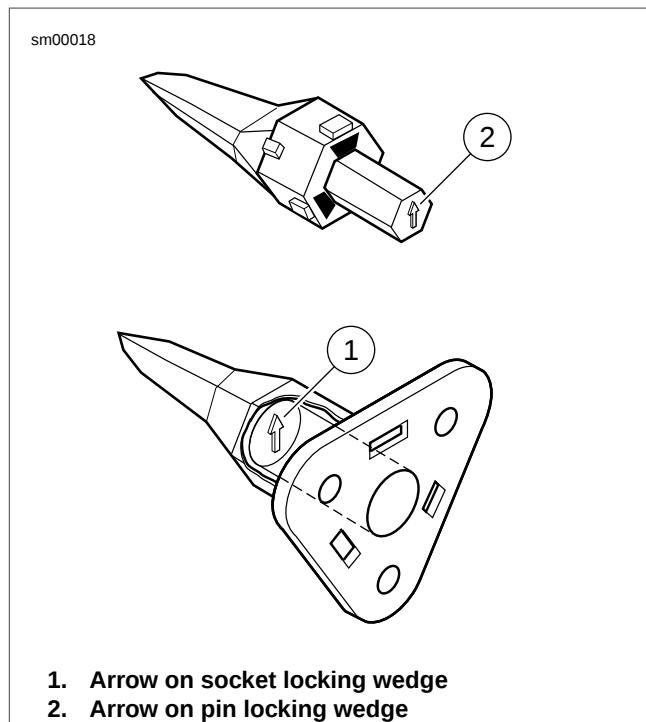


Figure A-31. Deutsch DT Sealed Connector: 3-Place Locking Wedges

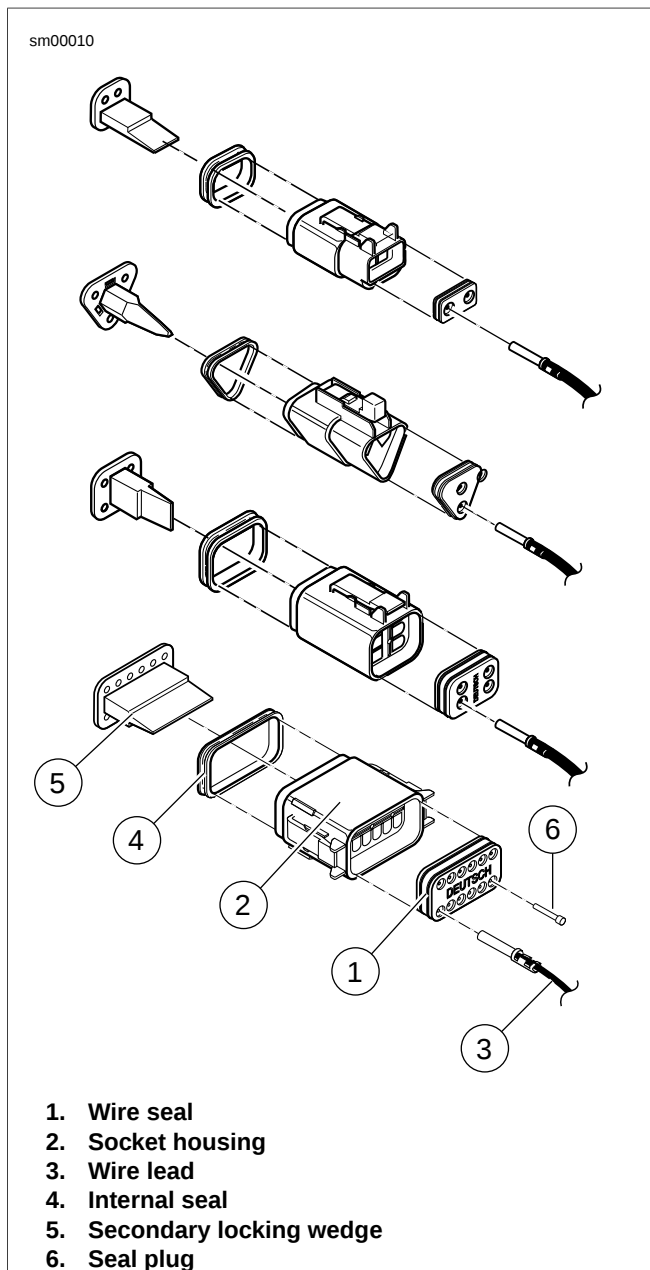


Figure A-32. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Socket Housings

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.

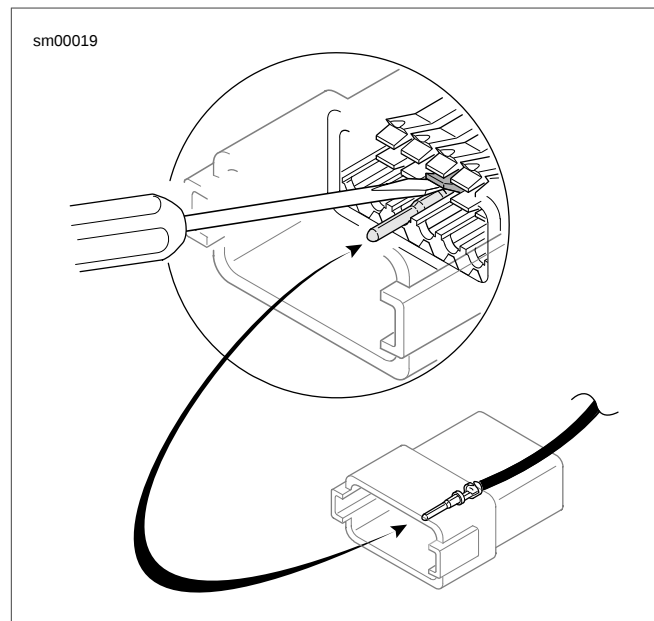


Figure A-33. Deutsch DT Sealed Connector: Press Terminal Latch and Back Out Pin

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.

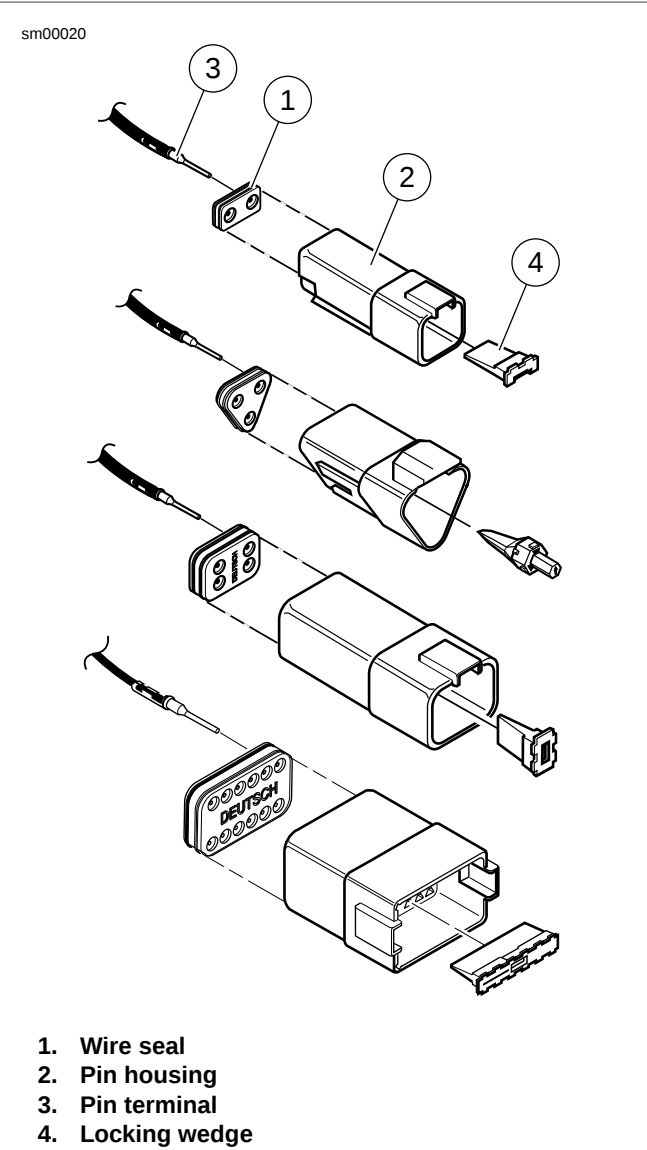


Figure A-34. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Pin Housings

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

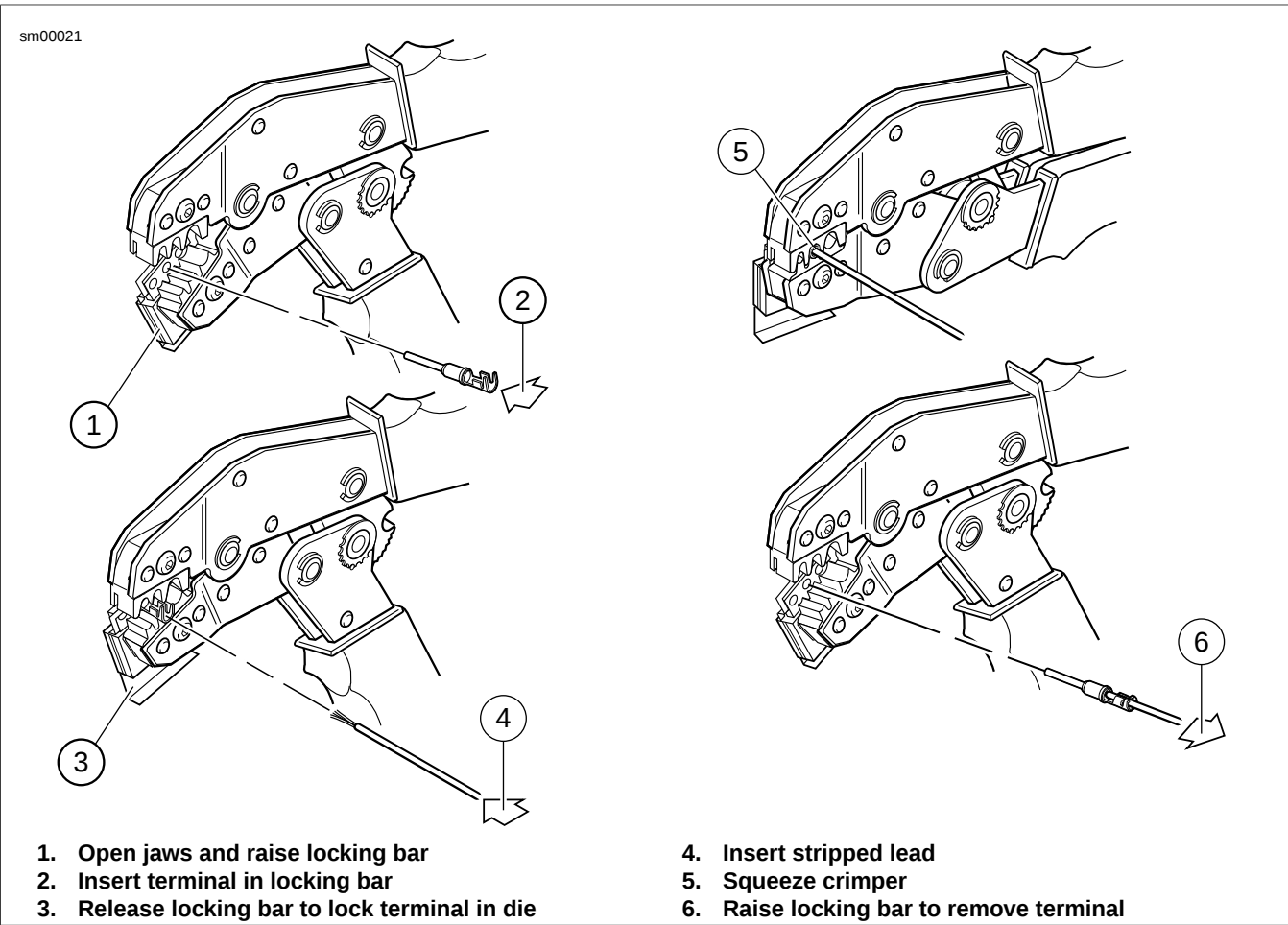


Figure A-35. Crimping a Deutsch DT Sealed Terminal

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.

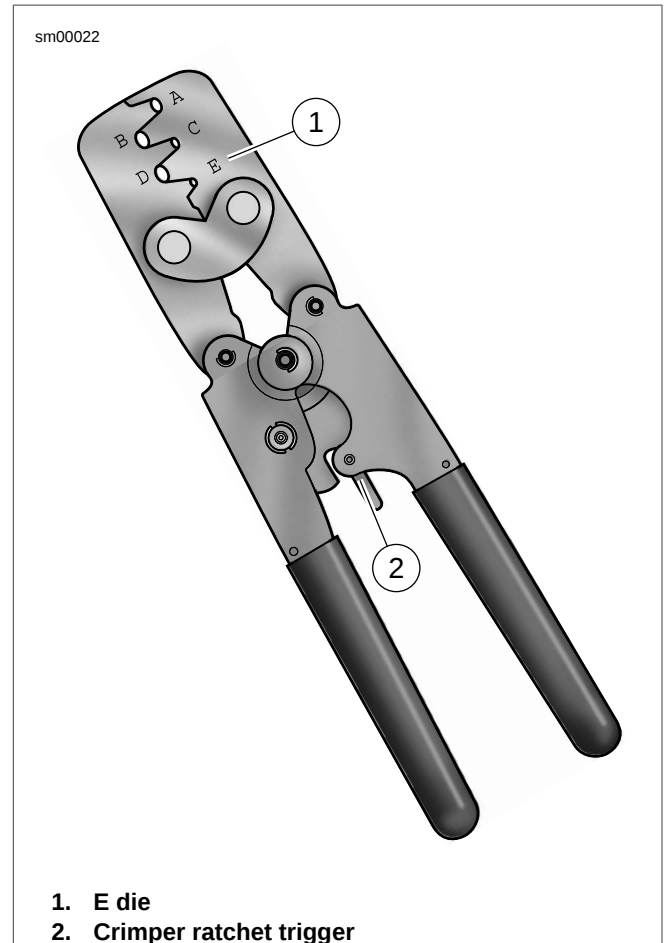


Figure A-36. Packard Terminal Crimper (HD-38125-7)

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. Rotate 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 indenter cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of recess in indenter cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact centers between the four indenter 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 indenter.

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.

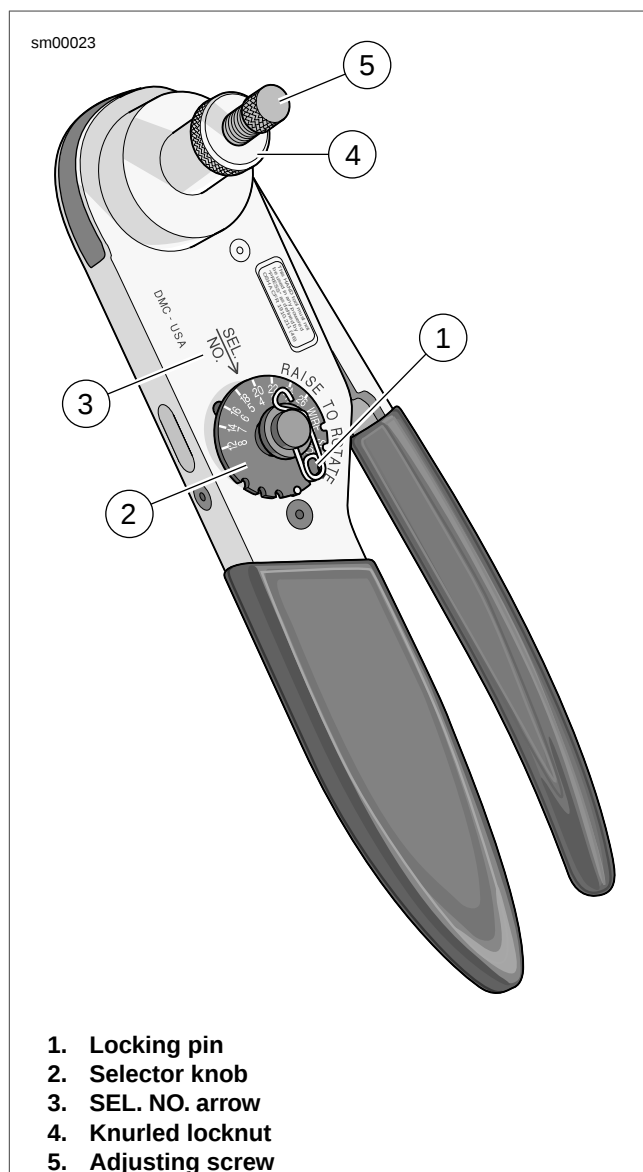


Figure A-37. Electrical Crimper Tool (HD-42879)

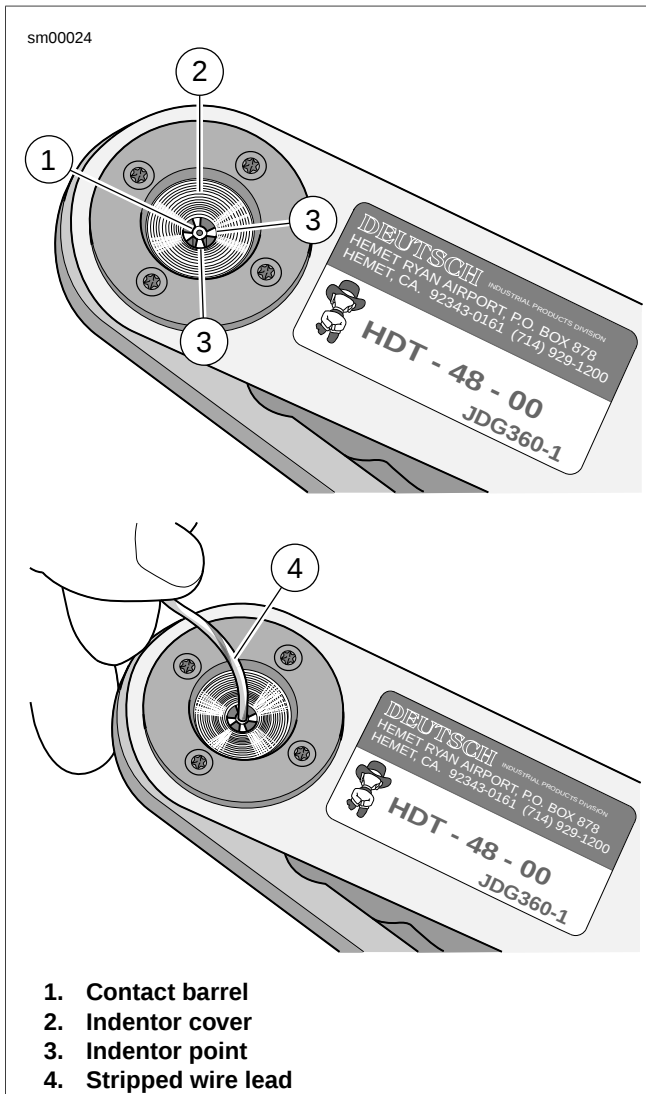


Figure A-38. Deutsch Solid Barrel

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.

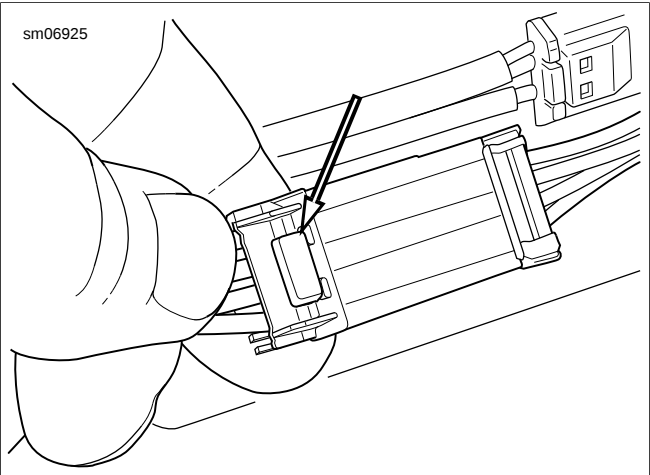


Figure A-39. Release Buttons: JAE MX19 Sealed Connector

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.

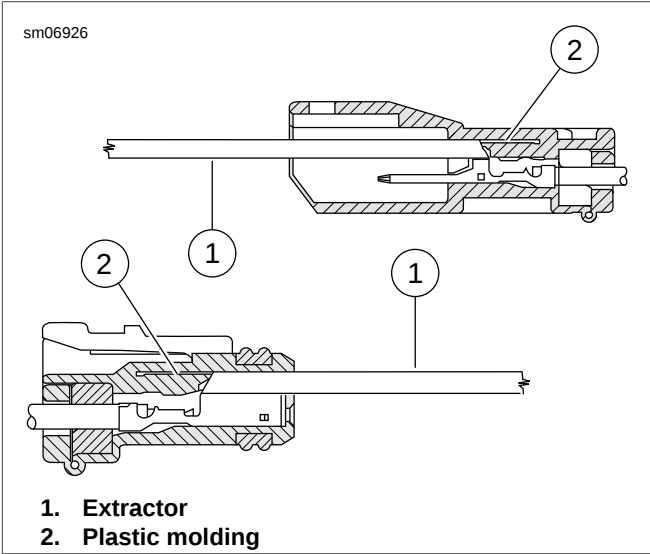


Figure A-40. JAE MX19 Terminal Removal

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.

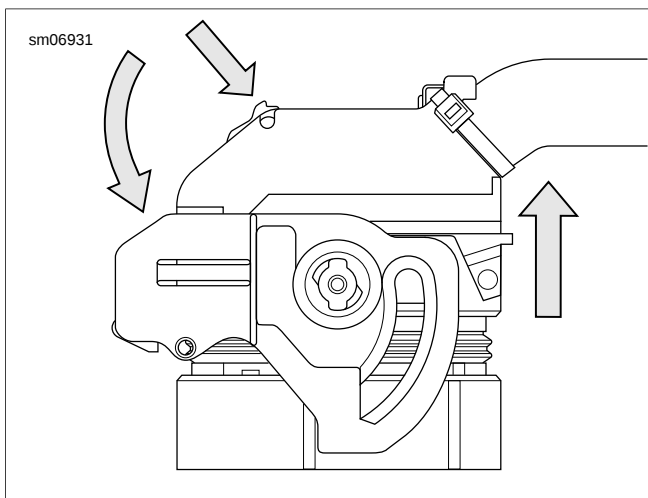


Figure A-41. Release

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.

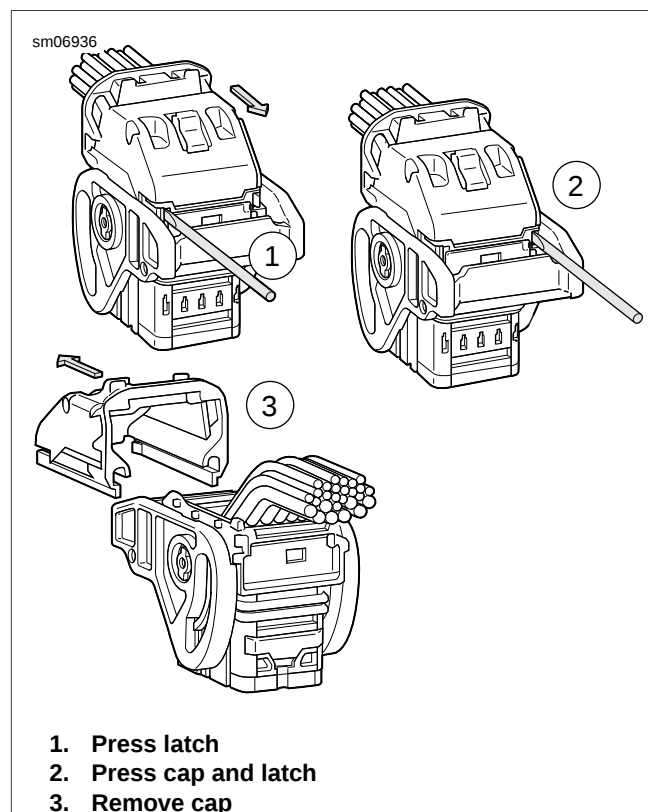


Figure A-42. Remove the Wire Lead Cap

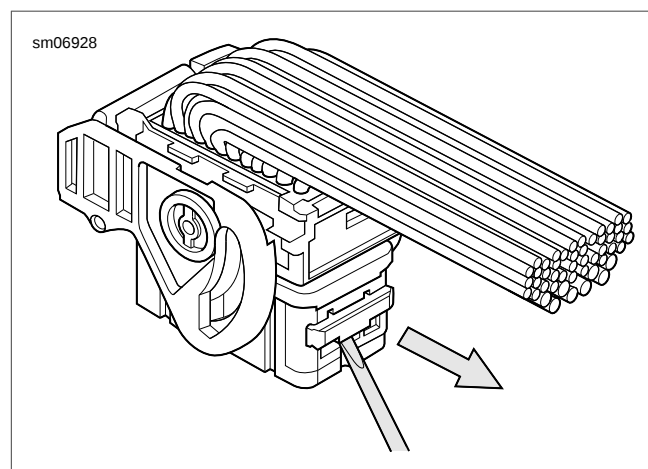


Figure A-43. Molex CMC Sealed Connector Secondary Lock

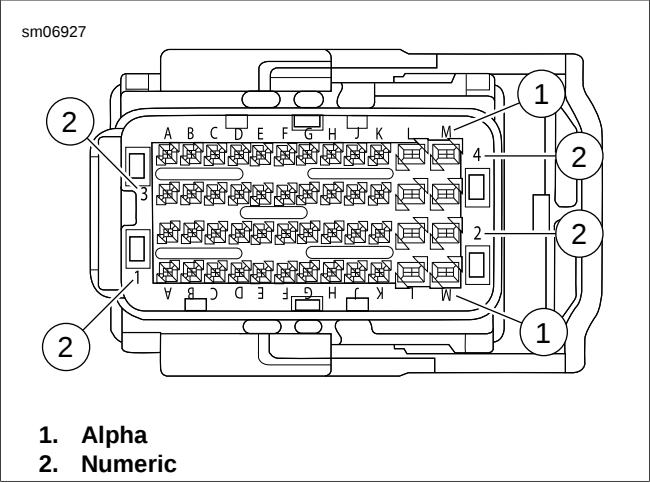


Figure A-44. Alpha-Numeric Coordinates

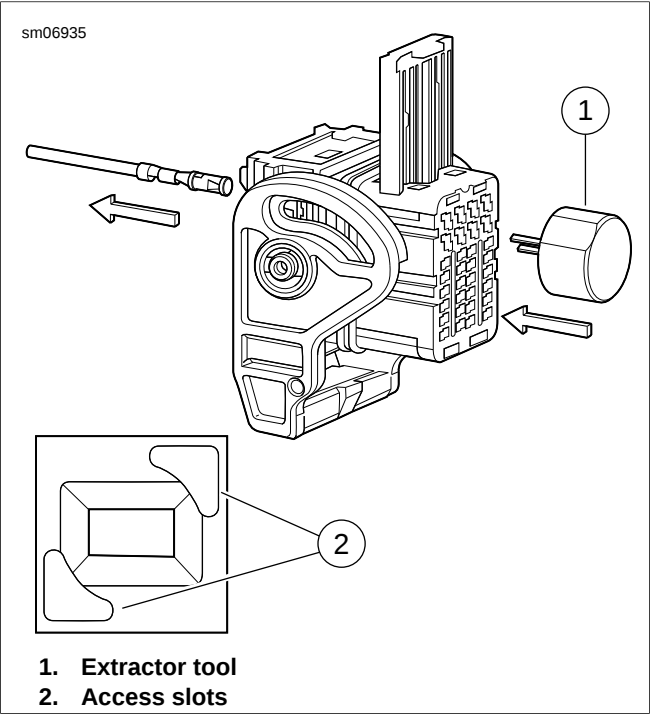


Figure A-45. Terminal Removal

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 CONNECTORS

A.19

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.

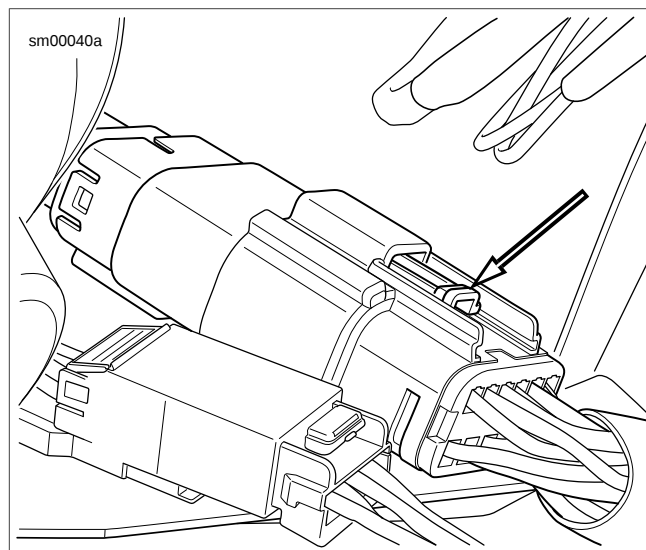


Figure A-46. Molex MX 150 Sealed Connector: Latch

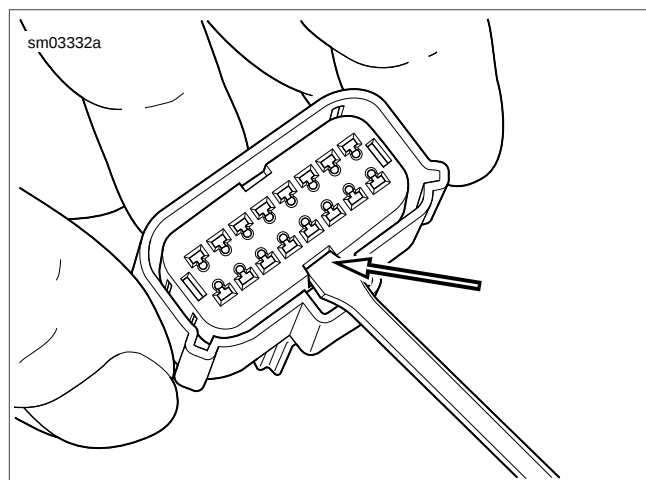


Figure A-47. Secondary Lock Pry Slot (Socket Housing)

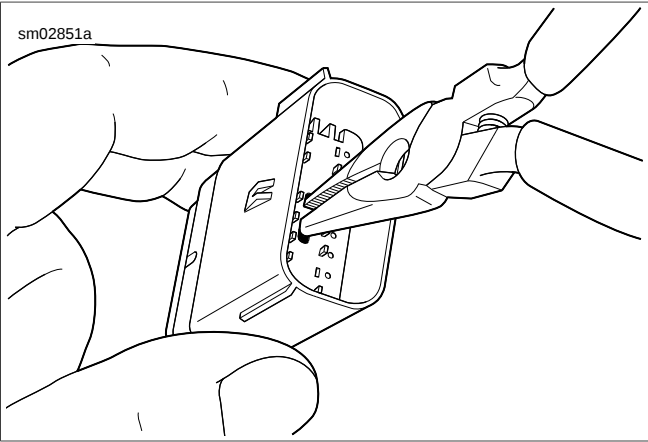


Figure A-48. Pull Up Secondary Lock

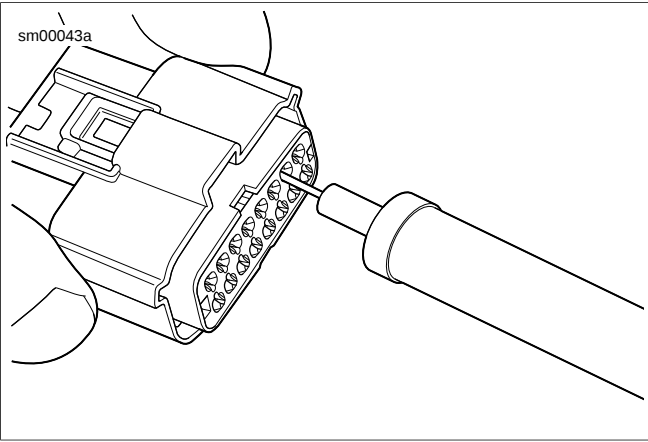


Figure A-49. Molex MX 150 Sealed Connector: Terminal Remover (HD-48114)

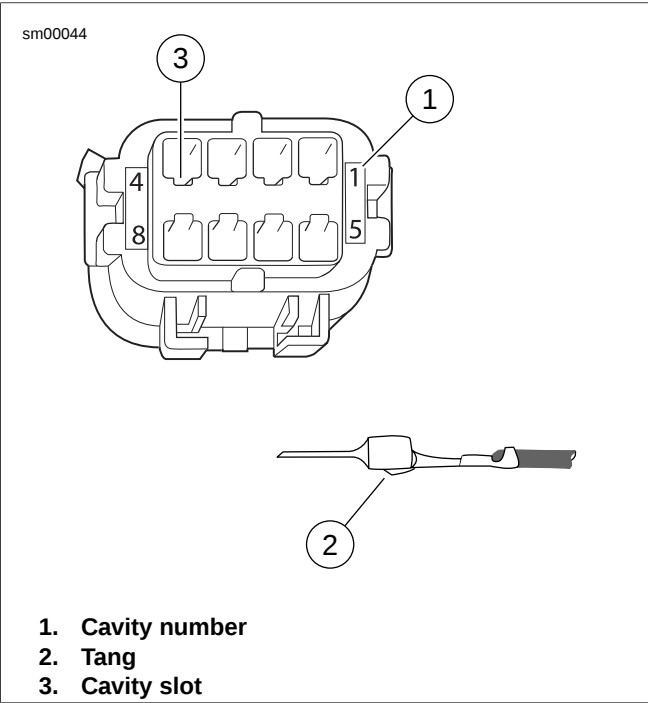


Figure A-50. Molex MX 150 Sealed Connector: Pin Cavities and Wire Terminal

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.	

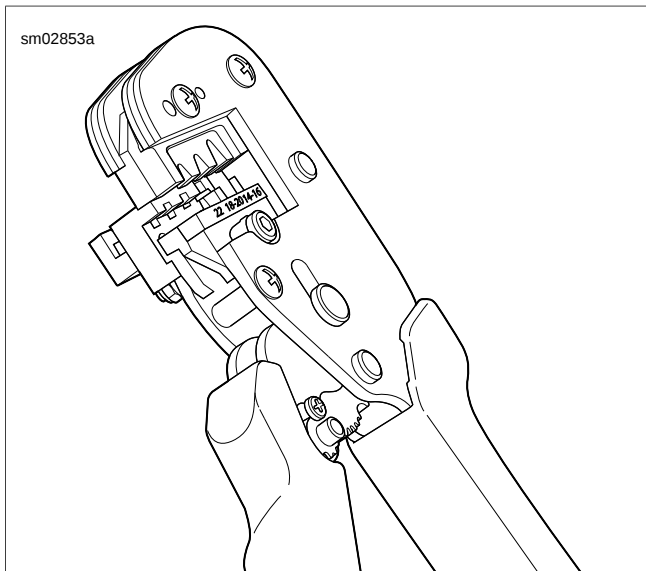


Figure A-51. Open Terminal Crimper (HD-48119) at 45 Degrees

2. See [Figure A-55](#). Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

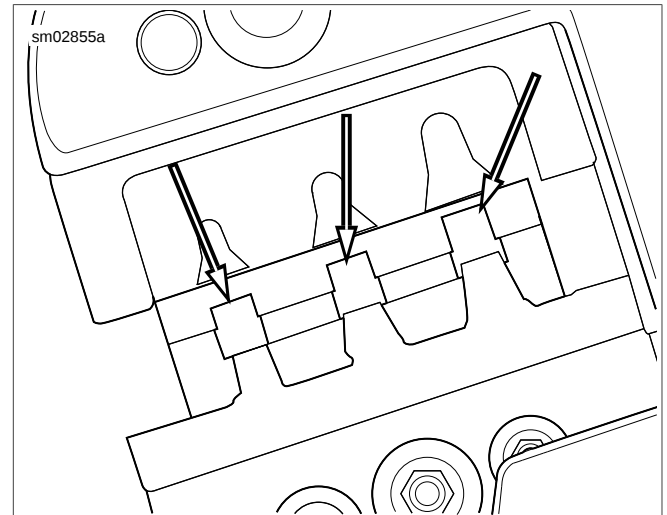
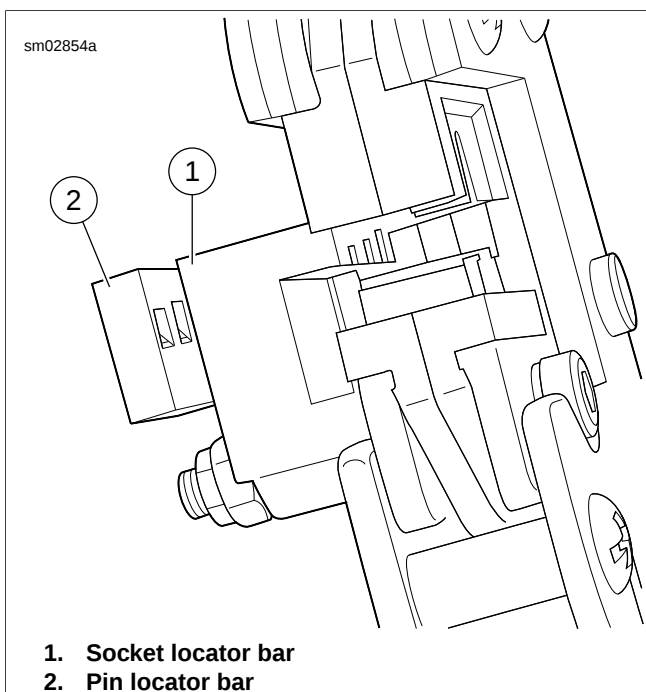


Figure A-53. Square Openings in Socket Locator Bar



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.

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.

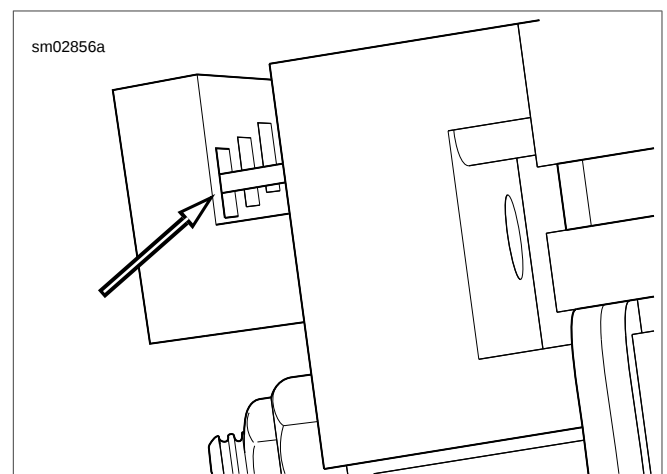


Figure A-54. Pin Terminal against Pin Locator Bar

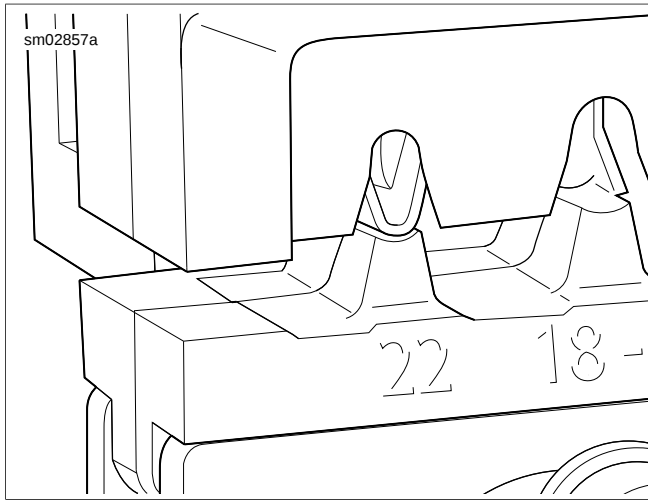


Figure A-55. Crimp Tails in Vertical Alignment between Punch and Die

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.

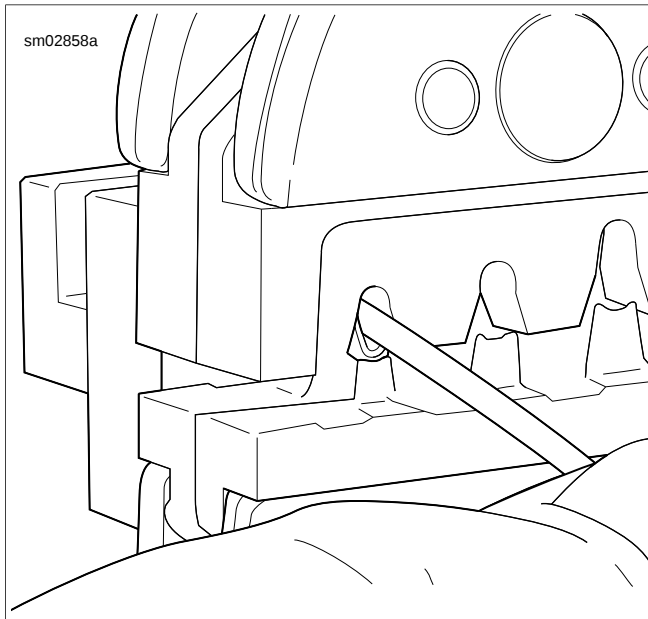


Figure A-56. Stripped Lead at Up Angle

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.

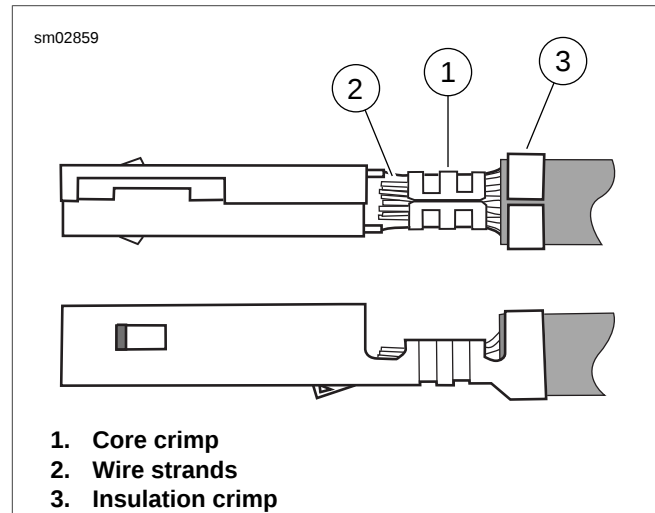


Figure A-57. Terminal Crimp

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.

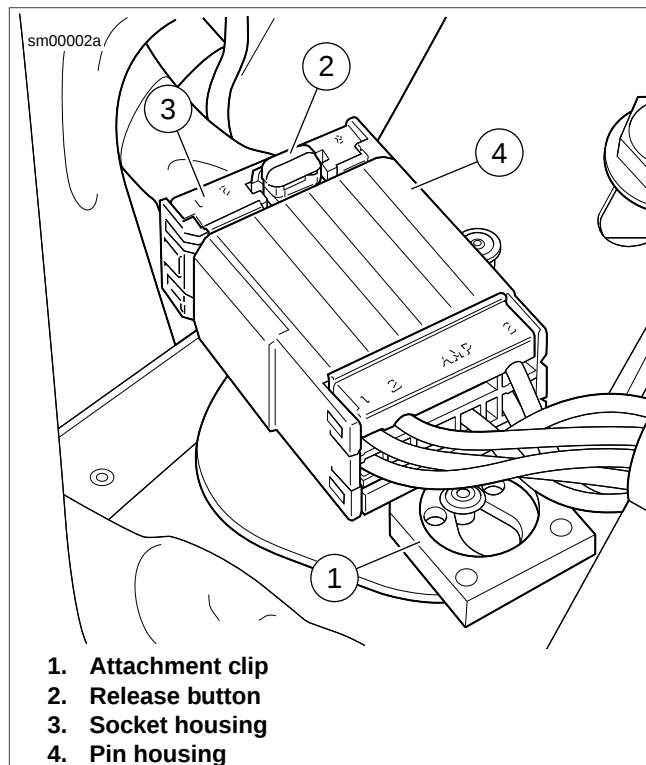


Figure A-58. Tyco 070 Multilock Unsealed Connector

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.

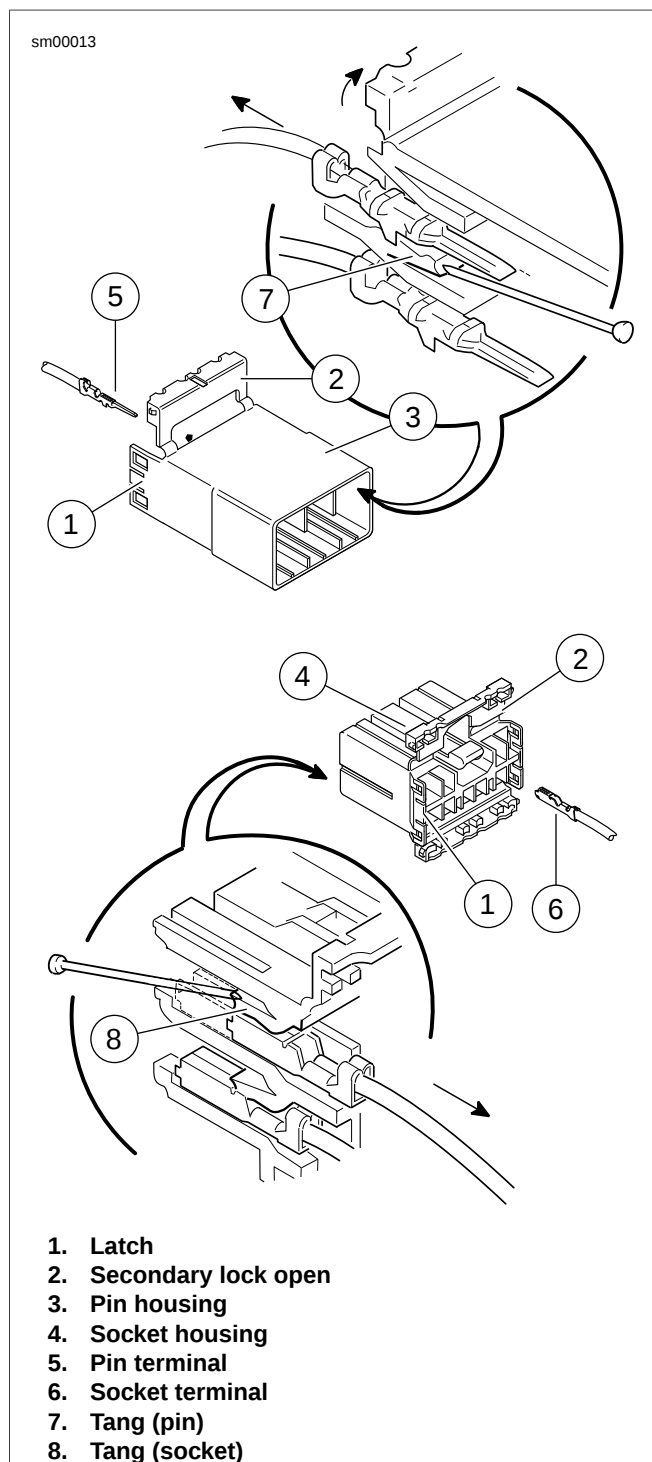


Figure A-59. Tyco 070 Multilock Unsealed Connector:
Socket and Pin Housings

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.

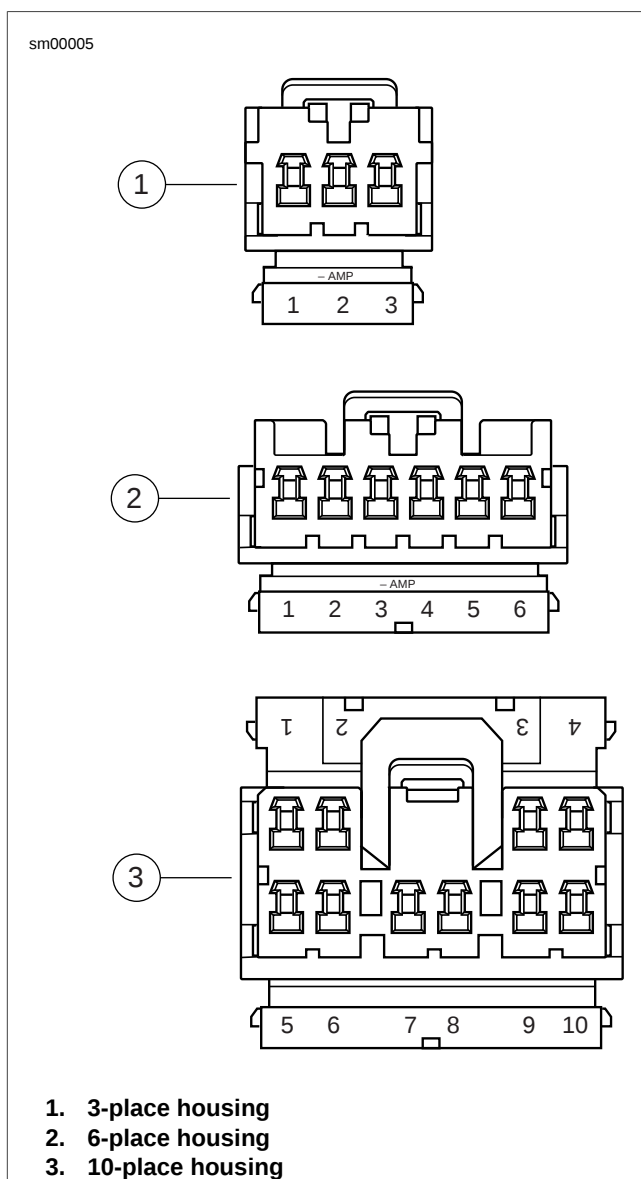


Figure A-60. Tyco 070 Multilock Unsealed Connector:
Cavity Numbers on Secondary Locks (socket housings
shown)

Preparing Wire Leads for Crimping

1. Strip wire lead removing 5/32 in (4.0 mm) of insulation.

- See [Figure A-61](#) 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).
- 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

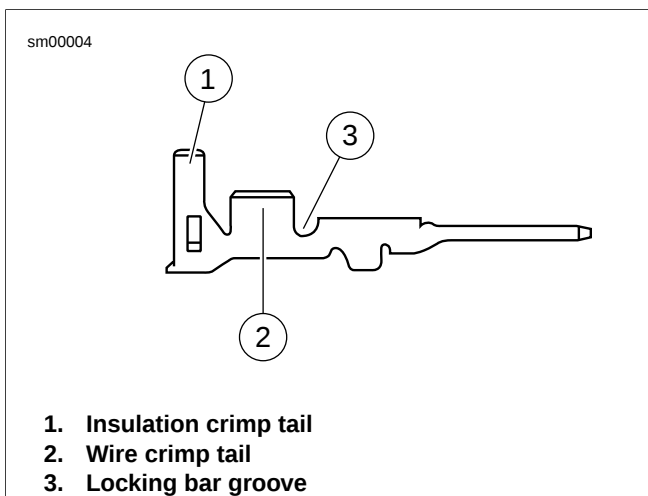


Figure A-61. Tyco 070 Multilock Unsealed Connector: Pin Terminal

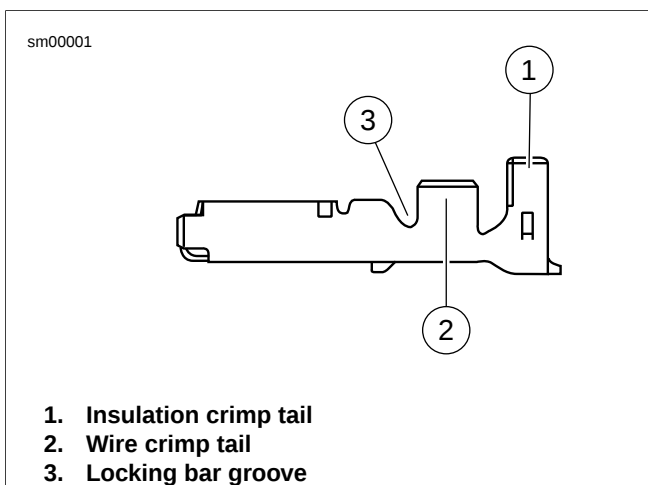


Figure A-62. Tyco 070 Multilock Unsealed Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

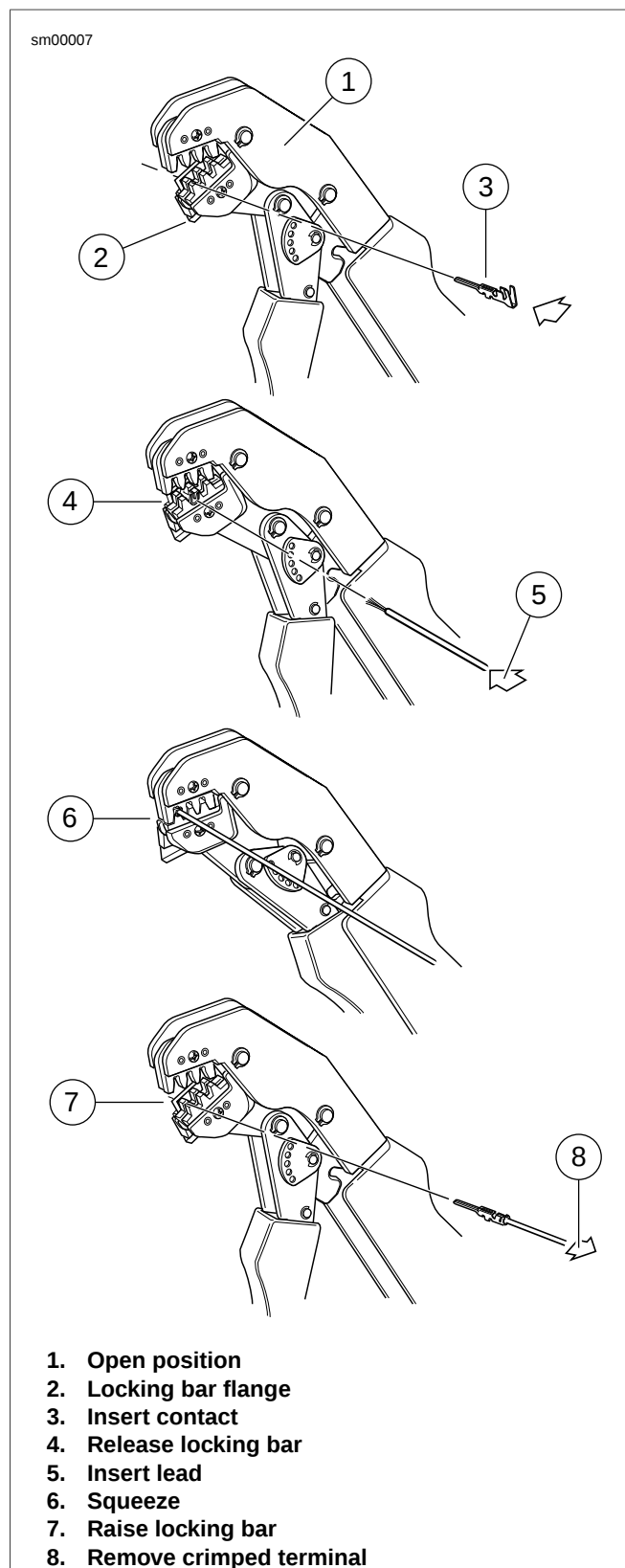
Crimping with the AMP Multi-lock Crimper is a one step operation. One squeeze crimps both the wire core and the insulation tails.

- See [Figure A-63](#). Squeeze the handles to cycle the AMP MULTI-LOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
- Raise locking bar by pushing up on bottom flange (2).

NOTE

See [Figure A-61](#) 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.

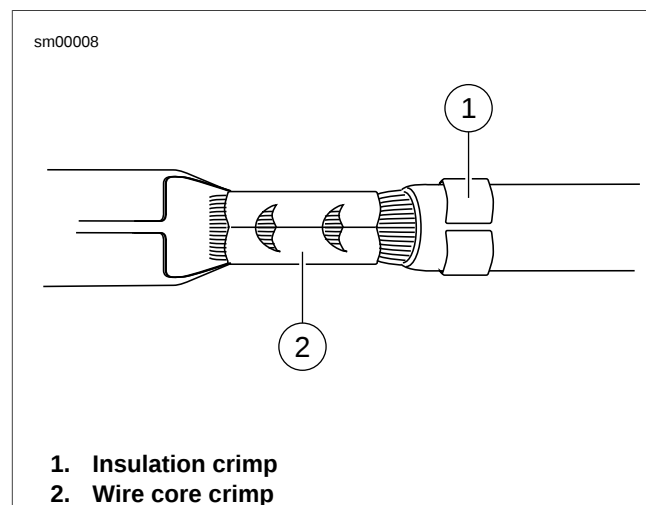
- See [Figure A-63](#). With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
- Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
- Insert stripped end of lead (5) 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.
- Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
- Raise up locking bar (7) to 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.



**Figure A-64. Tyco 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.

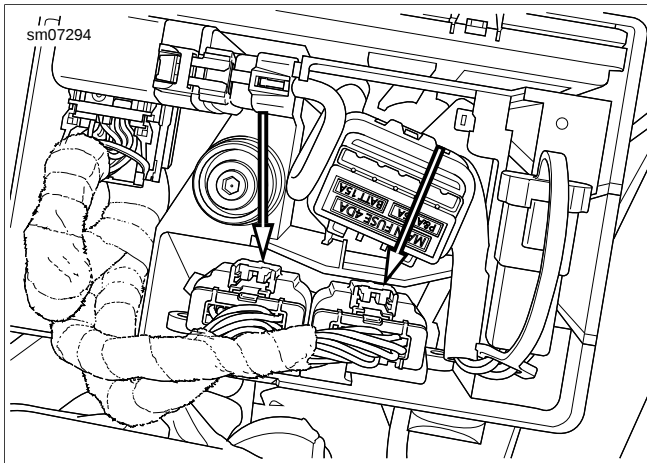


Figure A-65. Tyco GET 64 Sealed Connector Latch

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.

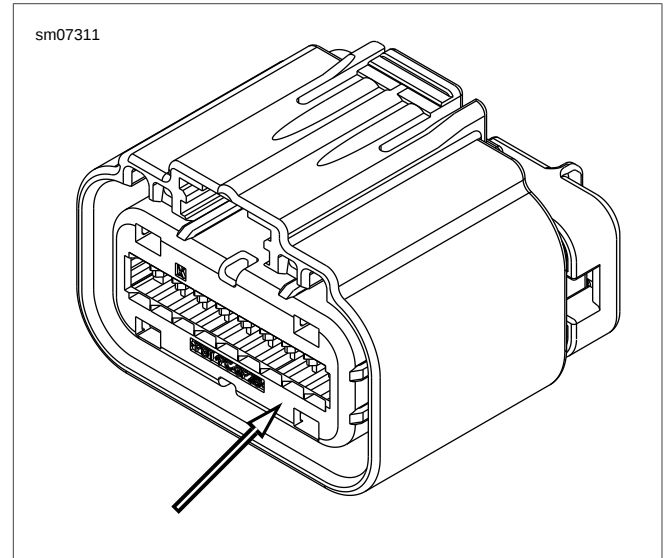


Figure A-66. Tyco GET 64 Secondary Lock

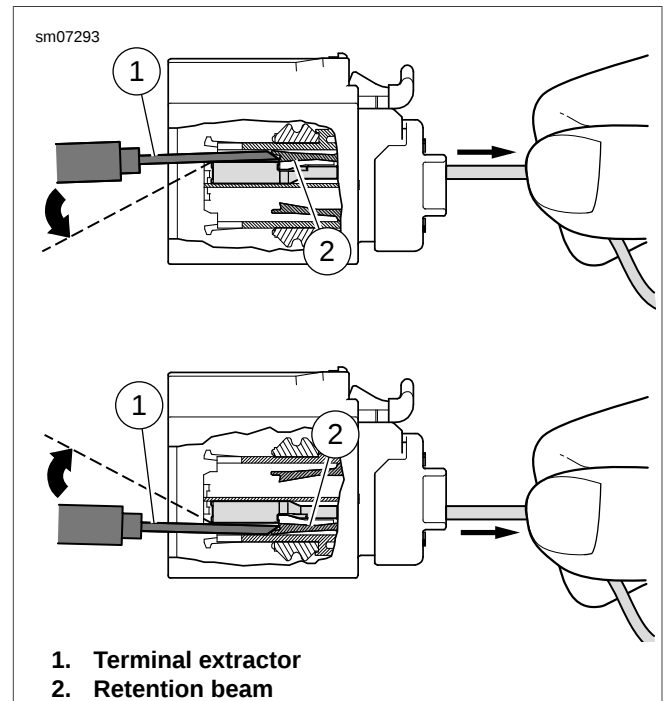


Figure A-67. Removing Terminals: Tyco GET 64 Sealed Connector

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.

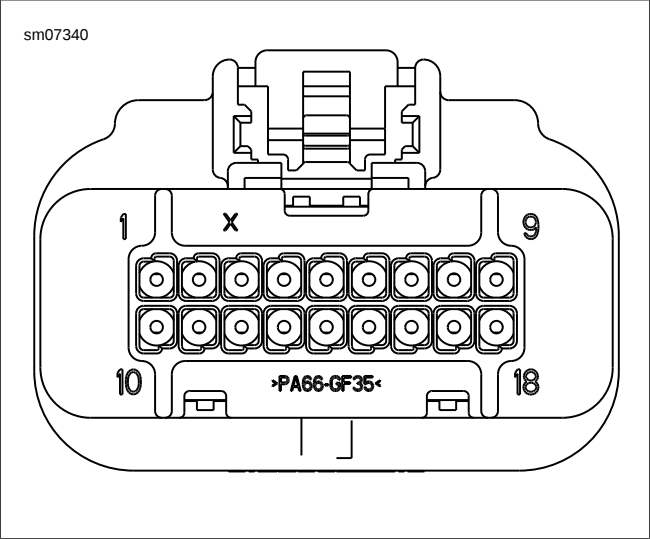


Figure A-68. Cavity Numbers

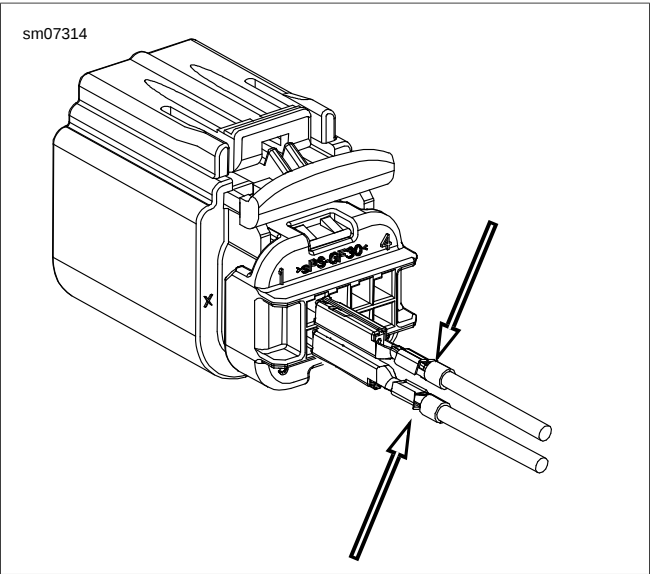


Figure A-69. Socket Terminal Orientation: Crimp Open Side

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

A.22

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.

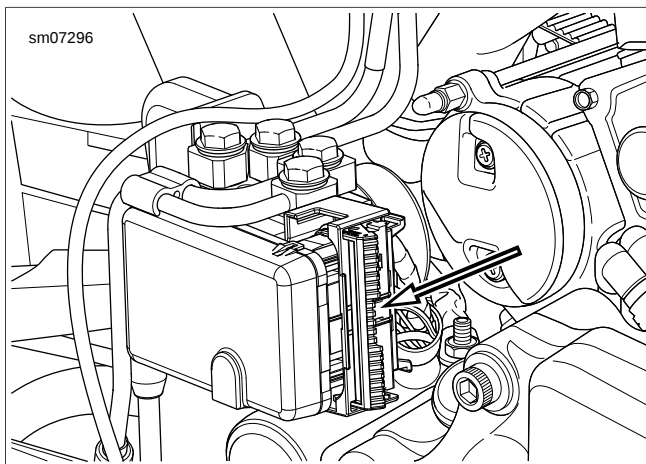


Figure A-70. Tyco MCP Connector Release Bar

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.

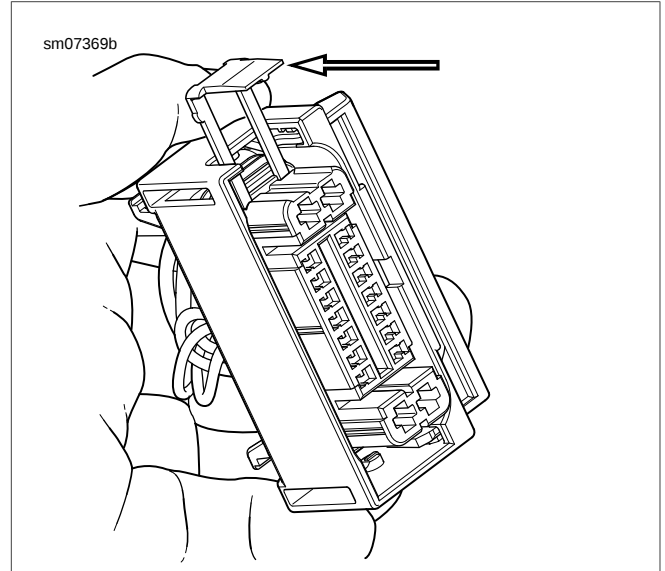


Figure A-71. Tyco MCP Connector Secondary Lock

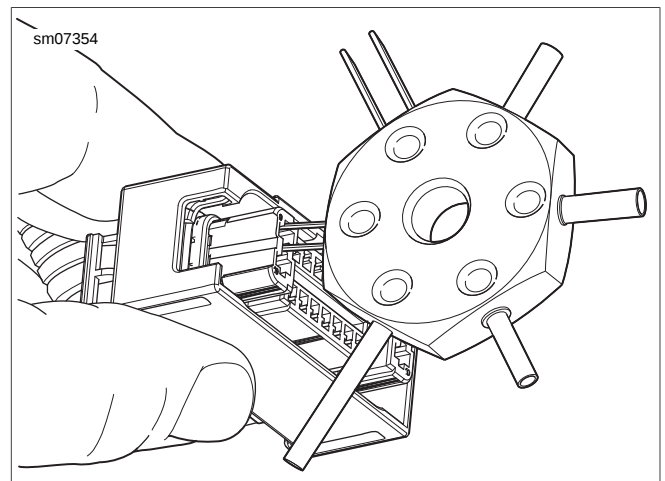


Figure A-72. Removing Large Socket Terminals: Tyco MCP Connector

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.

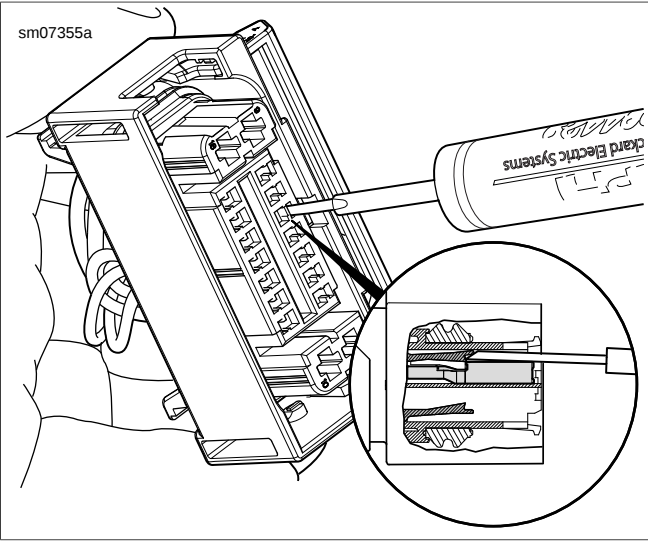


Figure A-73. Removing Small Socket Terminal: Tyco MCP Connector

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.

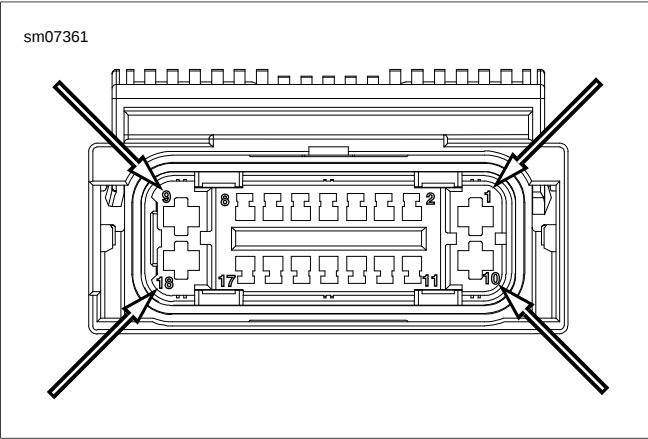


Figure A-74. Tyco MCP Sealed Connector Cavity Numbers

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

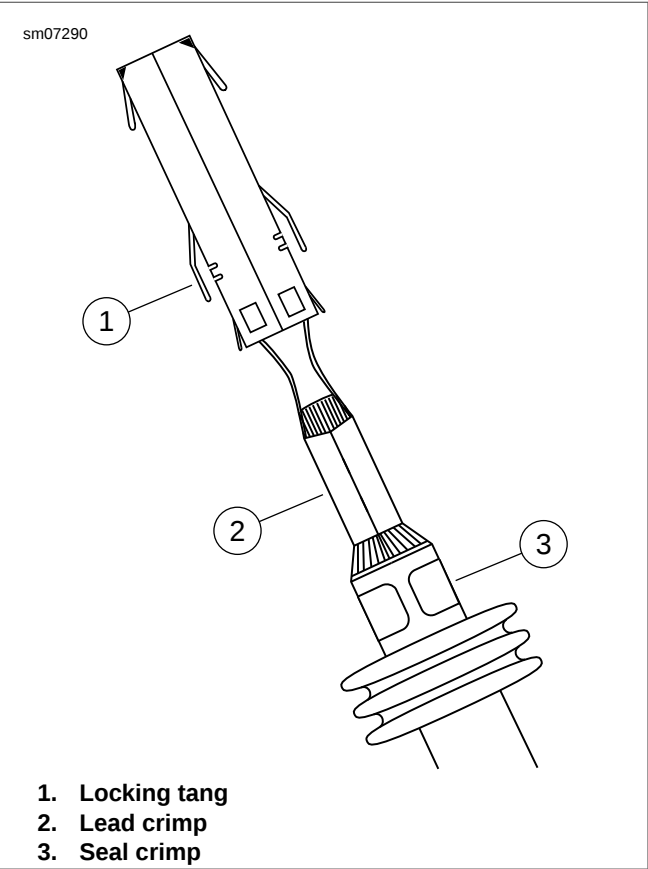


Figure A-75. Tyco MCP Socket Terminal Crimp

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.

- Using a shop gauge, identify the gauge of the wire.
- Match the wire gauge to a sealed splice connector by color and part number. Refer to [Table A-11](#).
- Strip insulation off 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.

- See [Figure A-76](#). Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
- Match the connector color to the wire gauge crimp die in the jaws. Insert one end of the sealed connector.
- Gently squeeze the handles until the connector is held in the jaws.
- See [Figure A-77](#). Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
- Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.

- 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.
- 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.

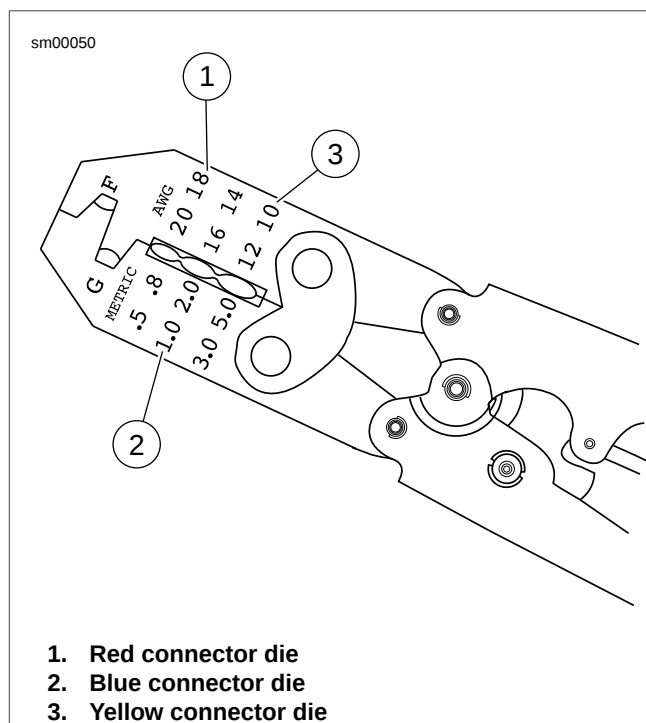


Figure A-76. Packard Crimping Tool (HD-38125-8)

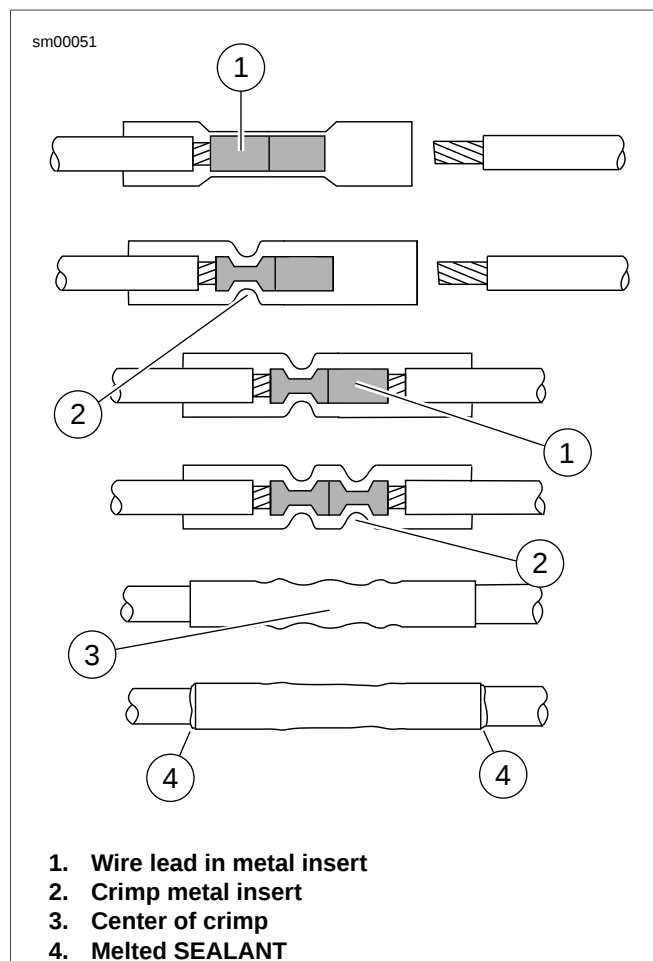


Figure A-77. Sealed Splice Connector

TABLE OF CONTENTS

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B.1 CONNECTORS.....	B-1
B.2 WIRING DIAGRAMS.....	B-5

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. Softail Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[7]	Tail lamp harness to main harness	8-place Tyco 070 Multilock Unsealed (BK) (except FXS/B)	Gray	Under seat
[13]	Fuel tank harness	4-place Tyco 070 Multilock Unsealed (BK) (FXS/B)	Gray	Behind fuel tank (under seat)
[18]	Right rear stop, tail, and turn assembly	2-place Tyco 070 Multilock Unsealed (except FLSTN, FXS/B, FLS) (BK) 2-place Deutsch DTM Sealed (FLSTN) 4-place Deutsch DTM Sealed (FXS/B, FLS) (GY)	Gray/Brown	Inside tail lamp lens (except FXS/B, FLS) Under seat (FXS/B and FLS)
[19]	Left rear stop, tail, and turn assembly	2-place Tyco 070 Multilock Unsealed (except FLSTN, FXS/B, FLS) (BK) 2-place Deutsch DTM Sealed (FLSTN) 4-place Deutsch DTM Sealed (FXS/B, FLS) (BK)	Gray/Brown	Inside tail lamp lens (except FXS/B, FLS) Under seat (FXS/B and FLS)
[20]	Console harness	6-place Molex MX 150 Sealed (BK)	Gray	Under console
[21]	Indicator lamps	6-place Molex MX 150 Sealed (BK)	Gray	Under console
[22-1]	Right hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Under fuel tank, right side
[22-2]	Right hand controls	2-place JAE MX19 Sealed (BK)	Yellow	Under fuel tank, right side
[24]	Left hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Under fuel tank, left side
[31]	Front turn signals	6-place Tyco 070 Multilock Unsealed (BK)	Gray	Under fuel tank, right side
[32]	Front fender tip lamp	2-place Tyco 070 Multilock Unsealed (BK)	Gray	Under fuel tank, left side
[33]	Ignition switch	2-place Delphi GT 150 Sealed (GY)	Gray	Under fuel tank console (except FXS/B) Behind ignition coil (FXS/B)
[38]	Headlamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Under fuel tank, left side
[39]	Speedometer	12-place Delphi Micro 64 Sealed (GY)	Breakout Box	Back of speedometer
[40]	LP, stop, and tail lamp	6-place Deutsch DTM Sealed (except FXS/B, FLS) (BK) 3-place Deutsch DTM Sealed (FXS/B, FLS) (BK)	Brown	Inside tail lamp lens (except FXS/B, FLS) Under seat (FXS/B and FLS)

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[45]	Rear fender tip lamp	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens
[47]	Voltage regulator to stator	3-place Dekko (BK)		Back of voltage regulator
[64]	Fuse block	Delphi 280 Metripack Sealed Delphi 800 Metripack Sealed (main fuse)	Gray/Red	Under seat
[65]	VSS	3-place Delphi GT 150 Sealed (BK)	Gray	Top of transmission case
[73]	Auxiliary lamps	2-place Tyco 070 Multilock Unsealed (BK)	Gray	Behind front fork panel
[77]	Voltage regulator	2-place Dekko (BK)		Back of voltage regulator
[78-1]	ECM	18-place Tyco (BK)	Breakout Box	Under seat in front of rear fender (except FXSB) Electrical panel behind fender extension (FXSB)
[78-2]	ECM	18-place Tyco (GY)	Breakout Box	Under seat in front of rear fender (except FXSB) Electrical panel behind fender extension (FXSB)
[79]	CKP sensor	2-place Deutsch DTM Sealed (BK)	Brown	Back of voltage regulator bracket
[80]	MAP sensor	3-place Delphi 150 Metripack Sealed (GY)	Gray	Top of induction module
[83]	Ignition coil	4-place Delphi GT 150 Sealed (BK)	Gray	Back of coil
[84]	Front fuel injector	2-place Delphi GT 150 Sealed (GY)	Gray	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi GT 150 Sealed (GY)	Gray	Beneath fuel tank
[87]	IAC	4-place Delphi GT 150 Sealed (BK)	Gray	Beneath fuel tank
[88]	TP sensor	3-place Delphi GT 150 Sealed (BK)	Gray	Behind air cleaner backing plate
[89]	IAT sensor	2-place Delphi GT 150 Sealed (GY)	Gray	Behind air cleaner backing plate
[90]	ET sensor	2-place Delphi GT 150 Sealed (BK)	Gray	Back of front cylinder, left side
[91]	DLC	6-place Deutsch DT Sealed (GY)	Black	Under seat
[93]	Tail lamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens
[94]	Rear fender lights harness in circuit board	6-place Tyco 070 Multilock Unsealed (BK)	Gray	Circuit board under tail lamp assembly
[95]	Purge solenoid	2-place Delphi 150 Metripack Sealed (BK)	Purple	Electrical panel behind fender extension
[109]	Auxiliary lamp switch	Tyco Insulated Spade terminal	Gray	Fork back panel
[117]	Fuel gauge	4-place Tyco 040 Unsealed (BK)	Gray	Left front side of fuel tank

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[120]	Oil pressure switch	Right Angle Push On Molded (BK)		Front right crankcase
[121]	Rear stop lamp switch	Tyco Insulated Spade terminal (BK)	Red	Right side of transmission
[122]	Horn	Flag terminals (BK)	Red	Between cylinders, left side (except FXS/B) Front of frame above voltage regulator (FXS/B)
[128]	Starter solenoid	Tyco Insulated Spade terminal (W)	Red	Top of starter
[131]	Neutral switch	Right Angle Push On Molded (BK)		Top of transmission
[133]	JSS	3-place Molex MX 150 Sealed (BK)	Gray	Back of voltage regulator bracket
[137]	HO2 sensor (rear)	4-place Molex MX 150 Sealed (BK)	Gray	Under seat in front of battery
[138]	HO2 sensor (front)	4-place Molex MX 150 Sealed (BK)	Gray	Behind voltage regulator
[141]	Fuel pump and sender	4-place Delphi GT 150 Sealed (BK)	Gray	Top of fuel tank
[142]	Security siren (optional)	3-place Delphi GT 150 Sealed (BK)	Gray	Electrical panel behind fender extension
[143]	Front fender tip lamp	2-place Tyco 070 Multilock Unsealed (BK)	Gray	In front fender tip lamp
[166]	ABS ECU	20-place Molex MX 150 Sealed (BK)	Breakout Box	Electrical panel behind fender extension
[167]	Front WSS	2-place Delphi 150 Metripack Sealed (BK)	Gray	Under fuel tank, left side
[168]	Rear WSS	2-place Delphi 150 Metripack Sealed (BK)	Gray	Electrical panel behind fender extension
[178]	Active intake solenoid	2-place Tyco Superseal 1.5 Sealed (BK)	Gray	Air cleaner backing plate
[179]	Active exhaust	5-place Tyco Superseal 1.5 Sealed (BK)	Gray	Exhaust bracket
[200]	Resistor assembly	3-place Molex MX 150 Sealed (GY)	Gray	Under seat
[203F]	ACR (front)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[203R]	ACR (rear)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[209]	Security antenna	2-place Molex MX 64 Unsealed (BK)	Light Blue	Under seat
[242]	BCM	48-place Molex CMC Sealed (BK)	Breakout Box	Electrical panel behind fender extension
[254]	Front HCU	4-place Delphi GT 150 Sealed (BK)	Gray	Front of frame above voltage regulator
[255]	Rear HCU	4-place Delphi GT 150 Sealed (BK)	Gray	Below electrical panel behind fender extension

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[259]	BCM battery power	1-place Delphi 800 Metripack Sealed (BK)		Electrical panel behind fender extension
[266]	Anti-theft Tracking Module	4-place Delphi GT 150 Sealed (BK)	Gray	Electrical panel behind fender extension
[GND1] [GND2] [GND2A]	Left side ground stud Right side ground stud (Regulator) Right side ground stud	Ring terminals		Under seat

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.

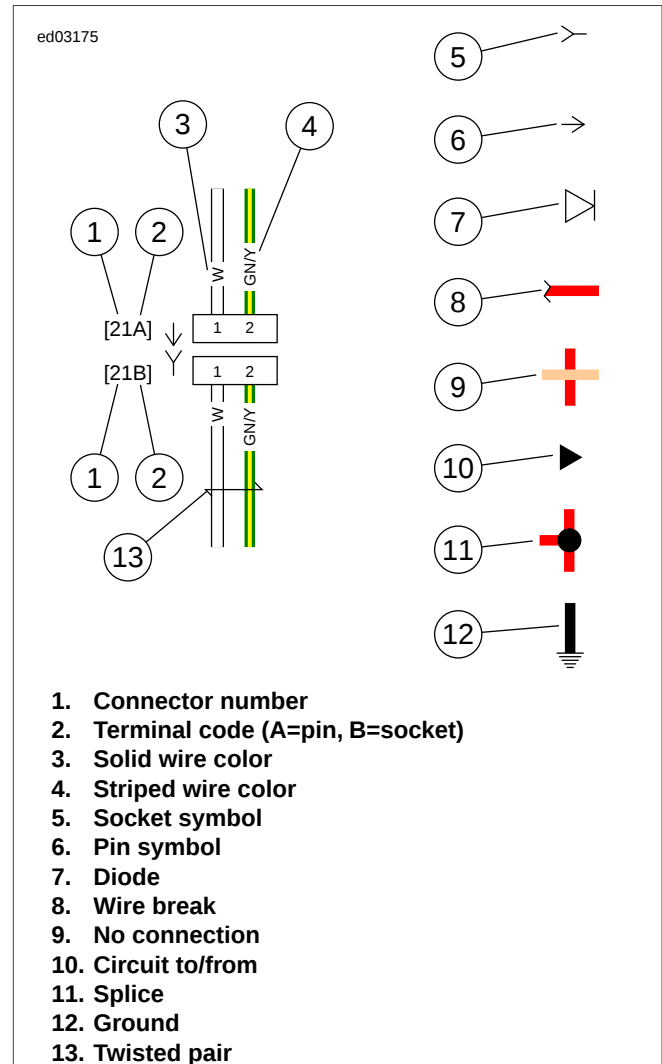


Figure B-1. Connector/Wiring Diagram Symbols

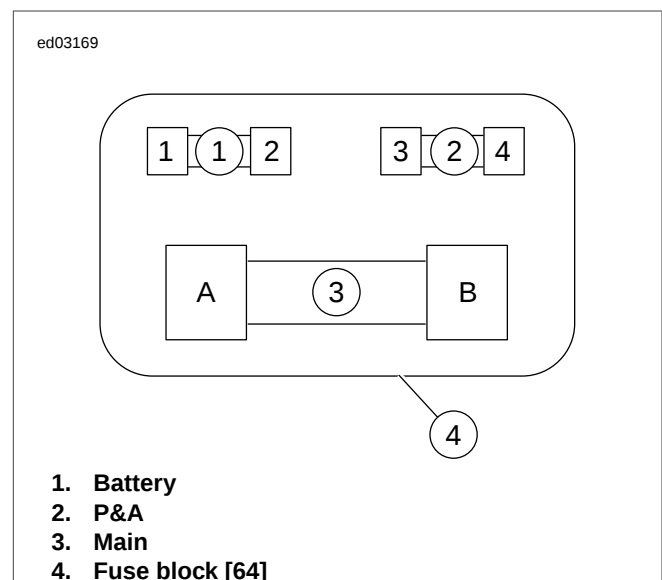


Figure B-2. Fuse Block and Socket Terminals

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

2013 SOFTAIL WIRING DIAGRAMS

Refer to the table below for wiring diagram information.

Wiring Diagram List

DIAGRAM	LOCATION
Battery Power Distribution	Figure B-3
Ignition and Accessory Power Distribution: Except FXS/B and FLS	Figure B-4
Ignition and Accessory Power Distribution: FXS/B	Figure B-5
Ignition and Accessory Power Distribution: FLS	Figure B-6
Sensor Grounds	Figure B-7
Ground Circuit: Except FXS/B and FLS	Figure B-8
Ground Circuit: FXS/B and FLS	Figure B-9
Front Lighting and Hand Controls: 2013 Softail	Figure B-10
Main Harness 1 of 2: 2013 Softail (Except FXS/B and FLS)	Figure B-11
Main Harness 2 of 2: 2013 Softail (Except FXS/B and FLS)	Figure B-12
Main Harness 1 of 3: 2013 Softail (FXS/B)	Figure B-13
Main Harness 2 of 3: 2013 Softail (FLS)	Figure B-14
Main Harness 3 of 3: 2013 Softail (FXS/B and FLS)	Figure B-15
Rear Lighting: 2013 Softail	Figure B-16

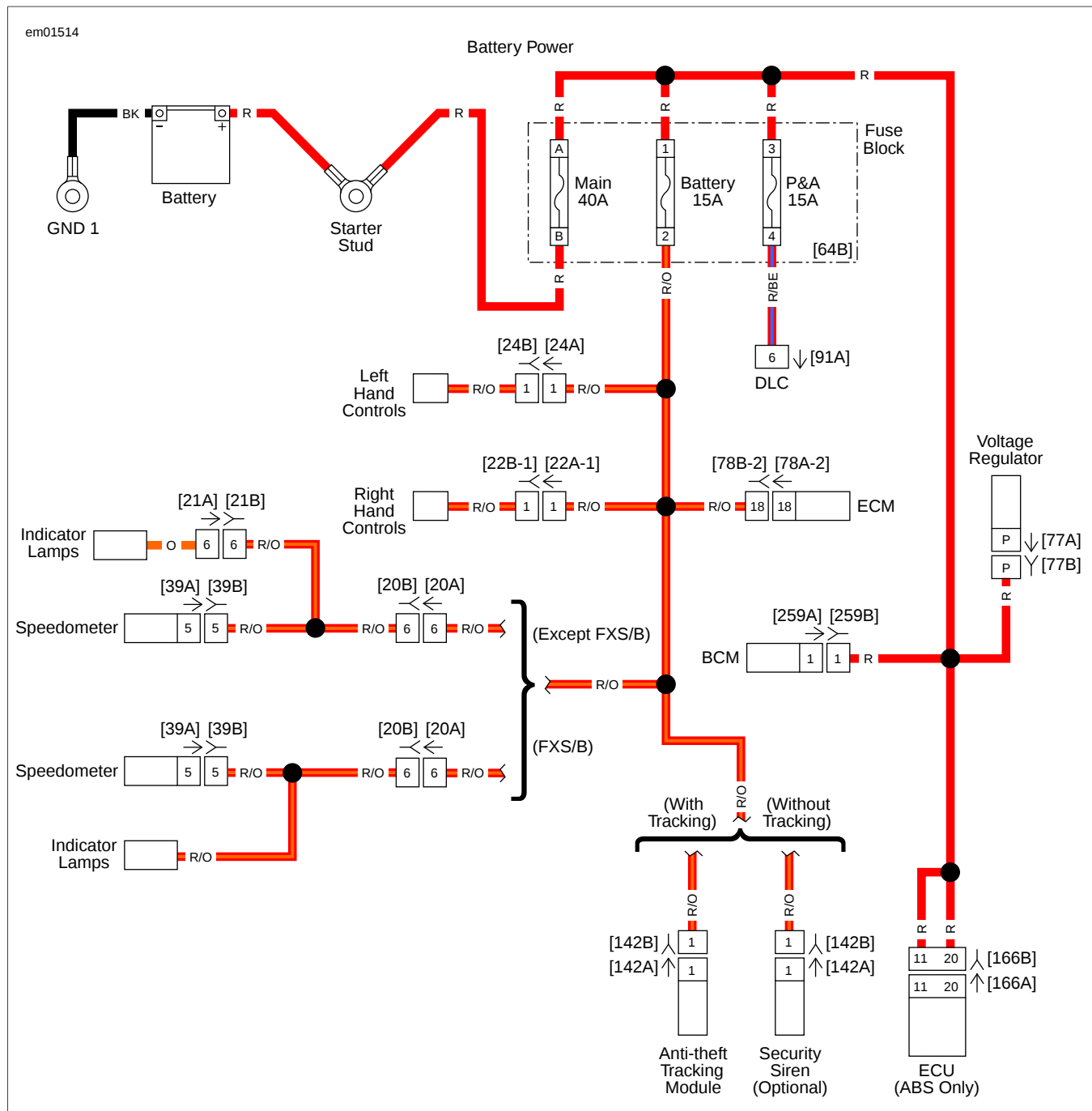


Figure B-3. Battery Power Distribution

2013 Softail Diagnostics: Appendix B Wiring B-9

em01431

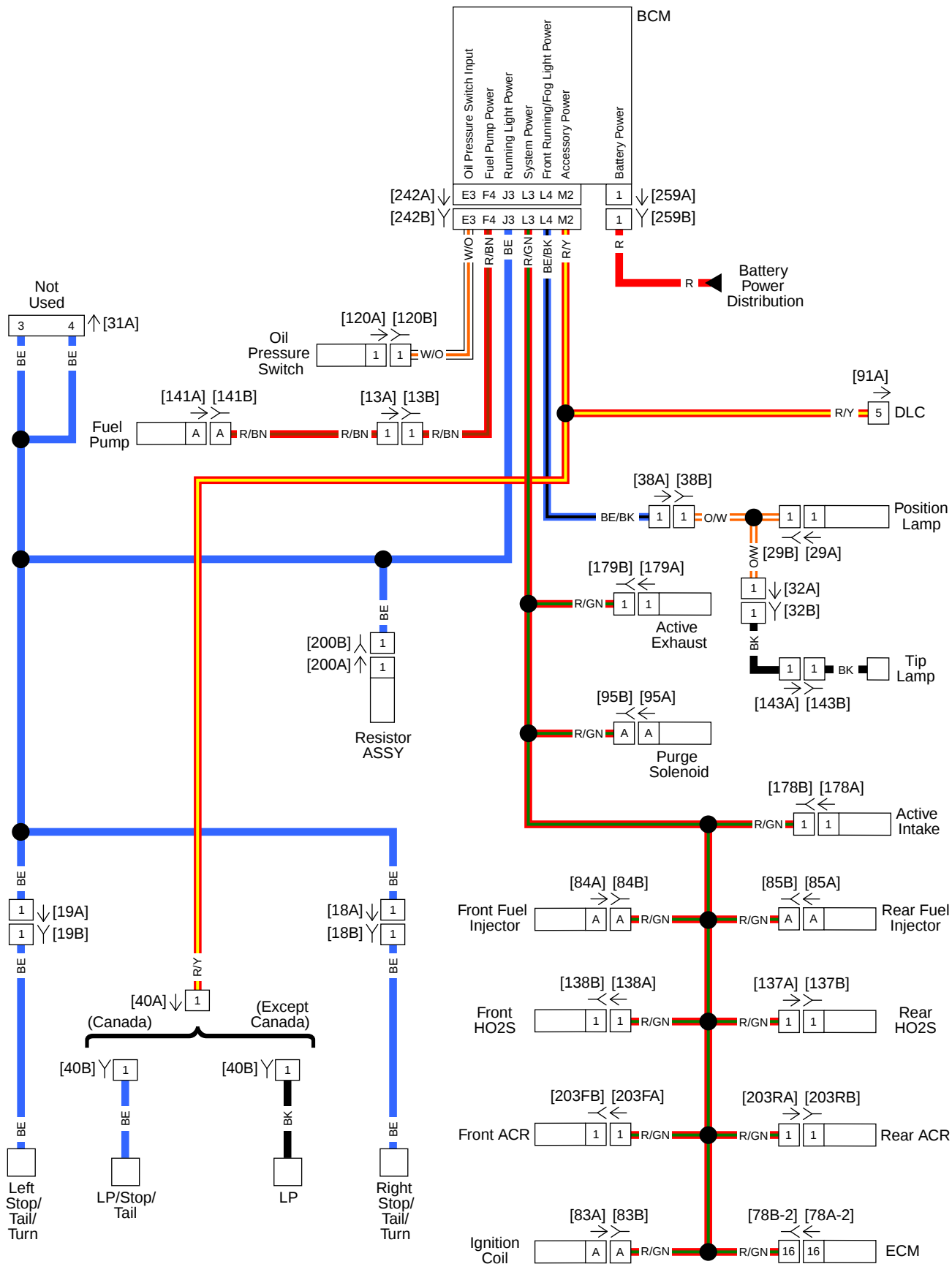


Figure B-5. Ignition and Accessory Power Distribution: FXS/B

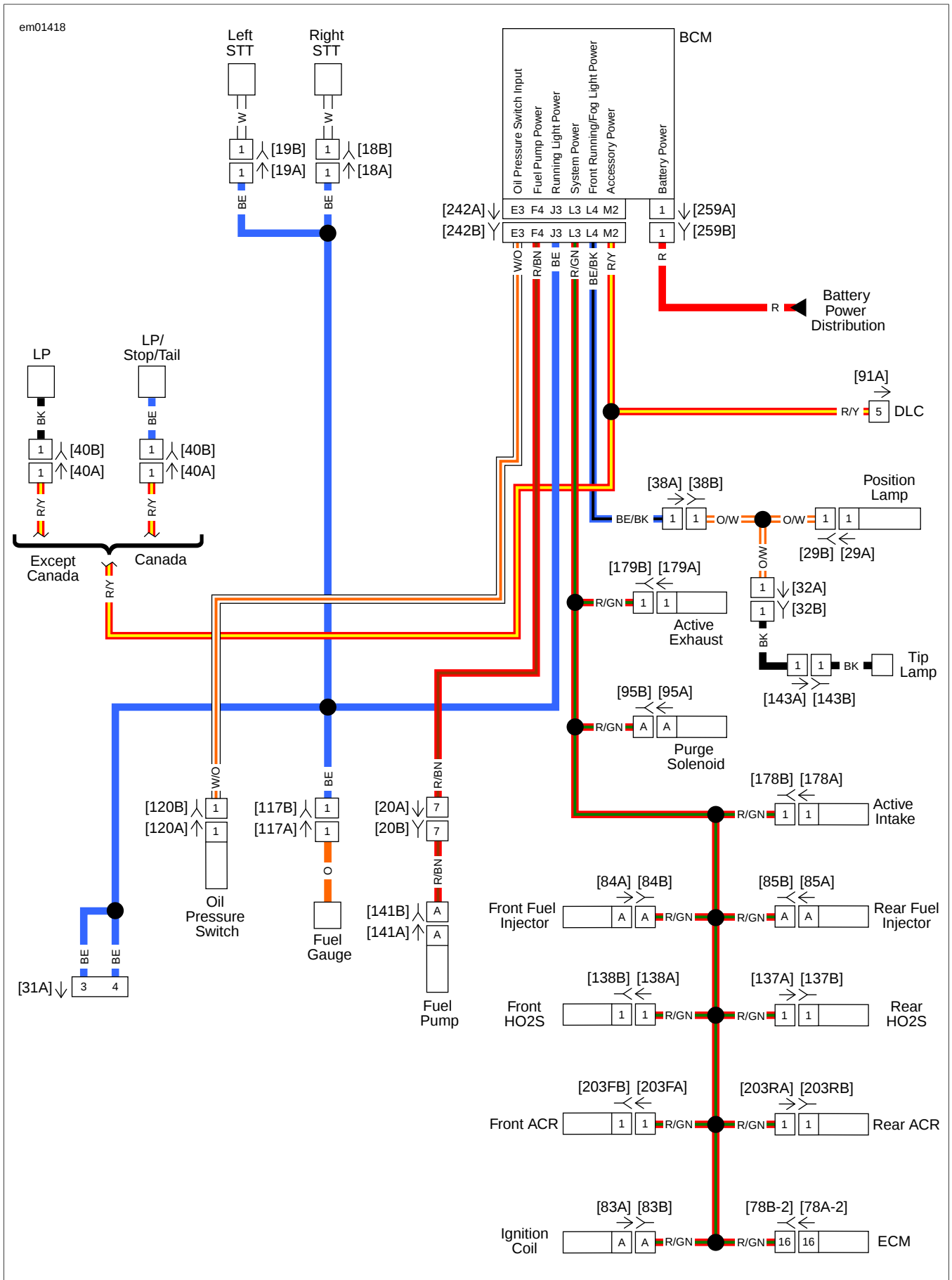


Figure B-6. Ignition and Accessory Power Distribution: FLS

em01515

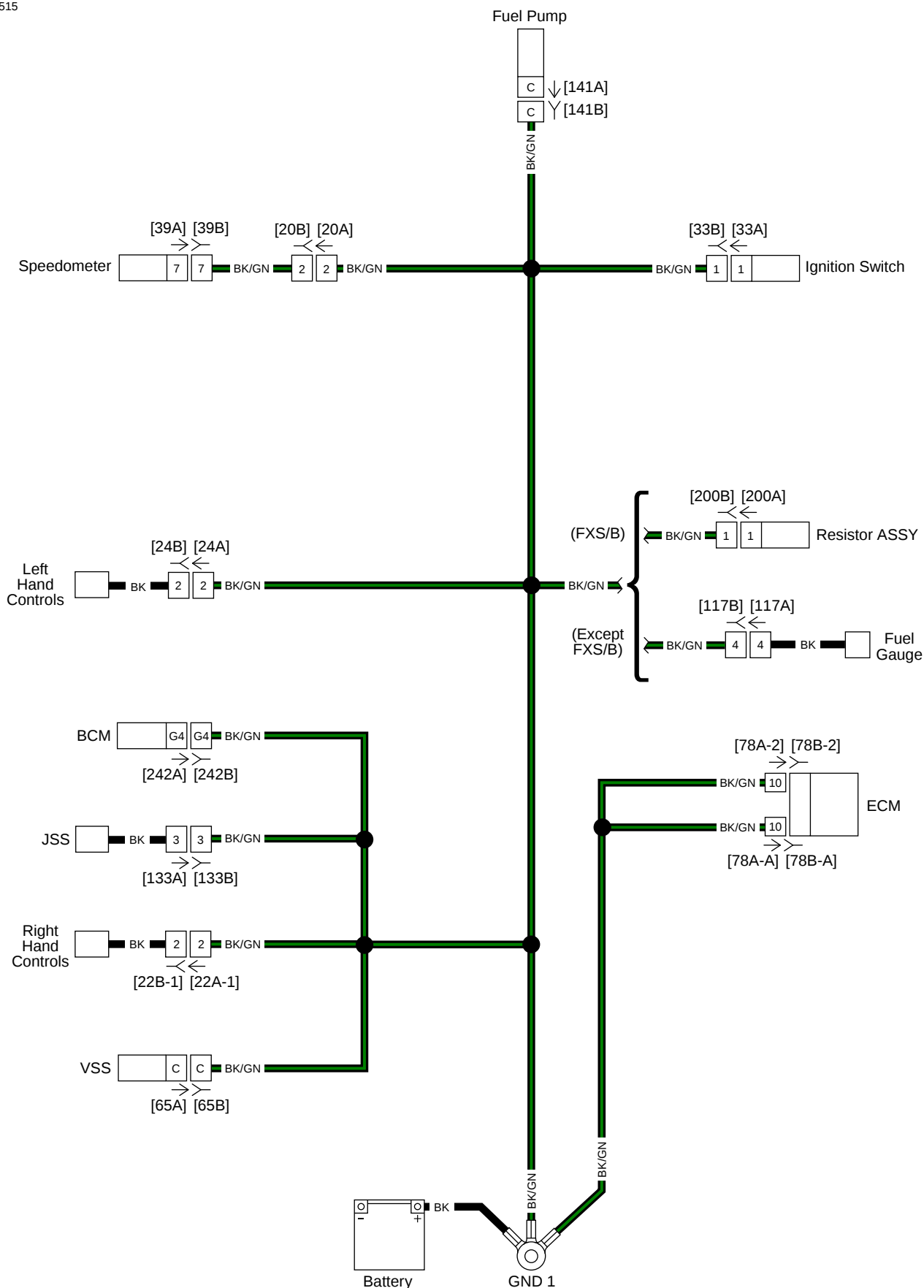


Figure B-7. Sensor Grounds

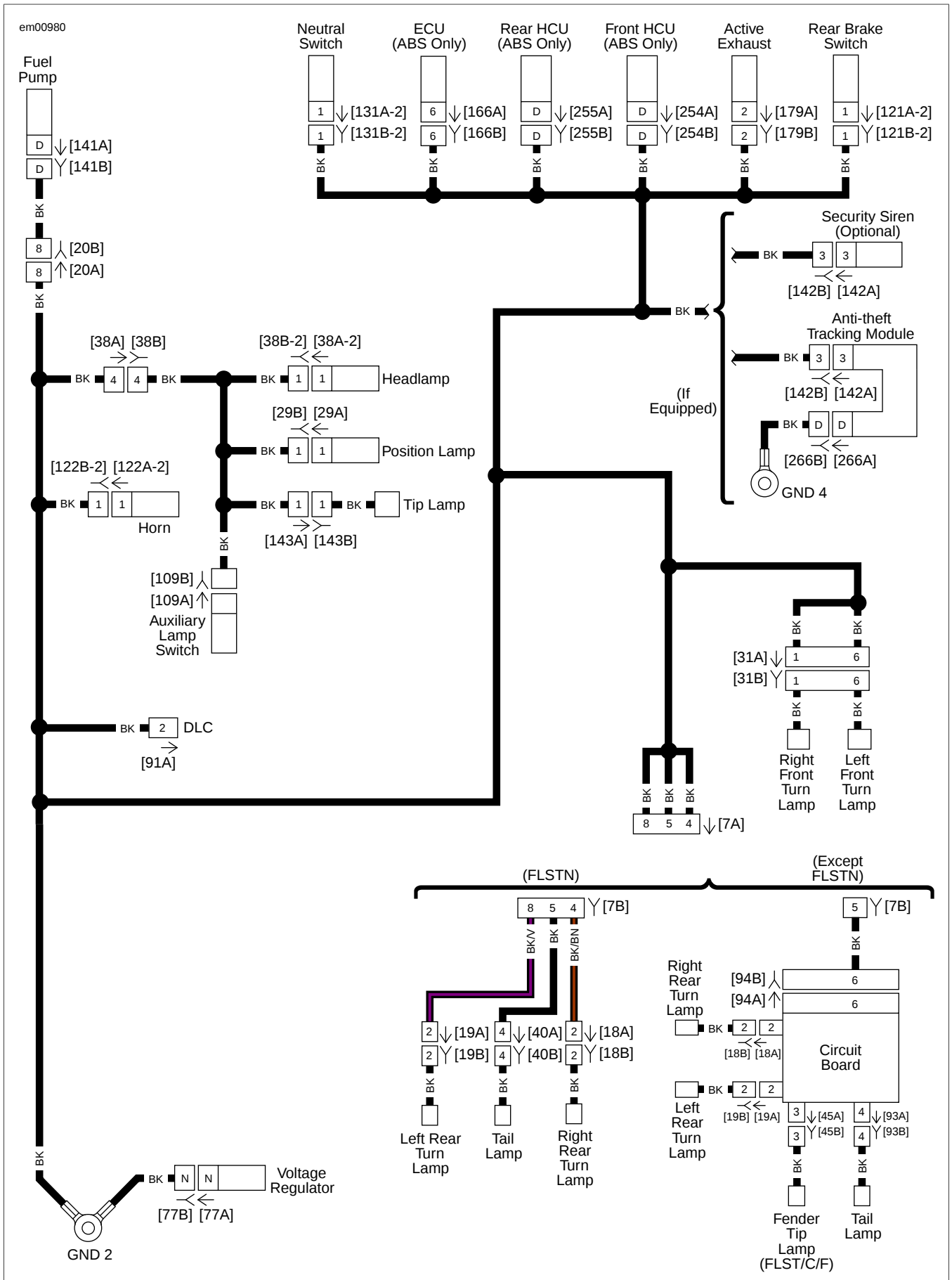


Figure B-8. Ground Circuit: Except FXS/B and FLS

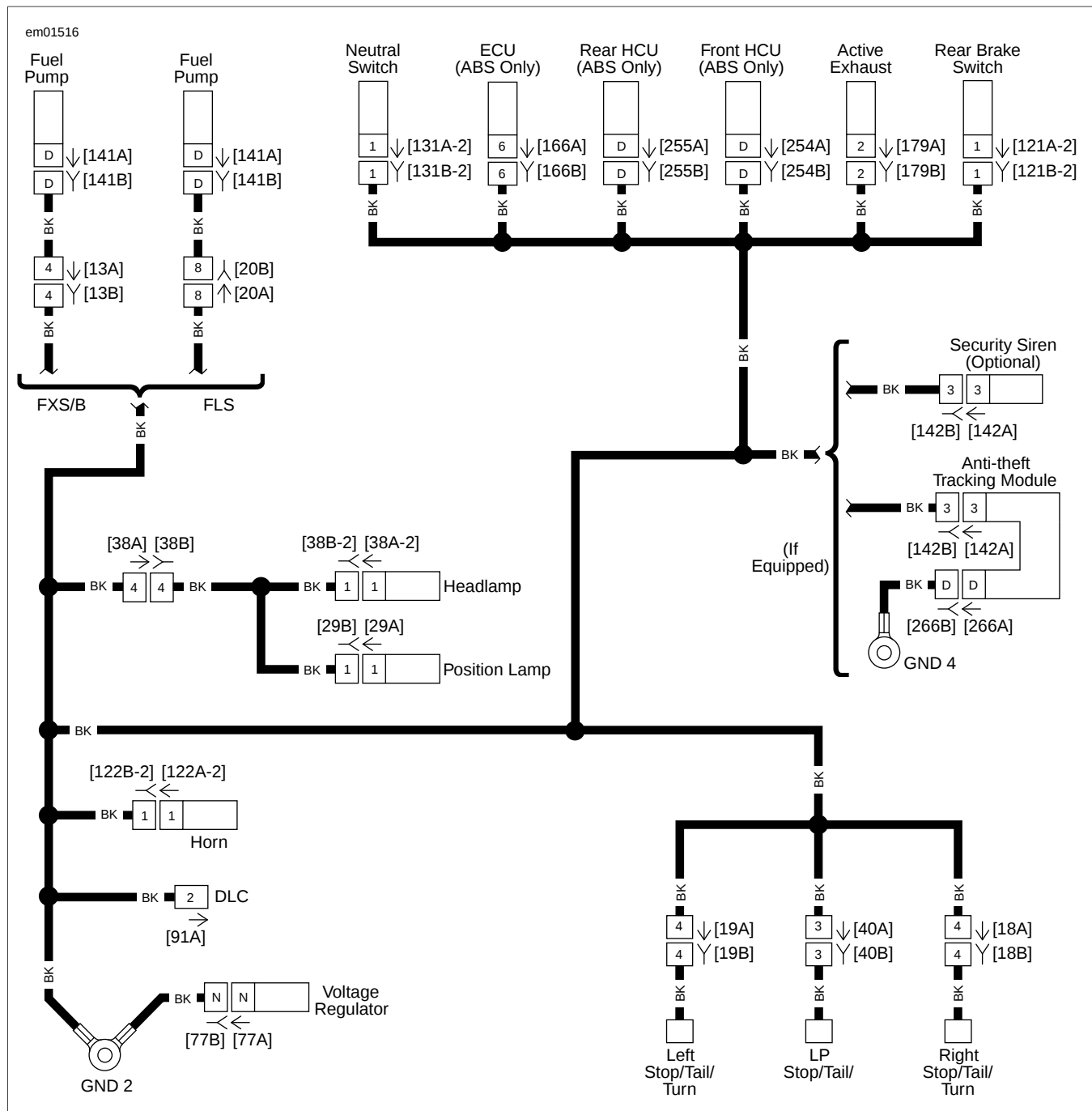


Figure B-9. Ground Circuit: FXS/B and FLS

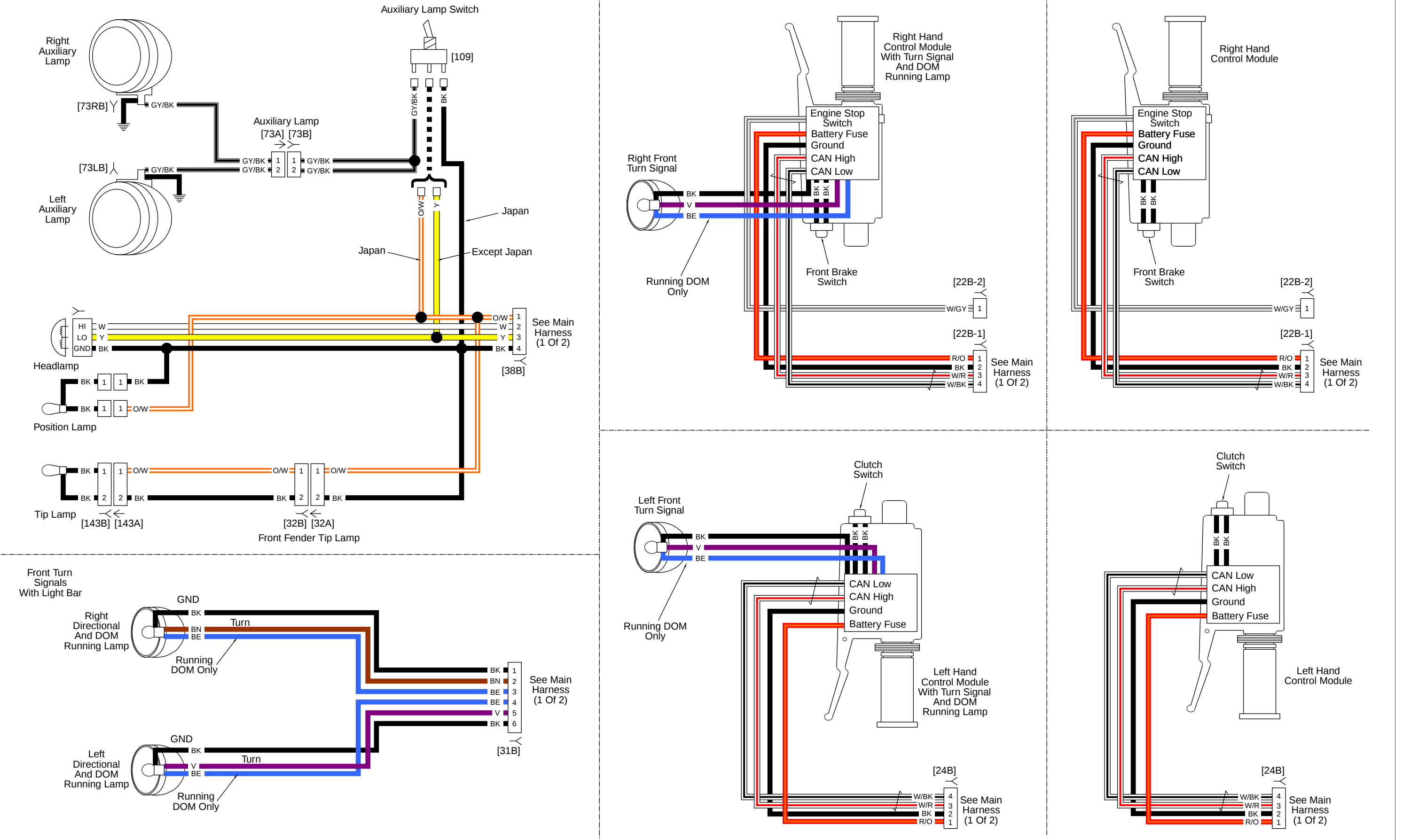


Figure B-10. Front Lighting and Hand Controls: 2013 Softail

Figure B-10.
Front Lighting and Hand Controls: 2013 Softail

Figure B-10.
Front Lighting and Hand Controls: 2013 Softail

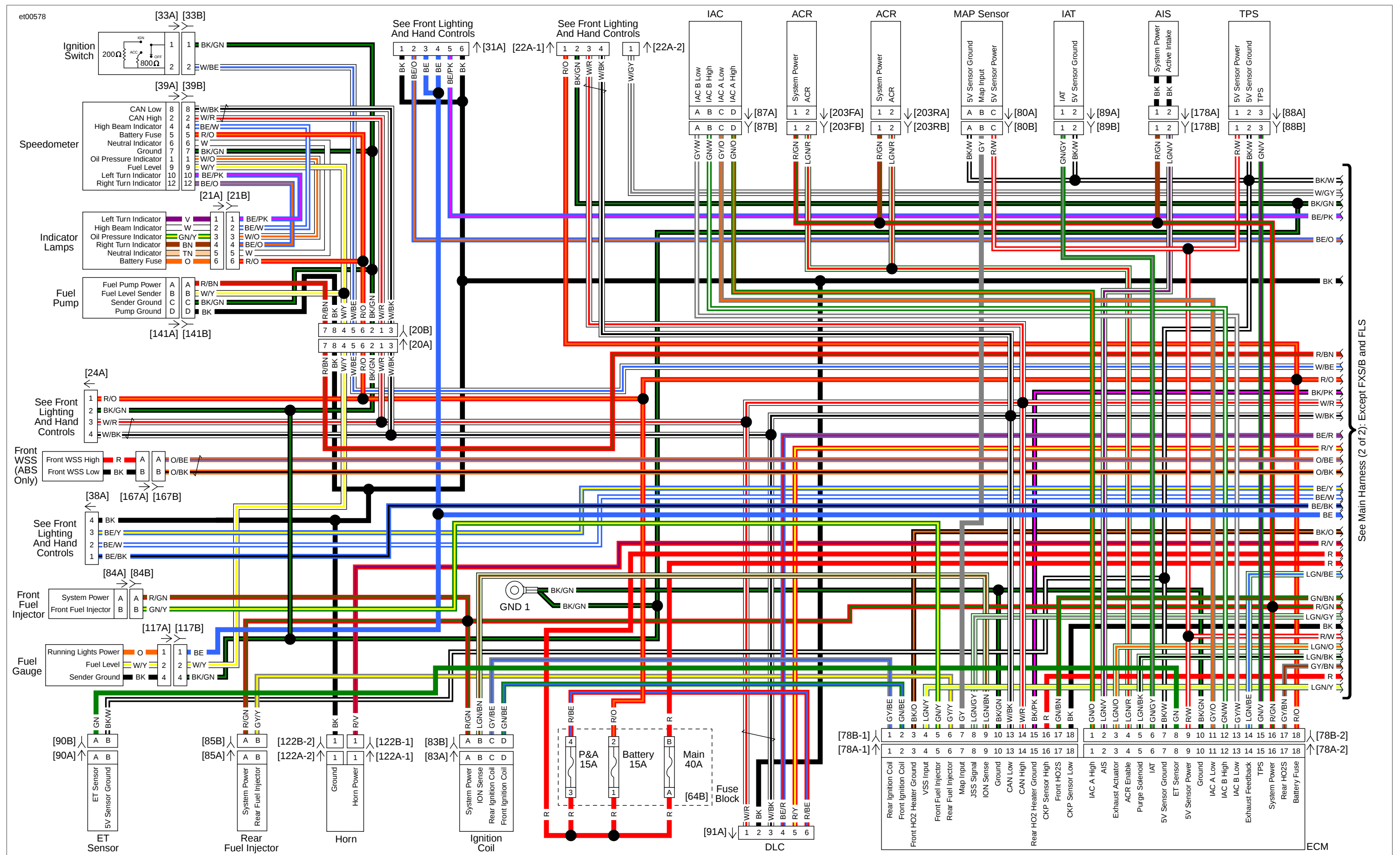


Figure B-11.

Main Harness 1 of 2: 2013 Softail (Except FXS/B and FLS)

Figure B-11.

Main Harness 1 of 2: 2013 Softail (Except FXS/B and FLS)

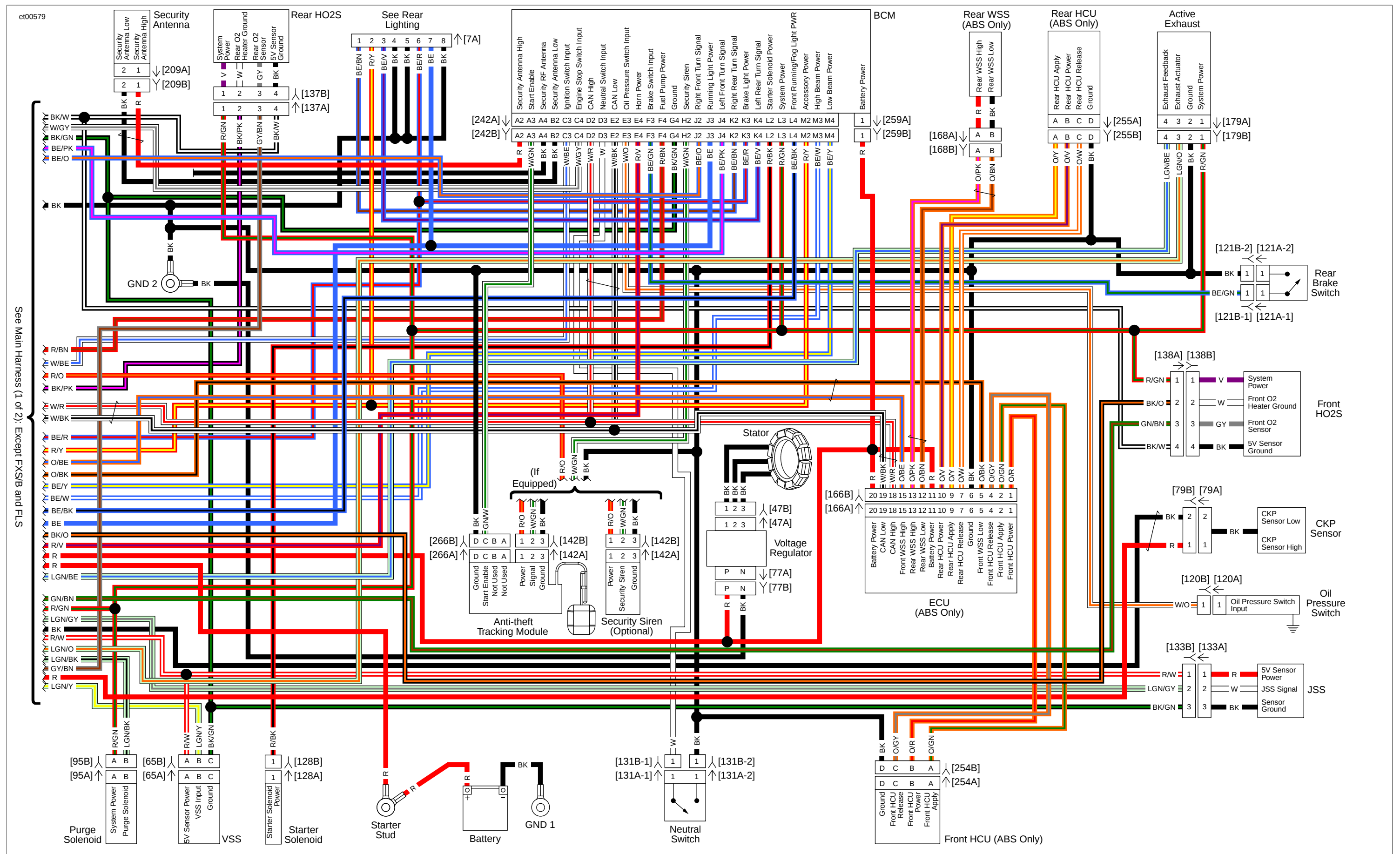


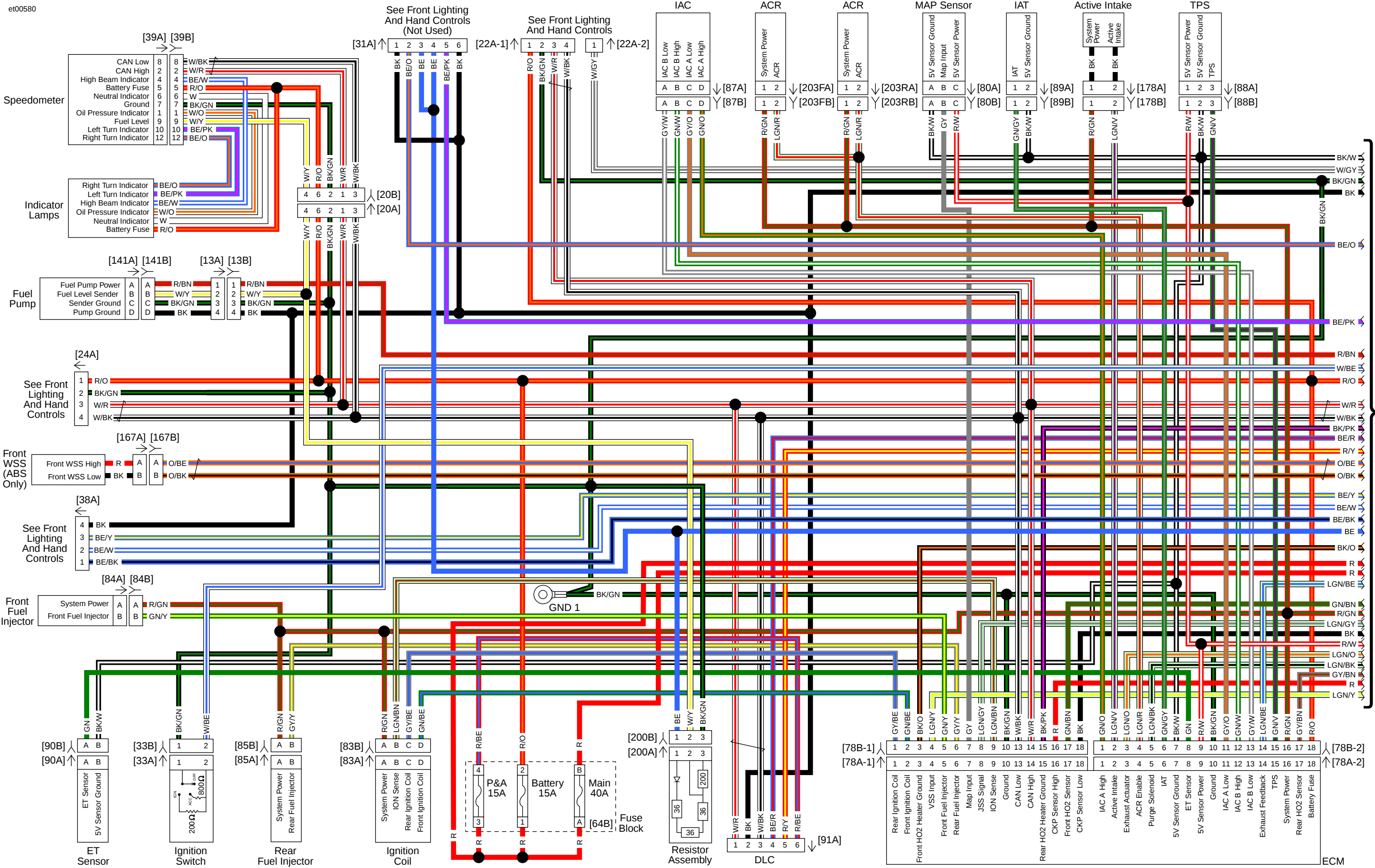
Figure B-12. Main Harness 2 of 2: 2013 Softail (Except FXS/B and FLS)

Figure B-12.

Main Harness 2 of 2: 2013 Softail (Except FXS/B and FLS)

Figure B-12.

Main Harness 2 of 2: 2013 Softail (Except FXS/B and FLS)



See Main Harness (3 of 3): FXS/B and FLS

Figure B-13. Main Harness 1 of 3: 2013 Softail (FXS/B)

Figure B-13.
Main Harness 1 of 3: 2013 Softail (FXS/B)

Figure B-13.
Main Harness 1 of 3: 2013 Softail (FXS/B)

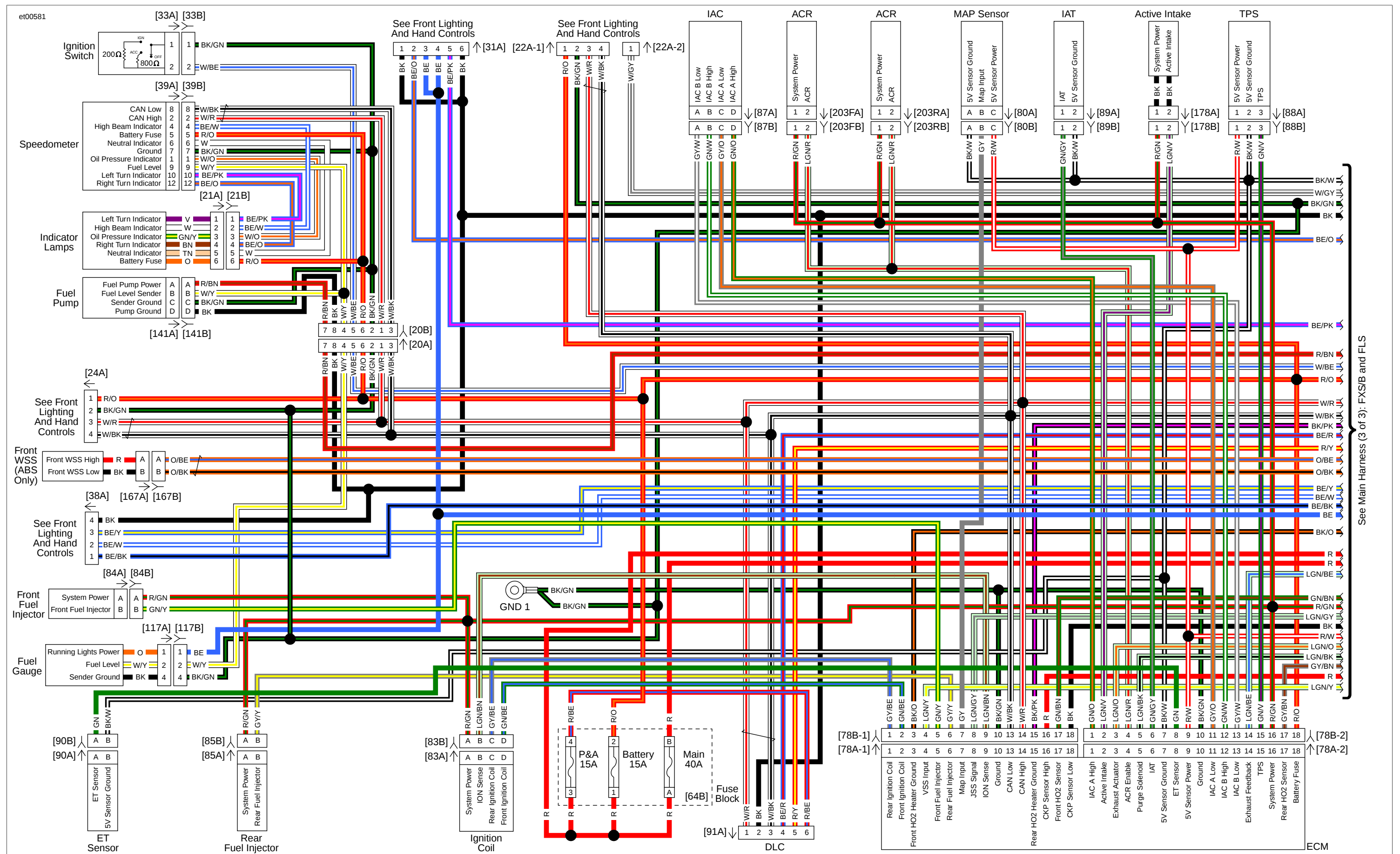


Figure B-14. Main Harness 2 of 3: 2013 Softail (FLS)

Figure B-14.
Main Harness 2 of 3: 2013 Softail (FLS)

Figure B-14.
Main Harness 2 of 3: 2013 Softail (FLS)

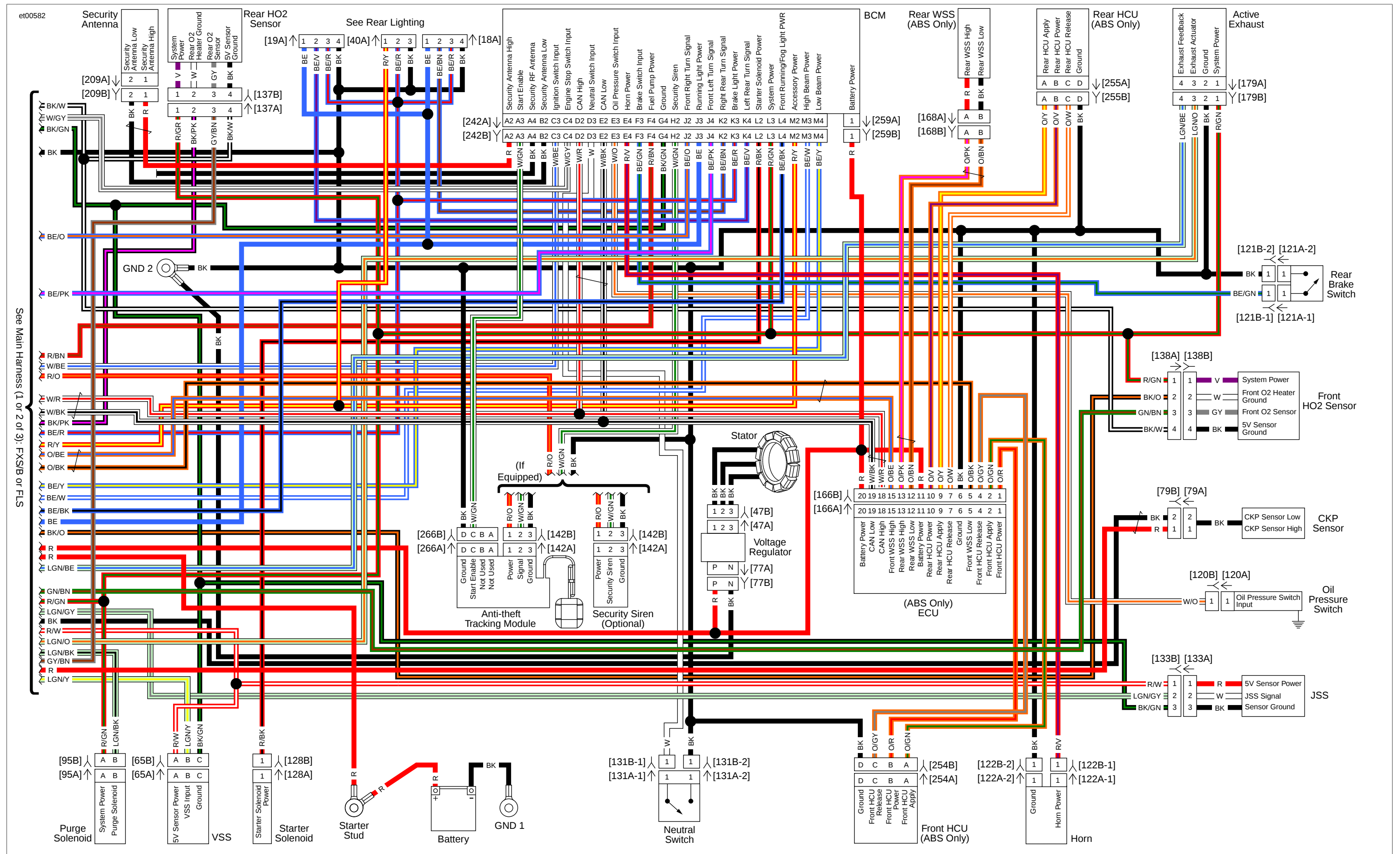


Figure B-15. Main Harness 3 of 3: 2013 Softail (FXS/B and FLS)

Figure B-15.

Main Harness 3 of 3: 2013 Softail (FXS/B and FLS)

Figure B-15.

Main Harness 3 of 3: 2013 Softail (FXS/B and FLS)

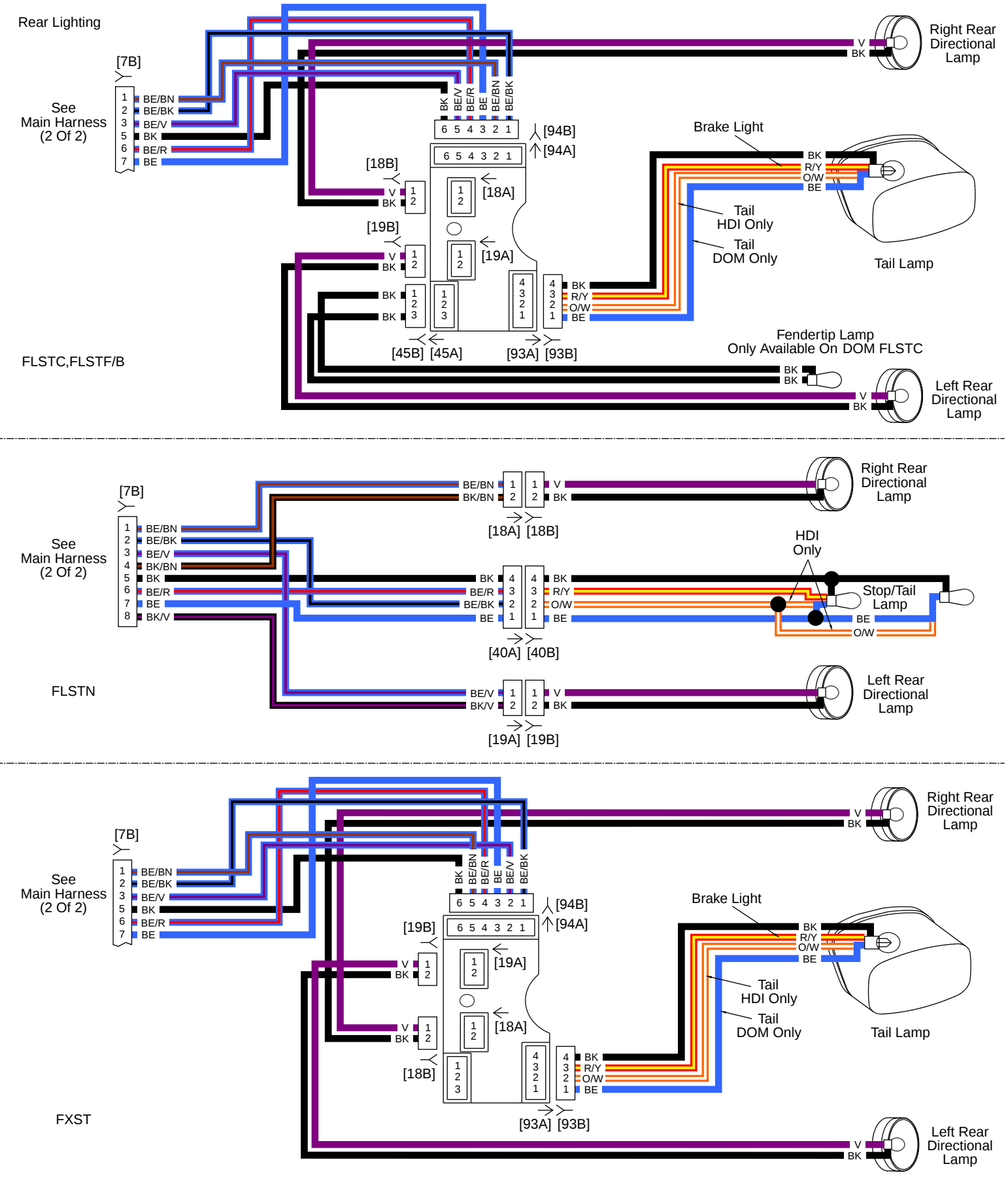
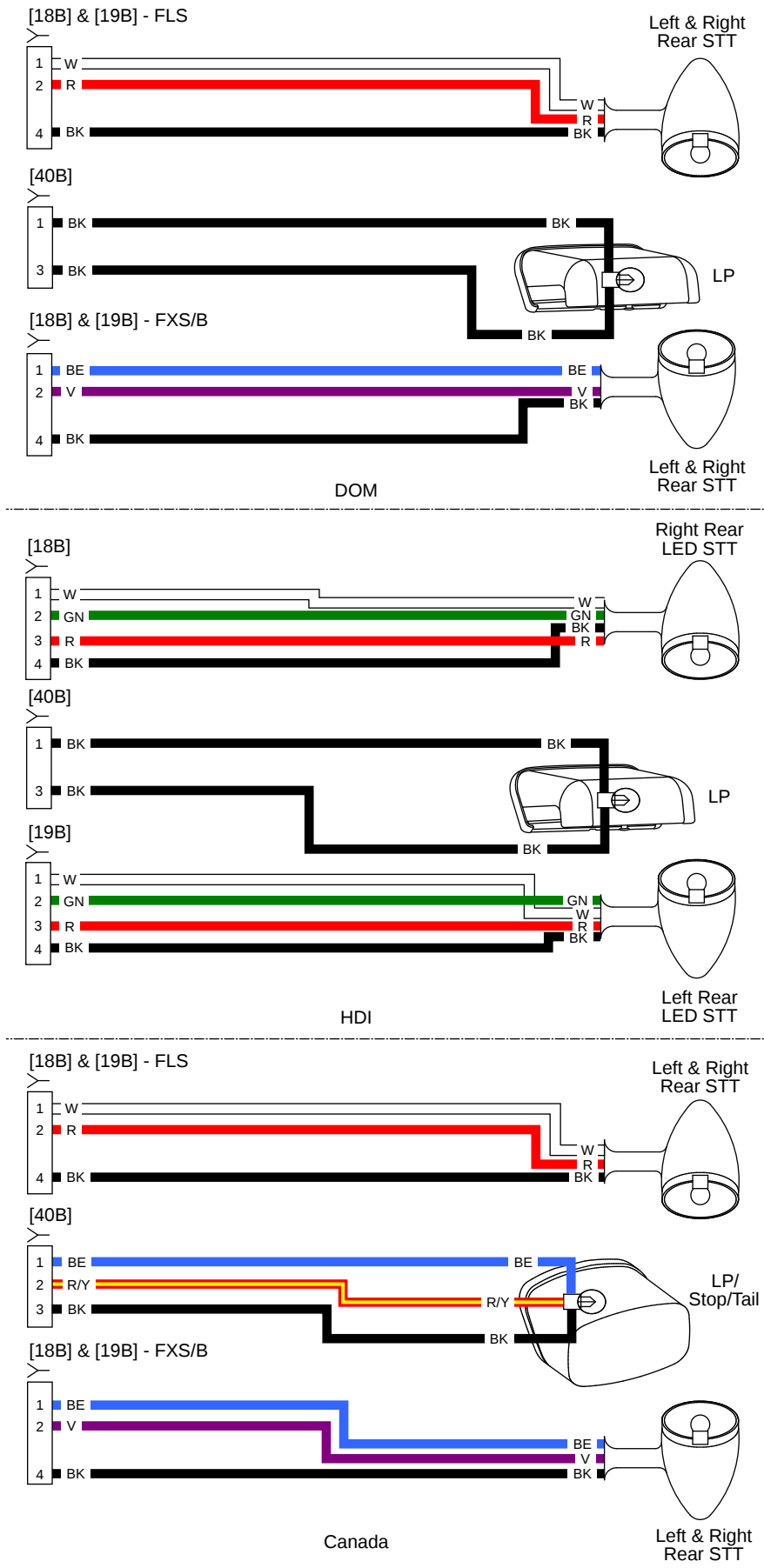


Figure B-16. Rear Lighting: 2013 Softail

Figure B-16.
Rear Lighting: 2013 Softail

Figure B-16.
Rear Lighting: 2013 Softail

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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.) $\times$ 29.574 = milliliters
- pints (U.S.) $\times$ 0.473 = liters
- quarts (U.S.) $\times$ 0.946 = liters
- gallons (U.S.) $\times$ 3.785 = liters
- milliliters $\times$ 0.0338 = fluid ounces (U.S.)
- liters $\times$ 2.114 = pints (U.S.)
- liters $\times$ 1.057 = quarts (U.S.)
- liters $\times$ 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.) $\times$ 1.042 = fluid ounces (Imp.)
- pints (U.S.) $\times$ 0.833 = pints (Imp.)
- quarts (U.S.) $\times$ 0.833 = quarts (Imp.)
- gallons (U.S.) $\times$ 0.833 = gallons (Imp.)
- fluid ounces (Imp.) $\times$ 0.960 = fluid ounces (U.S.)
- pints (Imp.) $\times$ 1.201 = pints (U.S.)
- quarts (Imp.) $\times$ 1.201 = quarts (U.S.)
- gallons (Imp.) $\times$ 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) $\times 12.00000$ = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) $\times 0.08333$ = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) $\times 0.737563$ = foot pounds (ft-lbs).
- Newton meters (Nm) $\times 8.85085$ = inch pounds (**in-lbs**).
- foot pounds (ft-lbs) $\times 1.35582$ = Newton meters (Nm).
- inch pounds (**in-lbs**) $\times 0.112985$ = Newton meters (Nm).

NOTES

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NOTES

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
EHCUC	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
O ₂	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
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	6.6 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	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-26792	SPARK TESTER	6.27 HESITATION, LOSS OF POWER, Hesitation, Loss of Power Test
HD-26792	SPARK TESTER	6.29 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.11 DTC P0261, P0262, P0264, P0265, DTC P0261
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.11 DTC P0261, P0262, P0264, P0265, DTC P0264
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.24 DTC P1655, P1656, DTC P1655
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.24 DTC P1655, P1656, DTC P1656
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-39617	FLUKE AC/DC CURRENT PROBE	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-39617	FLUKE AC/DC CURRENT PROBE	3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test
HD-39617	FLUKE AC/DC CURRENT PROBE	7.6 DTC C1052, C1102, DTC C1052, C1102
HD-39617	FLUKE AC/DC CURRENT PROBE	7.11 DTC C1192, C1193, DTC C1192, C1193
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)	1.2 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	6.15 DTC P0506, P0507, DTC P0506, P0507
HD-41404	HARNESS CONNECTOR TEST KIT	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-41404	HARNESS CONNECTOR TEST KIT	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-41404	HARNESS CONNECTOR TEST KIT	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, DTC U0100
HD-41404	HARNESS CONNECTOR TEST KIT	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140
HD-41404	HARNESS CONNECTOR TEST KIT	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Left Hand Controls Inoperative: DTC U0141
HD-41404	HARNESS CONNECTOR TEST KIT	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Speedometer Inoperative: DTC U0156
HD-41404	HARNESS CONNECTOR TEST KIT	3.2 STARTING SYSTEM, Nothing Clicks
HD-41404	HARNESS CONNECTOR TEST KIT	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-41404	HARNESS CONNECTOR TEST KIT	3.3 DTC B2121, B2122, B2123, B2124, DTC B2122
HD-41404	HARNESS CONNECTOR TEST KIT	3.3 DTC B2121, B2122, B2123, B2124, DTC B2123
HD-41404	HARNESS CONNECTOR TEST KIT	3.6 CHARGING SYSTEM, Low or No Charging
HD-41404	HARNESS CONNECTOR TEST KIT	3.7 DTC C0562, C0563, C1222, C1223, DTC C0562
HD-41404	HARNESS CONNECTOR TEST KIT	3.7 DTC C0562, C0563, C1222, C1223, DTC C1222, C1223
HD-41404	HARNESS CONNECTOR TEST KIT	3.8 DTC P0562, DTC P0562
HD-41404	HARNESS CONNECTOR TEST KIT	3.9 DTC B2203, DTC B2203
HD-41404	HARNESS CONNECTOR TEST KIT	3.10 DTC B2206, B2208, DTC B2208
HD-41404	HARNESS CONNECTOR TEST KIT	3.11 DTC B2271, B2272, DTC B2271
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 DTC B1210, B1211, DTC B1211: Except FXS/B
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 DTC B1210, B1211, DTC B1211: FXS/B
HD-41404	HARNESS CONNECTOR TEST KIT	4.4 NO INSTRUMENT POWER, DTC B1200, No Instrument Power
HD-41404	HARNESS CONNECTOR TEST KIT	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-41404	HARNESS CONNECTOR TEST KIT	4.6 GAUGES, Fuel Gauge Inaccurate, No DTCs
HD-41404	HARNESS CONNECTOR TEST KIT	5.1 ACCESSORIES: DTC B2112, B2113, B2114, DTC B2113, B2114
HD-41404	HARNESS CONNECTOR TEST KIT	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2127
HD-41404	HARNESS CONNECTOR TEST KIT	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2143, B2144

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2148, B2149
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2151
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2153, B2154
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2156
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2158, B2159
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2131
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2132
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2133, B2134
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2137
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2138, B2139
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Stop Lamp Always On, DTC B2223
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2161
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2163, B2164
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, Front Running Lamps Inoperative
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2166 (Domestic Only)
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2166 (Domestic Only)
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169: FXS/B and FLS
HD-41404	HARNESS CONNECTOR TEST KIT	5.15 DTC B2172, B2173, DTC B2172
HD-41404	HARNESS CONNECTOR TEST KIT	5.15 DTC B2172, B2173, DTC B2173
HD-41404	HARNESS CONNECTOR TEST KIT	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2177
HD-41404	HARNESS CONNECTOR TEST KIT	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, Fails to Disarm
HD-41404	HARNESS CONNECTOR TEST KIT	5.18 DTC B2218, DTC B2218
HD-41404	HARNESS CONNECTOR TEST KIT	6.4 DTC B2102, B2103, B2104, DTC B2102
HD-41404	HARNESS CONNECTOR TEST KIT	6.4 DTC B2102, B2103, B2104, DTC B2103, B2104
HD-41404	HARNESS CONNECTOR TEST KIT	6.6 DTC P0107, P0108, DTC P0107
HD-41404	HARNESS CONNECTOR TEST KIT	6.6 DTC P0107, P0108, DTC P0108

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	6.7 DTC P0112, P0113, DTC P0113
HD-41404	HARNESS CONNECTOR TEST KIT	6.8 DTC P0117, P0118, DTC P0117
HD-41404	HARNESS CONNECTOR TEST KIT	6.8 DTC P0117, P0118, DTC P0118
HD-41404	HARNESS CONNECTOR TEST KIT	6.9 DTC P0122, P0123, DTC P0122
HD-41404	HARNESS CONNECTOR TEST KIT	6.9 DTC P0122, P0123, DTC P0123
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0031
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0051
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0052
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0132
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0152
HD-41404	HARNESS CONNECTOR TEST KIT	6.11 DTC P0261, P0262, P0264, P0265, DTC P0261
HD-41404	HARNESS CONNECTOR TEST KIT	6.11 DTC P0261, P0262, P0264, P0265, DTC P0264
HD-41404	HARNESS CONNECTOR TEST KIT	6.12 DTC P0371, P0372, P0374, DTC P0371, P0372, P0374
HD-41404	HARNESS CONNECTOR TEST KIT	6.13 DTC P0444, P0445, DTC P0445
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 DTC P0502, P0503, DTC P0503
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 DTC P0506, P0507, DTC P0506, P0507
HD-41404	HARNESS CONNECTOR TEST KIT	6.17 DTC P0641, DTC P0641
HD-41404	HARNESS CONNECTOR TEST KIT	6.18 DTC P0661, P0662, DTC P0661
HD-41404	HARNESS CONNECTOR TEST KIT	6.20 DTC P1353, P1356, DTC P1353, P1356
HD-41404	HARNESS CONNECTOR TEST KIT	6.21 DTC P1475, P1478, DTC P1475
HD-41404	HARNESS CONNECTOR TEST KIT	6.21 DTC P1475, P1478, DTC P1478
HD-41404	HARNESS CONNECTOR TEST KIT	6.22 DTC P1501, P1502, Side Stand Displayed on Speedometer
HD-41404	HARNESS CONNECTOR TEST KIT	6.24 DTC P1655, P1656, DTC P1655
HD-41404	HARNESS CONNECTOR TEST KIT	6.24 DTC P1655, P1656, DTC P1655
HD-41404	HARNESS CONNECTOR TEST KIT	6.24 DTC P1655, P1656, DTC P1656
HD-41404	HARNESS CONNECTOR TEST KIT	6.25 DTC P2300, P2301, P2303, P2304, DTC P2301
HD-41404	HARNESS CONNECTOR TEST KIT	6.25 DTC P2300, P2301, P2303, P2304, DTC P2304
HD-41404	HARNESS CONNECTOR TEST KIT	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-41404	HARNESS CONNECTOR TEST KIT	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-41404	HARNESS CONNECTOR TEST KIT	6.28 STARTS, THEN STALLS, Starts, Then Stalls
HD-41404	HARNESS CONNECTOR TEST KIT	6.29 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load
HD-41404	HARNESS CONNECTOR TEST KIT	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225, DTC C1018, C1042, C1224

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225, DTC C1041, C1044, C1225
HD-41404	HARNESS CONNECTOR TEST KIT	7.4 DTC C1025, C1032, C1206, DTC C1025, C1032, C1206
HD-41404	HARNESS CONNECTOR TEST KIT	7.5 DTC C1027, C1034, C1208, DTC C1027, C1034, C1208
HD-41404	HARNESS CONNECTOR TEST KIT	7.7 DTC C1055, DTC C1055
HD-41404	HARNESS CONNECTOR TEST KIT	7.11 DTC C1192, C1193, DTC C1192, C1193
HD-41475	DEUTSCH TERMINAL REPAIR KIT	A.13 DEUTSCH DT SEALED CONNECTORS, Deutsch DT Sealed Connector Repair
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 CONNECTOR, Tyco 070 Multilock Unsealed Connector Repair
HD-41609	AMP MULTI-LOCK CRIMPER	A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR, 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	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-42682	BREAKOUT BOX	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-42682	BREAKOUT BOX	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Speedometer Inoperative: DTC U0156
HD-42682	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-42682	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-42682	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1211: Except FXS/B
HD-42682	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1211: FXS/B
HD-42682	BREAKOUT BOX	4.4 NO INSTRUMENT POWER, DTC B1200, No Instrument Power
HD-42682	BREAKOUT BOX	4.4 NO INSTRUMENT POWER, DTC B1200, DTC B1200
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Low Fuel Lamp Always On
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, High Beam Indicator Lamp Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Turn Signal Indicator Inoperative
HD-42682	BREAKOUT BOX	7.15 ABS INDICATOR ALWAYS ON OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-42879	ELECTRICAL CRIMPER TOOL	A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR, Deutsch DTM Sealed Solid Barrel Terminal Crimps

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-45325	JUMPER HARNESS	7.15 ABS INDICATOR ALWAYS ON OR INOPERATIVE, ABS Indicator Always On or Inoperative
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 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-46601	BREAKOUT BOX ADAPTERS	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-46601	BREAKOUT BOX ADAPTERS	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Speedometer Inoperative: DTC U0156
HD-46601	BREAKOUT BOX ADAPTERS	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-46601	BREAKOUT BOX ADAPTERS	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-46601	BREAKOUT BOX ADAPTERS	4.2 DTC B1210, B1211, DTC B1211: Except FXS/B
HD-46601	BREAKOUT BOX ADAPTERS	4.2 DTC B1210, B1211, DTC B1211: FXS/B
HD-46601	BREAKOUT BOX ADAPTERS	4.4 NO INSTRUMENT POWER, DTC B1200, No Instrument Power
HD-46601	BREAKOUT BOX ADAPTERS	4.4 NO INSTRUMENT POWER, DTC B1200, DTC B1200
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, High Beam Indicator Lamp Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Turn Signal Indicator 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-48642	ABS BREAKOUT BOX	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-48642	BREAKOUT BOX	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-48642	ABS BREAKOUT BOX	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, DTC U0121
HD-48642	ABS BREAKOUT BOX	3.7 DTC C0562, C0563, C1222, C1223, DTC C0562
HD-48642	BREAKOUT BOX	3.7 DTC C0562, C0563, C1222, C1223, DTC C1222, C1223
HD-48642	ABS BREAKOUT BOX	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225, DTC C1018, C1042, C1224
HD-48642	ABS BREAKOUT BOX	7.2 DTC C1018, C1041, C1042, C1044, C1224, C1225, DTC C1041, C1044, C1225

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-48642	ABS BREAKOUT BOX	7.4 DTC C1025, C1032, C1206, DTC C1025, C1032, C1206
HD-48642	ABS BREAKOUT BOX	7.5 DTC C1027, C1034, C1208, DTC C1027, C1034, C1208
HD-48642	ABS BREAKOUT BOX	7.6 DTC C1052, C1102, DTC C1052, C1102
HD-48642	ABS BREAKOUT BOX	7.7 DTC C1055, DTC C1055
HD-48642	ABS BREAKOUT BOX	7.11 DTC C1192, C1193, DTC C1192, C1193
HD-48642	ABS BREAKOUT BOX	7.13 DTC C1561, C1562, C1563, C1564, C1565, DTC C1561-C1565
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	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	5.11 SECURITY SYSTEM, Security System Features
HD-48650	DIGITAL TECHNICIAN II	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	6.15 DTC P0506, P0507, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	6.19 DTC P1009, General
HD-48650	DIGITAL TECHNICIAN II	7.1 ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	7.10 DTC C1158, C1178, C1184, 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-50341	WHEEL SPEED SENSOR TEST LEAD	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50341	WHEEL SPEED SENSOR TEST LEAD	7.4 DTC C1025, C1032, C1206, DTC C1025, C1032, C1206
HD-50341	WHEEL SPEED SENSOR TEST LEAD	7.5 DTC C1027, C1034, C1208, DTC C1027, C1034, C1208
HD-50390-1	BREAKOUT BOX	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-1	BREAKOUT BOX	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-1	BREAKOUT BOX	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-1	BREAKOUT BOX	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, DTC U0100
HD-50390-1	BREAKOUT BOX	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140
HD-50390-1	BREAKOUT BOX	3.2 STARTING SYSTEM, Nothing Clicks
HD-50390-1	BREAKOUT BOX	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-50390-1	BREAKOUT BOX	3.3 DTC B2121, B2122, B2123, B2124, DTC B2121
HD-50390-1	BREAKOUT BOX	3.3 DTC B2121, B2122, B2123, B2124, DTC B2122
HD-50390-1	BREAKOUT BOX	3.3 DTC B2121, B2122, B2123, B2124, DTC B2123
HD-50390-1	BREAKOUT BOX	3.3 DTC B2121, B2122, B2123, B2124, DTC B2124
HD-50390-1	BREAKOUT BOX	3.8 DTC P0562, DTC P0562
HD-50390-1	BREAKOUT BOX	3.8 DTC P0562, DTC P0562
HD-50390-1	BREAKOUT BOX	3.9 DTC B2203, DTC B2203
HD-50390-1	BREAKOUT BOX	3.10 DTC B2206, B2208, DTC B2206
HD-50390-1	BREAKOUT BOX	3.10 DTC B2206, B2208, DTC B2208
HD-50390-1	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-50390-1	BREAKOUT BOX	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-50390-1	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-1	BREAKOUT BOX	5.1 ACCESSORIES: DTC B2112, B2113, B2114, DTC B2113, B2114
HD-50390-1	BREAKOUT BOX	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2126
HD-50390-1	BREAKOUT BOX	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2127
HD-50390-1	BREAKOUT BOX	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2141
HD-50390-1	BREAKOUT BOX	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2143, B2144
HD-50390-1	BREAKOUT BOX	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2146
HD-50390-1	BREAKOUT BOX	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2148, B2149
HD-50390-1	BREAKOUT BOX	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2151
HD-50390-1	BREAKOUT BOX	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2153, B2154
HD-50390-1	BREAKOUT BOX	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2156
HD-50390-1	BREAKOUT BOX	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2158, B2159
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2131
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2133, B2134
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2136
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2138, B2139
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Stop Lamp Always On, DTC B2223
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2161
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2163, B2164
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2223
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2107
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2108, B2109
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2166 (Domestic Only)
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169: FXS/B and FLS
HD-50390-1	BREAKOUT BOX	5.15 DTC B2172, B2173, DTC B2173
HD-50390-1	BREAKOUT BOX	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2176
HD-50390-1	BREAKOUT BOX	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2177
HD-50390-1	BREAKOUT BOX	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, Fails to Disarm
HD-50390-1	BREAKOUT BOX	5.18 DTC B2218, DTC B2218
HD-50390-1	BREAKOUT BOX	6.4 DTC B2102, B2103, B2104, DTC B2102
HD-50390-1	BREAKOUT BOX	6.4 DTC B2102, B2103, B2104, DTC B2103, B2104
HD-50390-1	BREAKOUT BOX	6.5 DTC B2116, B2117, B2118, B2119, DTC B2116
HD-50390-1	BREAKOUT BOX	6.6 DTC P0107, P0108, DTC P0107
HD-50390-1	BREAKOUT BOX	6.6 DTC P0107, P0108, DTC P0107
HD-50390-1	BREAKOUT BOX	6.6 DTC P0107, P0108, DTC P0108
HD-50390-1	BREAKOUT BOX	6.6 DTC P0107, P0108, DTC P0108
HD-50390-1	BREAKOUT BOX	6.7 DTC P0112, P0113, DTC P0112
HD-50390-1	BREAKOUT BOX	6.7 DTC P0112, P0113, DTC P0113
HD-50390-1	BREAKOUT BOX	6.8 DTC P0117, P0118, DTC P0117
HD-50390-1	BREAKOUT BOX	6.8 DTC P0117, P0118, DTC P0118
HD-50390-1	BREAKOUT BOX	6.9 DTC P0122, P0123, DTC P0122
HD-50390-1	BREAKOUT BOX	6.9 DTC P0122, P0123, DTC P0122
HD-50390-1	BREAKOUT BOX	6.9 DTC P0122, P0123, DTC P0123
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0031
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0032
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0051
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0052
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0131
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0132
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0134
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0152
HD-50390-1	BREAKOUT BOX	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0154
HD-50390-1	BREAKOUT BOX	6.11 DTC P0261, P0262, P0264, P0265, DTC P0261

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	6.11 DTC P0261, P0262, P0264, P0265, DTC P0264
HD-50390-1	BREAKOUT BOX	6.12 DTC P0371, P0372, P0374, DTC P0371, P0372, P0374
HD-50390-1	BREAKOUT BOX	6.13 DTC P0444, P0445, DTC P0444
HD-50390-1	BREAKOUT BOX	6.13 DTC P0444, P0445, DTC P0444
HD-50390-1	BREAKOUT BOX	6.14 DTC P0502, P0503, DTC P0502
HD-50390-1	BREAKOUT BOX	6.14 DTC P0502, P0503, DTC P0503
HD-50390-1	BREAKOUT BOX	6.15 DTC P0506, P0507, DTC P0506, P0507
HD-50390-1	BREAKOUT BOX	6.17 DTC P0641, DTC P0641
HD-50390-1	BREAKOUT BOX	6.18 DTC P0661, P0662, DTC P0661
HD-50390-1	BREAKOUT BOX	6.20 DTC P1353, P1356, DTC P1353, P1356
HD-50390-1	BREAKOUT BOX	6.21 DTC P1475, P1478, DTC P1475
HD-50390-1	BREAKOUT BOX	6.21 DTC P1475, P1478, DTC P1478
HD-50390-1	BREAKOUT BOX	6.22 DTC P1501, P1502, DTC P1502
HD-50390-1	BREAKOUT BOX	6.22 DTC P1501, P1502, Side Stand Displayed on Speedometer
HD-50390-1	BREAKOUT BOX	6.24 DTC P1655, P1656, DTC P1655
HD-50390-1	BREAKOUT BOX	6.25 DTC P2300, P2301, P2303, P2304, DTC P2300
HD-50390-1	BREAKOUT BOX	6.25 DTC P2300, P2301, P2303, P2304, DTC P2303
HD-50390-1	BREAKOUT BOX	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-1	BREAKOUT BOX	6.28 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-1	BREAKOUT BOX	6.29 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load
HD-50390-2	BCM CABLE	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2	BCM CABLE	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2	BCM CABLE	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-2	BCM CABLE	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140
HD-50390-2	BCM CABLE	3.2 STARTING SYSTEM, Nothing Clicks
HD-50390-2	BCM CABLE	3.3 DTC B2121, B2122, B2123, B2124, DTC B2121
HD-50390-2	BCM CABLE	3.3 DTC B2121, B2122, B2123, B2124, DTC B2122
HD-50390-2	BCM CABLE	3.3 DTC B2121, B2122, B2123, B2124, DTC B2123
HD-50390-2	BCM CABLE	3.3 DTC B2121, B2122, B2123, B2124, DTC B2124
HD-50390-2	BCM CABLE	3.8 DTC P0562, DTC P0562
HD-50390-2	BCM CABLE	3.9 DTC B2203, DTC B2203
HD-50390-2	BCM CABLE	3.10 DTC B2206, B2208, DTC B2206
HD-50390-2	BCM CABLE	3.10 DTC B2206, B2208, DTC B2208
HD-50390-2	BCM CABLE	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-50390-2	BCM CABLE	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-50390-2	BCM CABLE	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-2	BCM CABLE	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-2	BCM CABLE	5.1 ACCESSORIES: DTC B2112, B2113, B2114, DTC B2113, B2114
HD-50390-2	BCM CABLE	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2126
HD-50390-2	BCM CABLE	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2127
HD-50390-2	BCM CABLE	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2141
HD-50390-2	BCM CABLE	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2143, B2144
HD-50390-2	BCM CABLE	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2146
HD-50390-2	BCM CABLE	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2148, B2149
HD-50390-2	BCM CABLE	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2151
HD-50390-2	BCM CABLE	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2153, B2154
HD-50390-2	BCM CABLE	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2156
HD-50390-2	BCM CABLE	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2158, B2159
HD-50390-2	BCM CABLE	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2131
HD-50390-2	BCM CABLE	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2133, B2134
HD-50390-2	BCM CABLE	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2136
HD-50390-2	BCM CABLE	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2138, B2139
HD-50390-2	BCM CABLE	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Stop Lamp Always On, DTC B2223
HD-50390-2	BCM CABLE	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2161
HD-50390-2	BCM CABLE	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2163, B2164
HD-50390-2	BCM CABLE	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2223
HD-50390-2	BCM CABLE	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2107
HD-50390-2	BCM CABLE	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2108, B2109
HD-50390-2	BCM CABLE	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2166 (Domestic Only)
HD-50390-2	BCM CABLE	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-2	BCM CABLE	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169: FXS/B and FLS
HD-50390-2	BCM CABLE	5.15 DTC B2172, B2173, DTC B2173
HD-50390-2	BCM CABLE	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2176
HD-50390-2	BCM CABLE	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2177
HD-50390-2	BCM CABLE	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, Fails to Disarm
HD-50390-2	BCM CABLE	5.18 DTC B2218, DTC B2218
HD-50390-2	BCM CABLE	6.4 DTC B2102, B2103, B2104, DTC B2103, B2104
HD-50390-2	BCM CABLE	6.5 DTC B2116, B2117, B2118, B2119, DTC B2116
HD-50390-2	BCM CABLE	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-2-P	BCM OVERLAY	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2-P	BCM OVERLAY	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-2-P	BCM OVERLAY	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, No Vehicle Power: DTC U0140
HD-50390-2-P	BCM OVERLAY	3.2 STARTING SYSTEM, Nothing Clicks
HD-50390-2-P	BCM OVERLAY	3.3 DTC B2121, B2122, B2123, B2124, DTC B2121
HD-50390-2-P	BCM OVERLAY	3.3 DTC B2121, B2122, B2123, B2124, DTC B2122
HD-50390-2-P	BCM OVERLAY	3.3 DTC B2121, B2122, B2123, B2124, DTC B2123
HD-50390-2-P	BCM OVERLAY	3.3 DTC B2121, B2122, B2123, B2124, DTC B2124
HD-50390-2-P	BCM OVERLAY	3.8 DTC P0562, DTC P0562
HD-50390-2-P	BCM OVERLAY	3.9 DTC B2203, DTC B2203
HD-50390-2-P	BCM OVERLAY	3.10 DTC B2206, B2208, DTC B2206
HD-50390-2-P	BCM OVERLAY	3.10 DTC B2206, B2208, DTC B2208
HD-50390-2-P	BCM OVERLAY	4.2 DTC B1210, B1211, DTC B1210: Except FXS/B
HD-50390-2-P	BCM OVERLAY	4.2 DTC B1210, B1211, DTC B1210: FXS/B
HD-50390-2-P	BCM OVERLAY	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-50390-2-P	BCM OVERLAY	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-2-P	BCM OVERLAY	5.1 ACCESSORIES: DTC B2112, B2113, B2114, DTC B2113, B2114
HD-50390-2-P	BCM OVERLAY	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2126
HD-50390-2-P	BCM OVERLAY	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2127
HD-50390-2-P	BCM OVERLAY	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2141
HD-50390-2-P	BCM OVERLAY	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2143, B2144
HD-50390-2-P	BCM OVERLAY	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2146

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PART NUMBER	TOOL NAME	NOTES
HD-50390-2-P	BCM OVERLAY	5.5 DTC B2141, B2143, B2144, B2146, B2148, B2149, DTC B2148, B2149
HD-50390-2-P	BCM OVERLAY	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2151
HD-50390-2-P	BCM OVERLAY	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2153, B2154
HD-50390-2-P	BCM OVERLAY	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2156
HD-50390-2-P	BCM OVERLAY	5.6 DTC B2151, B2153, B2154, B2156, B2158, B2159, DTC B2158, B2159
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2131
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2133, B2134
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2136
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2138, B2139
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Stop Lamp Always On, DTC B2223
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2161
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2163, B2164
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, DTC B2223
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2107
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2108, B2109
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2166 (Domestic Only)
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2168, B2169: FXS/B and FLS
HD-50390-2-P	BCM OVERLAY	5.15 DTC B2172, B2173, DTC B2173
HD-50390-2-P	BCM OVERLAY	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2176
HD-50390-2-P	BCM OVERLAY	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, DTC B2177
HD-50390-2-P	BCM OVERLAY	5.16 FAILS TO DISARM: DTC B2176, B2177, B2178, Fails to Disarm
HD-50390-2-P	BCM OVERLAY	5.18 DTC B2218, DTC B2218
HD-50390-2-P	BCM OVERLAY	6.4 DTC B2102, B2103, B2104, DTC B2103, B2104
HD-50390-2-P	BCM OVERLAY	6.5 DTC B2116, B2117, B2118, B2119, DTC B2116
HD-50390-2-P	BCM OVERLAY	6.13 DTC P0444, P0445, DTC P0444

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PART NUMBER	TOOL NAME	NOTES
HD-50390-2-P	BCM OVERLAY	6.26 ENGINE CRANKS, BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-4	ECM CABLE	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4	ECM CABLE	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4	ECM CABLE	1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-4	ECM CABLE	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-4	ECM CABLE	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, DTC U0100
HD-50390-4	ECM CABLE	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-50390-4	ECM CABLE	3.8 DTC P0562, DTC P0562
HD-50390-4	ECM CABLE	6.4 DTC B2102, B2103, B2104, DTC B2102
HD-50390-4	ECM CABLE	6.6 DTC P0107, P0108, DTC P0107
HD-50390-4	ECM CABLE	6.6 DTC P0107, P0108, DTC P0107
HD-50390-4	ECM CABLE	6.7 DTC P0112, P0113, DTC P0112
HD-50390-4	ECM CABLE	6.7 DTC P0112, P0113, DTC P0113
HD-50390-4	ECM CABLE	6.8 DTC P0117, P0118, DTC P0117
HD-50390-4	ECM CABLE	6.8 DTC P0117, P0118, DTC P0118
HD-50390-4	ECM CABLE	6.9 DTC P0122, P0123, DTC P0122
HD-50390-4	ECM CABLE	6.9 DTC P0122, P0123, DTC P0122
HD-50390-4	ECM CABLE	6.9 DTC P0122, P0123, DTC P0123
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0031
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0032
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0051
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0052
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0131
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0132
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0134
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0152
HD-50390-4	ECM CABLE	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0154
HD-50390-4	ECM CABLE	6.11 DTC P0261, P0262, P0264, P0265, DTC P0261
HD-50390-4	ECM CABLE	6.11 DTC P0261, P0262, P0264, P0265, DTC P0264

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PART NUMBER	TOOL NAME	NOTES
HD-50390-4	ECM CABLE	6.12 DTC P0371, P0372, P0374, DTC P0371, P0372, P0374
HD-50390-4	ECM CABLE	6.13 DTC P0444, P0445, DTC P0444
HD-50390-4	ECM CABLE	6.13 DTC P0444, P0445, DTC P0444
HD-50390-4	ECM CABLE	6.14 DTC P0502, P0503, DTC P0502
HD-50390-4	ECM CABLE	6.14 DTC P0502, P0503, DTC P0503
HD-50390-4	ECM CABLE	6.15 DTC P0506, P0507, DTC P0506, P0507
HD-50390-4	ECM CABLE	6.17 DTC P0641, DTC P0641
HD-50390-4	ECM CABLE	6.18 DTC P0661, P0662, DTC P0661
HD-50390-4	ECM CABLE	6.20 DTC P1353, P1356, DTC P1353, P1356
HD-50390-4	ECM CABLE	6.21 DTC P1475, P1478, DTC P1475
HD-50390-4	ECM CABLE	6.21 DTC P1475, P1478, DTC P1478
HD-50390-4	ECM CABLE	6.22 DTC P1501, P1502, DTC P1502
HD-50390-4	ECM CABLE	6.22 DTC P1501, P1502, Side Stand Displayed on Speedometer
HD-50390-4	ECM CABLE	6.24 DTC P1655, P1656, DTC P1655
HD-50390-4	ECM CABLE	6.25 DTC P2300, P2301, P2303, P2304, DTC P2300
HD-50390-4	ECM CABLE	6.25 DTC P2300, P2301, P2303, P2304, DTC P2303
HD-50390-4	ECM CABLE	6.28 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-4	ECM CABLE	6.29 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load
HD-50390-4-P	ECM OVERLAY	1.2 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4-P	ECM OVERLAY	1.3 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-4-P	ECM OVERLAY	2.3 ODOMETER SELF-DIAGNOSTIC INOPERATIVE, DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative, DTC U0001, U0011, B2274
HD-50390-4-P	ECM OVERLAY	2.4 NO VEHICLE POWER OR DTC U0100, U0121, U0140, U0141, U0142, U0156, DTC U0100
HD-50390-4-P	ECM OVERLAY	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-50390-4-P	ECM OVERLAY	3.8 DTC P0562, DTC P0562
HD-50390-4-P	ECM OVERLAY	6.4 DTC B2102, B2103, B2104, DTC B2102
HD-50390-4-P	ECM OVERLAY	6.6 DTC P0107, P0108, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.6 DTC P0107, P0108, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.6 DTC P0107, P0108, DTC P0108
HD-50390-4-P	ECM OVERLAY	6.7 DTC P0112, P0113, DTC P0112
HD-50390-4-P	ECM OVERLAY	6.7 DTC P0112, P0113, DTC P0113
HD-50390-4-P	ECM OVERLAY	6.8 DTC P0117, P0118, DTC P0117
HD-50390-4-P	ECM OVERLAY	6.8 DTC P0117, P0118, DTC P0118
HD-50390-4-P	ECM OVERLAY	6.9 DTC P0122, P0123, DTC P0122
HD-50390-4-P	ECM OVERLAY	6.9 DTC P0122, P0123, DTC P0122
HD-50390-4-P	ECM OVERLAY	6.9 DTC P0122, P0123, DTC P0123
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0031

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PART NUMBER	TOOL NAME	NOTES
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0032
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0051
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0052
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0131
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0132
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0134
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0151
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0152
HD-50390-4-P	ECM OVERLAY	6.10 DTC P0031, P0032, P0051, P0052, P0131, P0132, P0134, P0151, P0152, P0154, DTC P0154
HD-50390-4-P	ECM OVERLAY	6.11 DTC P0261, P0262, P0264, P0265, DTC P0261
HD-50390-4-P	ECM OVERLAY	6.11 DTC P0261, P0262, P0264, P0265, DTC P0264
HD-50390-4-P	ECM OVERLAY	6.12 DTC P0371, P0372, P0374, DTC P0371, P0372, P0374
HD-50390-4-P	ECM OVERLAY	6.13 DTC P0444, P0445, DTC P0444
HD-50390-4-P	ECM OVERLAY	6.14 DTC P0502, P0503, DTC P0502
HD-50390-4-P	ECM OVERLAY	6.14 DTC P0502, P0503, DTC P0503
HD-50390-4-P	ECM OVERLAY	6.15 DTC P0506, P0507, DTC P0506, P0507
HD-50390-4-P	ECM OVERLAY	6.17 DTC P0641, DTC P0641
HD-50390-4-P	ECM OVERLAY	6.18 DTC P0661, P0662, DTC P0661
HD-50390-4-P	ECM OVERLAY	6.20 DTC P1353, P1356, DTC P1353, P1356
HD-50390-4-P	ECM OVERLAY	6.21 DTC P1475, P1478, DTC P1475
HD-50390-4-P	ECM OVERLAY	6.21 DTC P1475, P1478, DTC P1478
HD-50390-4-P	ECM OVERLAY	6.22 DTC P1501, P1502, DTC P1502
HD-50390-4-P	ECM OVERLAY	6.22 DTC P1501, P1502, Side Stand Displayed on Speedometer
HD-50390-4-P	ECM OVERLAY	6.24 DTC P1655, P1656, DTC P1655
HD-50390-4-P	ECM OVERLAY	6.25 DTC P2300, P2301, P2303, P2304, DTC P2300
HD-50390-4-P	ECM OVERLAY	6.25 DTC P2300, P2301, P2303, P2304, DTC P2303
HD-50390-4-P	ECM OVERLAY	6.28 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-4-P	ECM OVERLAY	6.29 MISFIRE AT IDLE OR UNDER LOAD, Misfire At Idle or Under Load
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	5.2 HORN: DTC B2126, B2127, B2128, B2129, DTC B2127
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	5.8 STOP LAMPS: DTC B2161, B2163, B2164, B2223, Stop Lamp Always On, DTC B2223
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2132
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	5.7 HEADLAMPS: DTC B2131, B2132, B2133, B2134, B2136, B2137, B2138, B2139, DTC B2137
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	5.10 RUNNING LAMPS: DTC B2107, B2108, B2109, B2166, B2168, B2169, DTC B2107
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-96921-52D	OIL PRESSURE GAUGE SET	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
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	6.29 MISFIRE AT IDLE OR UNDER LOAD, In-line Spark Tester

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FASTENER	TORQUE VALUE	NOTES
No torque values were found in this manual.		

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