DYNAMIC DIGITAL FUEL INJECTION (DDFI) 4.2

INTRODUCTION

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

- Independently mapped spark and fuel control.
- Engine and air temperature compensated fuel delivery.
- Engine load measurement through throttle position.
- Single point spark delivery (no waste spark).
- Sequential port indirect (manifold) fuel injection.
- Open/Closed-loop air/fuel control.
- Automatic enrichment at start-up.
- Electric cooling fan for improved thermal management.
- Engine speed and position determined using a single sensor (Cam Position Sensor).
- Full diagnostic capability compatible with the DIGITAL TECHNICIAN (Part No. HD-44750-P28/Panasonic Toughbook or Part No. HD-44750-D150/Dell Desktop).
- Returnless fuel system (excess pressure relieved in tank by Fuel Pressure Regulator Valve).
- Interactive muffler control with muffler valve position feedback for 1203cc engines only.

The DDFI system uses six sensors to monitor the operating conditions of the engine and make decisions as to spark and fuel delivery. These sensors are:

- Throttle position (TP) sensor.
- Cam position (CMP) sensor.
- Engine temperature (ET) sensor.
- Intake air temperature (IAT) sensor.
- Oxygen (O2) sensor.
- Bank Angle Sensor (BAS).

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

The XB12R utilizes an interactive exhaust system which has an electronically controlled actuator that activates a butterfly valve that controls exhaust flow in the dual-chamber muffler. The engine ECM monitors engine speed and throttle position while activating the valve. See 7.6 INTERACTIVE EXHAUST SYSTEM (XB12 MODEL).

GENERAL

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

During closed loop operation, the system relies on input from the O2 sensor to provide for the most efficient, stoichiometric air fuel mixture (14.7:1) which results in reduced emissions, good fuel economy and power. In order for the system to enter closed loop operation, the following conditions must be met:

- O2 Sensor at operating temperature (Engine at normal operating temperature).
- Operation below 4000 RPM or lower with engine under, steady or light load conditions.

By using both open and closed loop systems, engine performance is continuously tuned to compensate for changing conditions and provide maximum performance.

FOR MORE INFORMATION

To learn more about the Buell DDFI system, read the following topics in this section. A system diagram can be found on the next page in Figure 4-1.

Troubleshooting

- 4.3 DIAGNOSTIC INTRODUCTION.
- 4.4 CHECKING FOR TROUBLE CODES.
- 4.5 CHECK ENGINE LAMP DIAGNOSTICS.
- 4.8 INITIAL DIAGNOSTIC CHECK.
- TABLE 4-7. TROUBLE CODES AND FAULT CONDITIONS.

Fuel Injection Components

- 4.30 ELECTRONIC CONTROL MODULE.
- 4.31 CAM POSITION SENSOR AND ROTOR.
- 4.33 OXYGEN SENSOR.
- 4.34 ENGINE TEMPERATURE SENSOR.
- 4.35 BANK ANGLE SENSOR.
- 4.36 INTAKE AIR TEMPERATURE SENSOR.
- 4.37 THROTTLE POSITION SENSOR.
- 4.39 FUEL PUMP.
- 4.42 THROTTLE BODY.

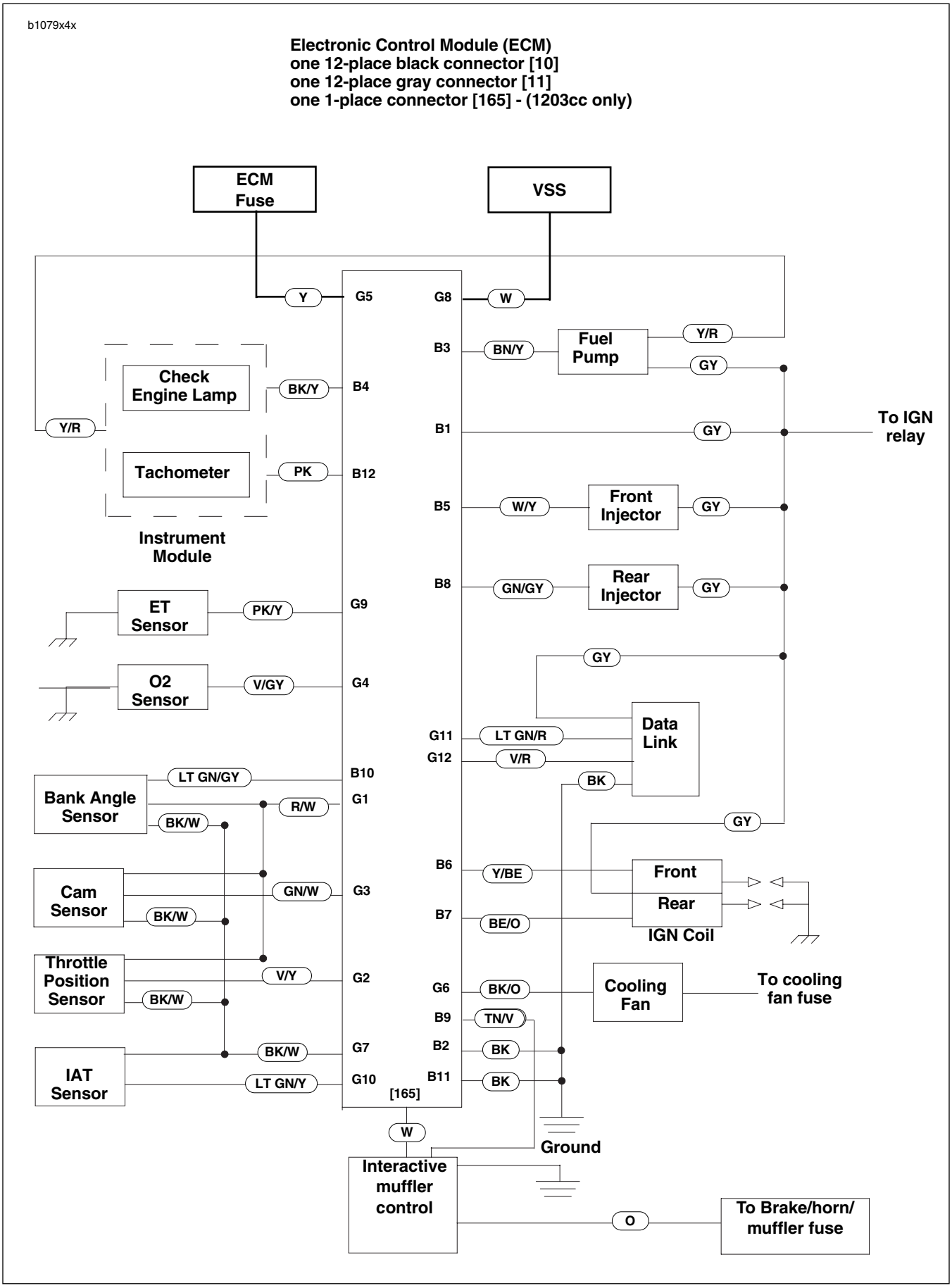


Figure 4-1. Buell Dynamic Digital Fuel Injection

SYSTEM PROBLEMS

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

No Start

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

Poor Performance

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

Check Engine Lamp

See Figure 4-2. The check engine lamp indicates a fault condition exists. There may also be starting or performance problems.

1. **Low fuel lamp**
2. **Check engine lamp**

Figure 4-2. Check Engine Lamp

RESOLVING PROBLEMS

NOTE

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

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

1. Check for trouble codes by observing check engine lamp. See 4.4 CHECKING FOR TROUBLE CODES.
2. Retrieve trouble codes using check engine lamp diagnostics. See 4.5 CHECK ENGINE LAMP DIAGNOSTICS.
3. Diagnose system problems. This involves using special tools and the diagnostic flow charts in this section.
4. Correct problems through the replacement and/or repair of the affected components.
5. After repairs are performed, the work must be validated. This involves clearing the trouble codes and confirming proper vehicle operation as indicated by the behavior of the check engine lamp.

CHECK ENGINE LAMP

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

NOTES

- *All references to "Key ON" or "Ignition Switch ON" require that the ignition key be in the ON position and the engine stop switch be set to RUN.*
- *If the check engine lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four second period, then a problem exists in the lamp circuit. See 4.9 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON or 4.10 CHECK ENGINE LAMP ON CONTINUOUSLY for more information.*

1. When the ignition switch is turned ON after being OFF for 2 seconds or more, the check engine lamp will illuminate for approximately four seconds and then turn off.
2. See Figure 4-5. After lamp turns off after being illuminated for the first four second period, one of three situations may occur.
   a. The lamp remains off. This indicates there are no current fault conditions or stored functional trouble codes currently detected by the ECM.
   b. The lamp stays off for only four seconds and then comes back on for an eight second period. This indicates a functional error code is stored, but no current trouble code exists.
   c. If the lamp remains on beyond the eight second period, then a current trouble code exists.
3. See CODE TYPES for a complete description of trouble code formats.

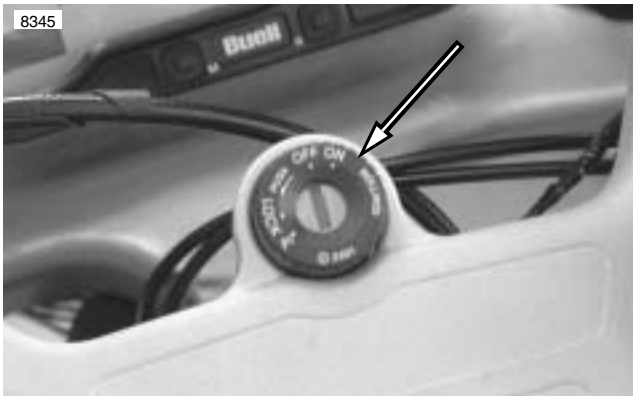
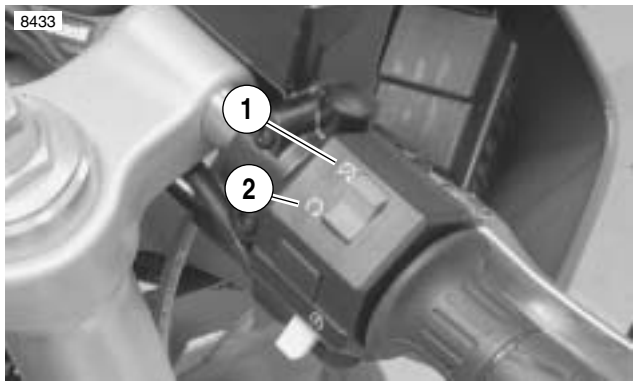


Figure 4-3. Ignition Key Switch



1. **OFF position**
2. **RUN position**

Figure 4-4. Engine Stop Switch

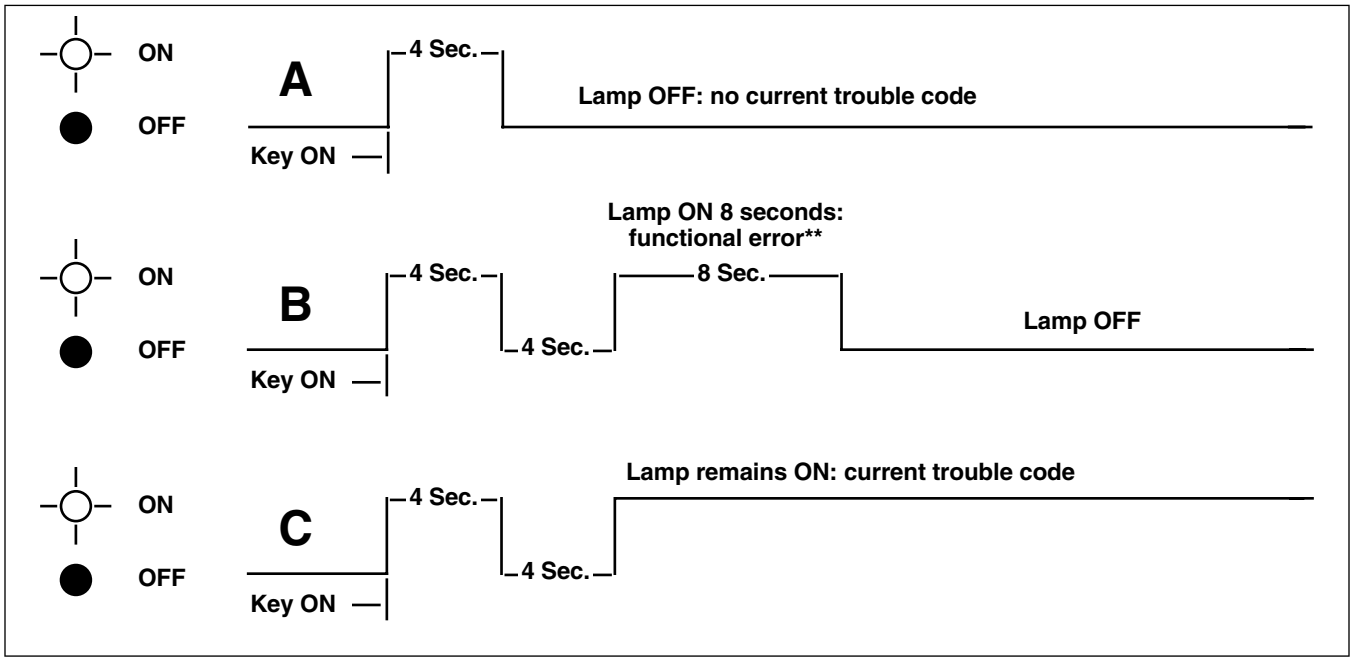


Figure 4-5. Check Engine Lamp Operation

CODE TYPES

There are two types of trouble codes: current and historic. Certain codes are also called functional codes. Historic codes can be read using the check engine lamp diagnostics.

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

NOTE

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

Current

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

Historic

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

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

It is important to note that historic trouble codes may also be present whenever the system indicates the existence of a current fault. See 4.4 CHECKING FOR TROUBLE CODES if multiple trouble codes are found.

Functional

Trouble codes 52 through 56 are considered to be functional codes. They indicate an internal problem with the ECM (trouble codes 52 through 55) or with the camshaft sensor/timing (trouble code 56).

RETRIEVING TROUBLE CODES

The fuel injection system provides two levels of diagnostics.

- The most sophisticated mode employs using a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The other mode requires using the check engine lamp. See 4.5 CHECK ENGINE LAMP DIAGNOSTICS for more information.

MULTIPLE TROUBLE CODES

The throttle position, cam position and bank angle sensors are all connected to the same reference line (5v REF). If this line goes to ground or open, multiple trouble codes (codes 11 and 56) may be set.

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

Always start with the trouble code having the lowest numerical value. See Table 4-7.

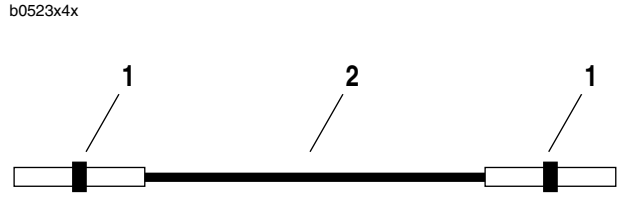
CHECK ENGINE LAMP BLINKS

In addition to alerting the rider to trouble codes, the check engine lamp will blink during operation to warn of potentially damaging engine operating temperatures. If the key is in the on position and the check engine lamp is blinking, the engine is at a potentially damaging temperature. While this condition is in effect, the ECM will reduce engine power to assist in cooling the engine down to a safe operating temperature. The check engine lamp will blink until the engine has cooled to a safe operating temperature. This will not set a trouble code.

RETRIEVING TROUBLE CODES

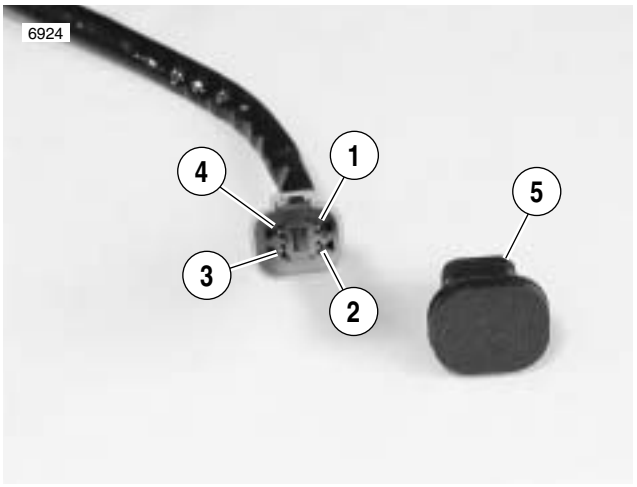
Trouble codes may be retrieved without the use of the DIGITAL TECHNICIAN (Part No. HD-44750).

1. Remove protective cover from data link connector [91A]. Data link connector is located on left side of vehicle under fairing.
2. To activate the diagnostic feature of the check engine lamp, proceed as follows:
   a. See Figure 4-6. Create diagnostic test wire from parts shown.
   b. See Figure 4-7. Install diagnostic test wire across Terminal 1 and Terminal 2 on the data link connector [91A].
   c. Turn the ignition/light key switch ON and wait approximately eight seconds for the check engine lamp to start flashing.
3. See Figure 4-8. All trouble codes are sent out as a series of flashes. To retrieve the first digit of the trouble code simply observe the number of times the lamp flashes.
   a. The transmission of a trouble code is always preceded by six rapid flashes (about 3 per second).
   b. This “intermission” is followed by a 2 second pause in which the lamp is off.
   c. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1 second in duration.
4. The second digit follows:
   a. Following transmission of the first digit, there is another 2 second pause in which the lamp is off.
   b. The lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the lamp flashes to retrieve the second digit.
5. If more than one trouble code is sent:
   a. Following transmission of the second digit of the first code, there is a third 2 second pause in which the lamp is off.
   b. After the pause comes the intermission, which is followed by transmission of the next recorded trouble code.
   c. All subsequent codes are sent in the same manner, each separated from the next by the intermission.
6. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.



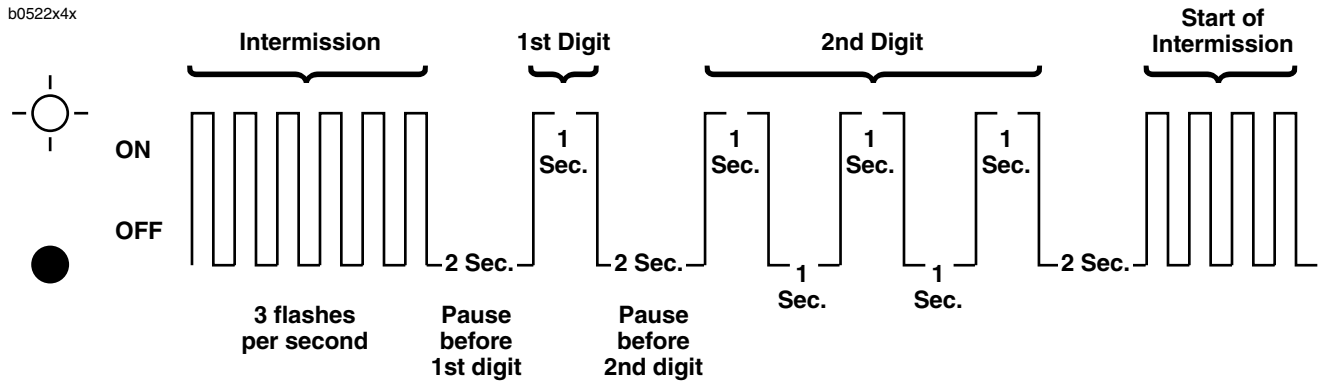
1. **Part Number 72191-94 (2)**
2. **2.0 in. (51 mm) 18 Gauge Wire**

Figure 4-6. Diagnostic Test Wire



1. **Terminal 1: Receive Data Line (Lt GN/R)**
2. **Terminal 2: Ground (BK)**
3. **Terminal 3: Transmit Data Line (V/R)**
4. **Terminal 4: Power (GY)**
5. **Protective Cap**

Figure 4-7. Installing Diagnostic Test Wire



NOTE

Looking at the above transmission, we can see that the trouble code is 13. The source of the fault condition is identified as the oxygen sensor according to Table 4-7.

Figure 4-8. Check Engine Lamp Diagnostics

NOTE

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

7. When examining trouble codes, write down all codes on a piece of paper.
   a. If trouble codes are present, see Table 4-7. Follow the applicable flow charts for each code.
   b. If trouble codes are NOT present, but starting or driveability problems are evident, see charts under 4.8 INITIAL DIAGNOSTIC CHECK.
8. Turn the ignition/light key switch OFF.
9. Remove diagnostic test wire and install protective cover over data link connector. Return data link to original position.

NOTE

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

CLEARING CODES

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

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

BREAKOUT BOX 4.6

GENERAL

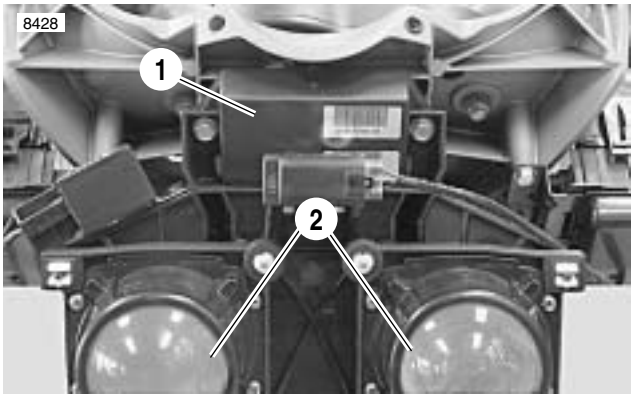
The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

1. Remove ECM. See 4.30 ELECTRONIC CONTROL MODULE.
2. Depress latches on each side of connectors [10] (black) and [11] (gray) and detach connectors from the ECM.
3. See Figure 4-10. Attach Breakout Box (2) to black connector [10].
   a. Attach black connector from Breakout Box to corresponding black ECM connector.
   b. Attach black connector from the wiring harness to black connector on Breakout Box.
4. Attach Breakout Box to gray connector [11].
   a. Attach gray connector from Breakout Box to corresponding gray ECM connector.
   b. Attach gray connector from the wiring harness to gray connector on Breakout Box.

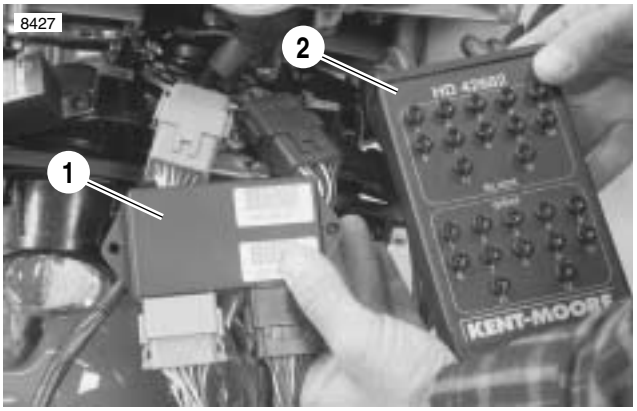
REMOVAL

1. See Figure 4-10. Depress latches on each side of connectors [10] (black) and [11] (gray).
2. Detach Breakout Box connectors from ECM connectors.
3. Detach Breakout Box connectors from wiring harness.
4. Install ECM. See 4.30 ELECTRONIC CONTROL MODULE.



1. ECM
2. Headlights

Figure 4-9. ECM



1. ECM
2. Breakout Box

Figure 4-10. Installed Breakout Box

WIGGLE TEST 4.7

GENERAL

NOTE

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

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

PROCEDURE

1. See Figure 4-11. Connect DVOM (Part No. HD-39978) to wiring harness between the suspect connections. When diagnosing ECM connections, a BREAKOUT BOX (Part No. HD-42682) may be used to simplify the procedure. See 4.6 BREAKOUT BOX.
2. Set DVOM to read voltage changes.
3. Start motorcycle engine and run at idle.
4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

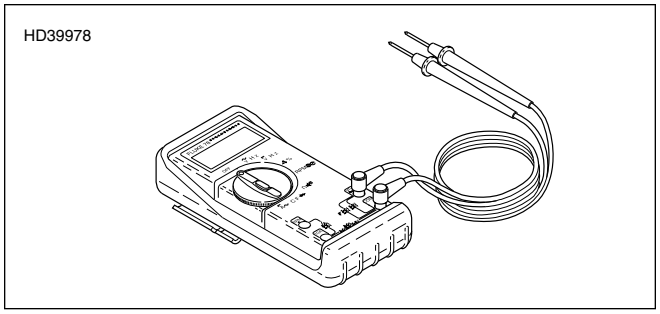


Figure 4-11. Fluke 78 Multimeter (DVOM) (Part No. HD-39978)

INITIAL DIAGNOSTIC CHECK 4.8

GENERAL

To locate faulty circuits, follow the diagnostic flow charts in this section. For a systematic approach, always begin with INITIAL DIAGNOSTICS. Read the general information and then work your way through the flow chart box by box.

Diagnostic Notes

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

Circuit Diagram/Wire Harness Connector Table

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

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See 4.6 BREAKOUT BOX. To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

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

INITIAL DIAGNOSTICS

General Information

The diagnostic check is identifies problems caused by an electronic control system malfunction.

NOTE

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

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the diagnostic check flow charts. See Diagnostic Check (Part 1 of 2).

1. Compare engine behavior to tables.
   a. Starts hard. See Table 4-4.
   b. Hesitates, stumbles, surges, misfires and/or sluggish performance. See Table 4-5.
   c. Engine exhaust emits black smoke or fouls plugs. See Table 4-6.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black socket probes and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-42682) to ECM. See 4.6 BREAKOUT BOX.

All diagnostic codes are listed in Table 4-7.

Table 4-4. Engine Starts Hard

CAUSE	SOLUTION
Engine temperature circuit	4.18 TROUBLE CODE 14.
Improper fuel pressure	4.13 FUEL PRESSURE TEST.
Spark plugs and/or wires	4.15 MISFIRE.
Battery discharged	See charging system troubleshooting in Section 7.
Cam position sensor	4.29 TROUBLE CODE 56.
Manifold leak	Spray water around induction module seals with engine idling. If RPM changes, change seals.
Ignition coil	4.15 MISFIRE.
Leaky injectors	Test fuel injectors. See 4.42 THROTTLE BODY.
Valve sticking	See Section 3.

Table 4-5. Engine Performance Problems

CAUSE	SOLUTION
Engine temperature circuit	4.18 TROUBLE CODE 14.
Improper ignition timing	1.18 IGNITION TIMING.
Cam position sensor circuit	4.29 TROUBLE CODE 56.
Spark plugs and/or wires	4.15 MISFIRE.
Improper fuel pressure	4.13 FUEL PRESSURE TEST.
Improper throttle position sensor adjustment	Calibrate sensor using DIGITAL TECHNICIAN (Part No. HD-44750).
Manifold leak	See 4.43 INTAKE LEAK TEST.
Throttle plates not opening fully	1.16 THROTTLE CABLE AND IDLE SPEED ADJUSTMENT.
EVAP hose disconnected from induction module (CA)	Connect.

Table 4-5. Engine Performance Problems

CAUSE	SOLUTION
Throttle plates not opening fully	1.16 THROTTLE CABLE AND IDLE SPEED ADJUSTMENT.
EVAP hose disconnected from induction module (CA)	Connect.
Water or dirt in fuel system	Drain and refill with fresh fuel.
Cooling fan inoperative	4.26 TROUBLE CODE 36.
Interactive muffler control Inoperative	4.21 TROUBLE CODE 21

Table 4-6. Engine Exhaust Emits Black Smoke or Fouls Plugs

CAUSE	SOLUTION
Engine temperature circuit	4.18 TROUBLE CODE 14.
Clogged air filter	1.15 AIR CLEANER FILTER.
Improper throttle position sensor adjustment	Calibrate sensor. See 4.37 THROTTLE POSITION SENSOR.
Leaky injectors	Test fuel injectors. See 4.42 THROTTLE BODY.
Improper fuel pressure	4.13 FUEL PRESSURE TEST.

Table 4-7. Trouble Codes and Fault Conditions

CODE NO.	FAULT CONDITION	RELEVANT TOPIC
11	Throttle position sensor	4.16 TROUBLE CODE 11
13	Oxygen sensor	4.17 TROUBLE CODE 13
14	Engine temperature sensor	4.18 TROUBLE CODE 14
15	Intake air temperature sensor	4.19 TROUBLE CODE 15
16	Battery voltage	4.20 TROUBLE CODE 16
21	Interactive muffler control (1203's only)	4.21 TROUBLE CODE 21
23	Front fuel injector	4.22 TROUBLE CODES 23 AND 32
24	Front ignition coil	4.23 TROUBLE CODES 24 AND 25
25	Rear ignition coil	4.23 TROUBLE CODES 24 AND 25
32	Rear fuel injector	4.22 TROUBLE CODES 23 AND 32
33	Fuel pump	4.24 TROUBLE CODE 33
35	Tachometer	4.25 TROUBLE CODE 35
36	Cooling fan	4.26 TROUBLE CODE 36
44	Bank angle sensor	4.27 TROUBLE CODE 44
52, 53, 54, 55	ECM failure	4.28 TROUBLE CODES 52, 53, 54 AND 55
56	Cam sync failure	4.29 TROUBLE CODE 56

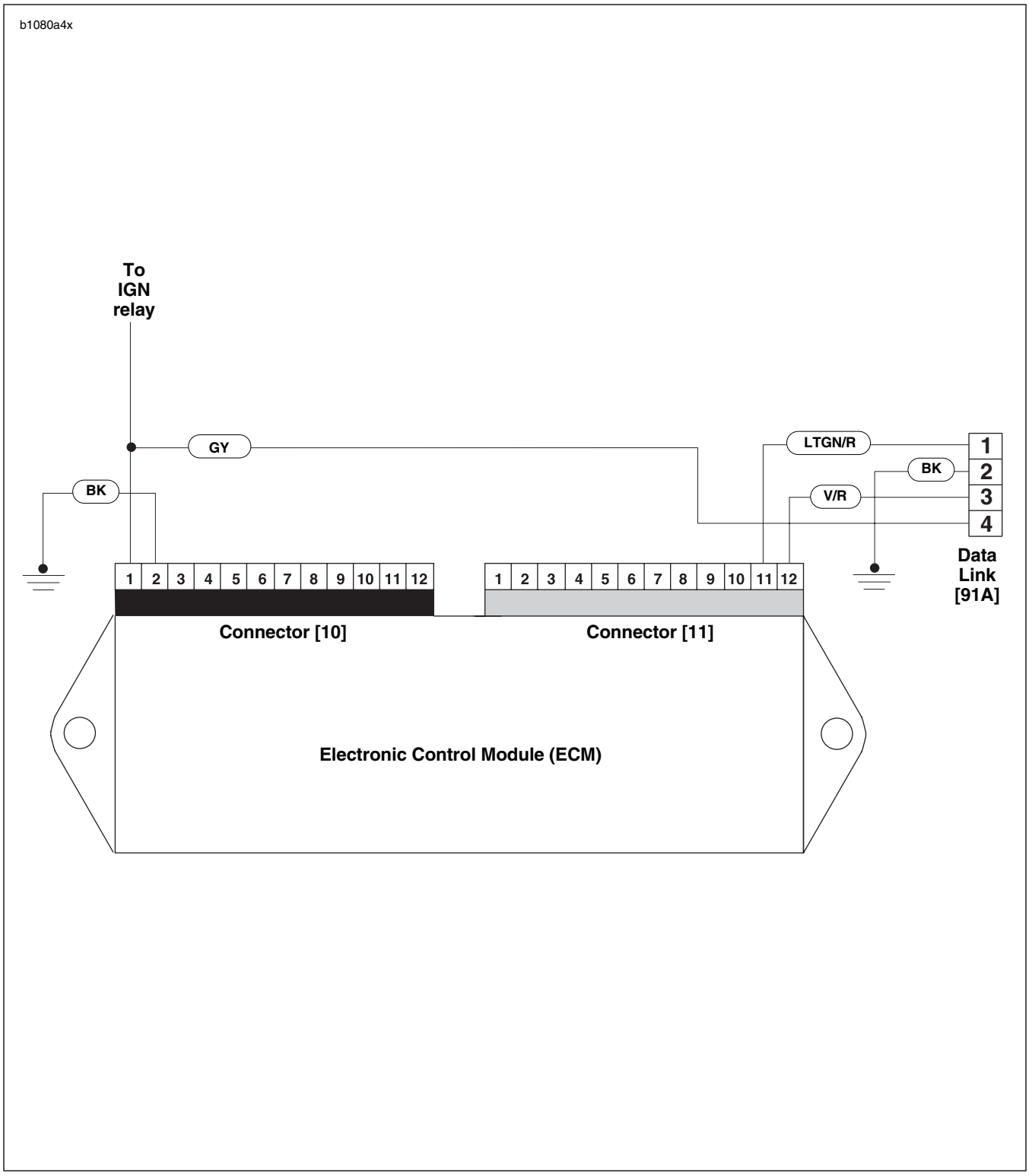
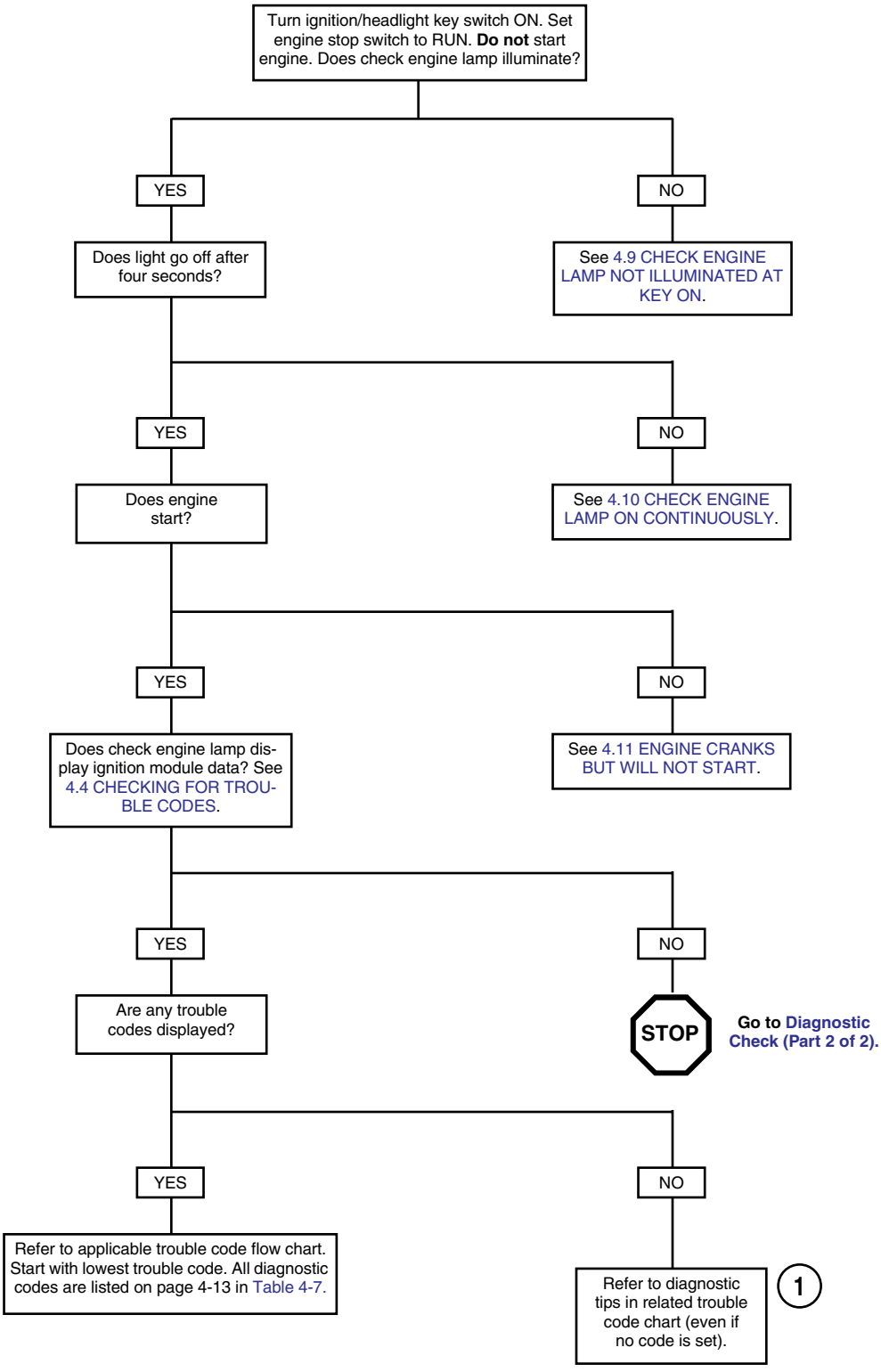


Figure 4-12. Diagnostic Check

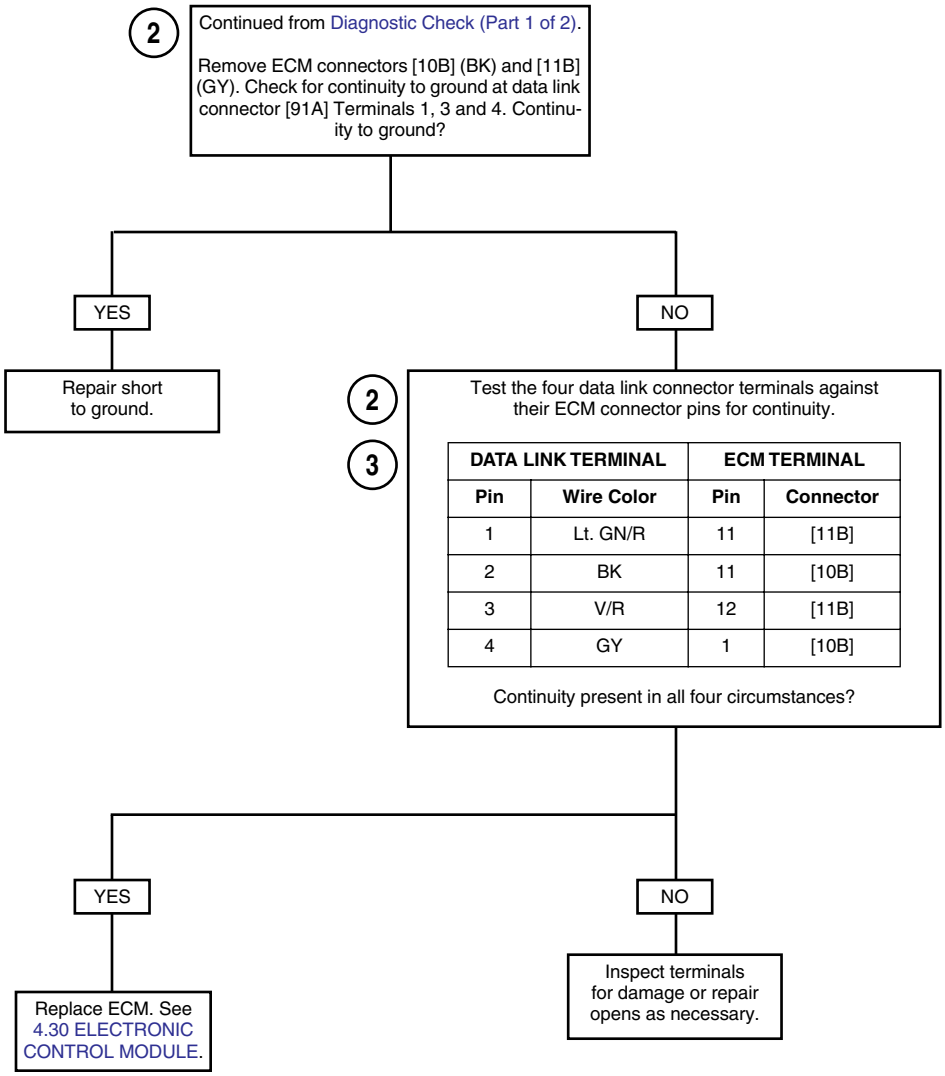
Table 4-8. Wire Harness Connectors in Figure 4-12.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[11]	ECM (gray)	12-place Deutsch	in fairing
[91A]	data link	4-place Deutsch	beneath left side fairing

Diagnostic Check (Part 1 of 2)



Diagnostic Check (Part 2 of 2)



CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON 4.9

GENERAL

If the engine stop switch is set to RUN with the engine off, and the ignition key switch is turned ON, the check engine lamp should illuminate for four seconds. See Figure 4-13.

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

DIAGNOSTICS

Diagnostic Tips

Check for the following conditions:

- Check for open in BK/Y wire.
- Check for blown accessory fuse.
- Check for failed bulb.

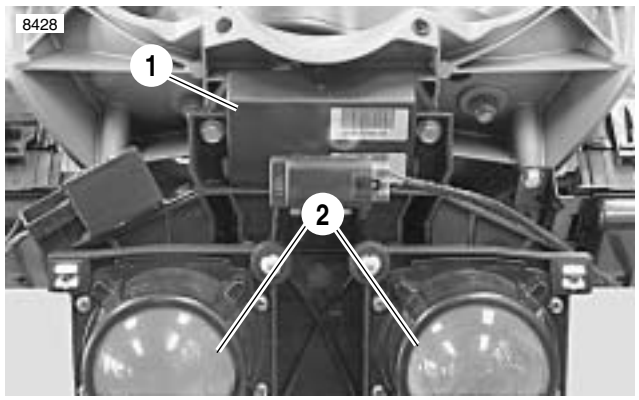
Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.9 flow chart.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probe and patch cord.
2. See Figure 4-14. Inspect connector [10] (black) for contamination or corrosion. If connection is good, replace ECM. See 4.30 ELECTRONIC CONTROL MODULE.
3. Check continuity between instrument connector [39] Pin 7 and ECM connector [10] (black), Pin 4.

1. **Low fuel lamp**
2. **Check engine lamp**

Figure 4-13. Check Engine Lamp (Typical)



1. **ECM**
2. **Headlights**

Figure 4-14. Electronic Control Module

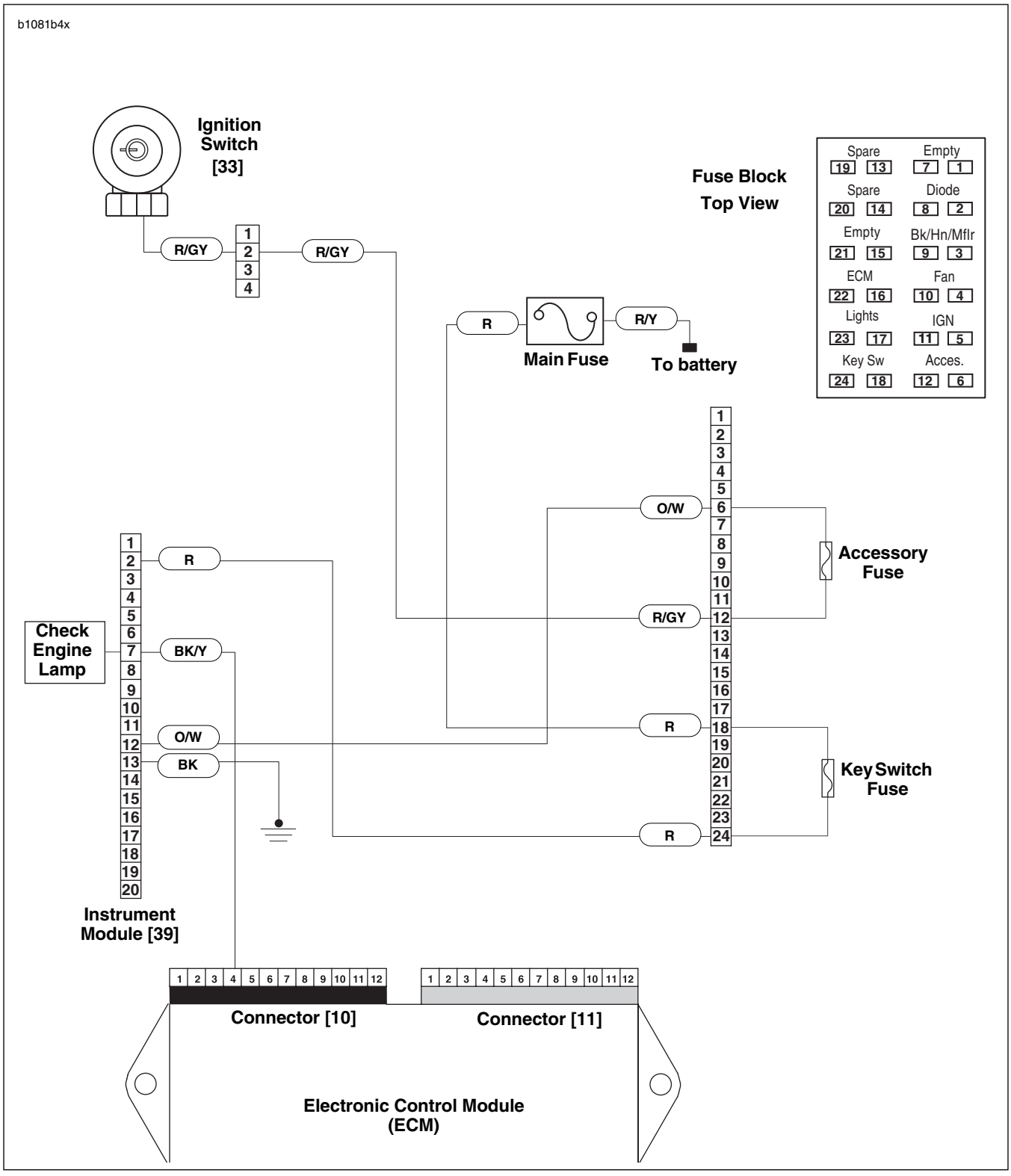
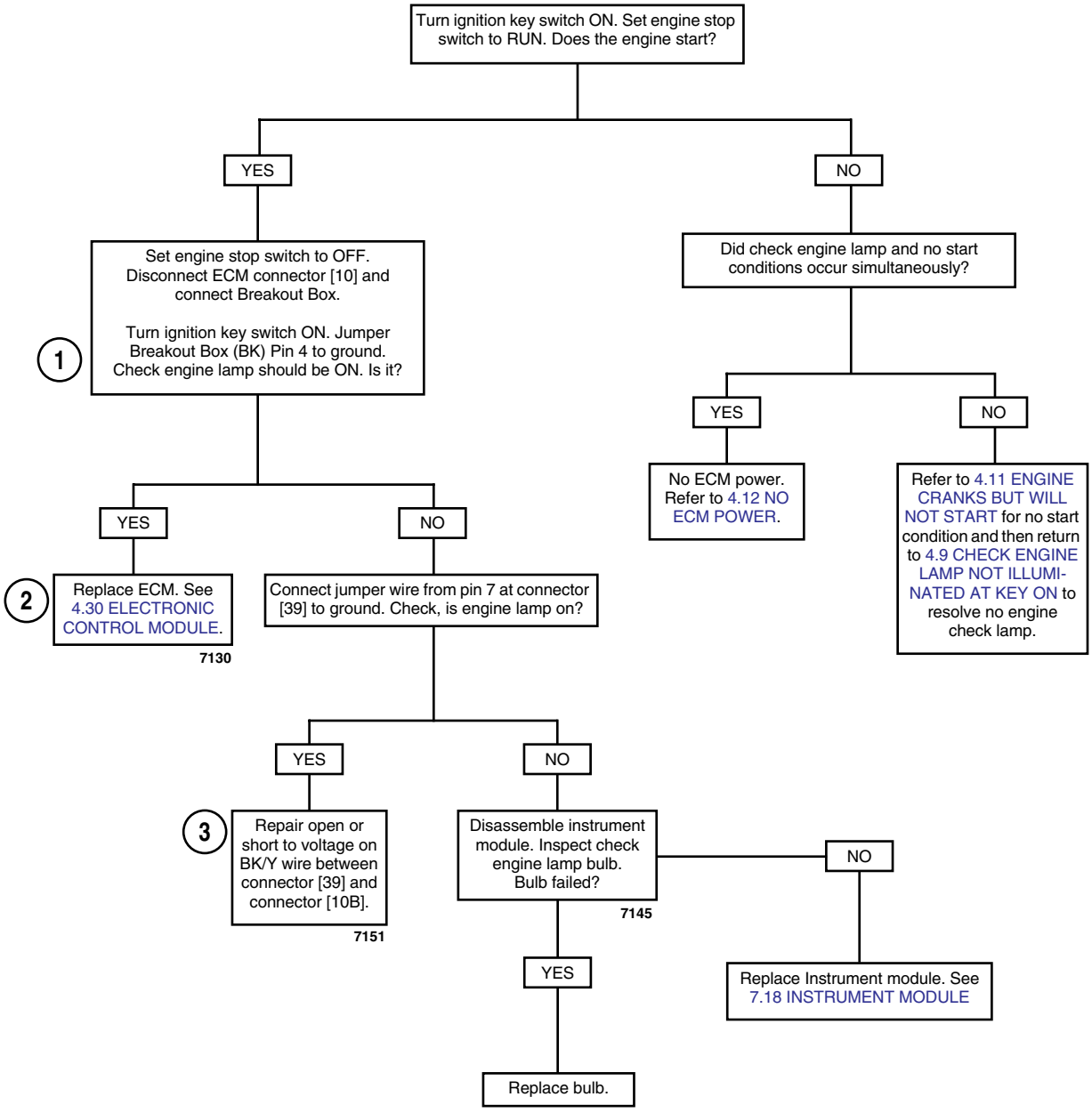


Figure 4-15. Check Engine Lamp Circuit

Table 4-9. Wire Harness Connectors in Figure 4-15.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[39]	instrument module	20-place Multilock	in fairing

Test 4.9


Turn ignition key switch ON. Set engine stop switch to RUN. Does the engine start?
YES
NO
Set engine stop switch to OFF. Disconnect ECM connector [10] and connect Breakout Box.
Turn ignition key switch ON. Jumper Breakout Box (BK) Pin 4 to ground. Check engine lamp should be ON. Is it?
1
Did check engine lamp and no start conditions occur simultaneously?
YES
NO
No ECM power. Refer to 4.12 NO ECM POWER.
Refer to 4.11 ENGINE CRANKS BUT WILL NOT START for no start condition and then return to 4.9 CHECK ENGINE LAMP NOT ILLUMINATED AT KEY ON to resolve no engine check lamp.
YES
NO
2
Replace ECM. See 4.30 ELECTRONIC CONTROL MODULE.
7130
Connect jumper wire from pin 7 at connector [39] to ground. Check, is engine lamp on?
YES
NO
3
Repair open or short to voltage on BK/Y wire between connector [39] and connector [10B].
7151
Disassemble instrument module. Inspect check engine lamp bulb. Bulb failed?
7145
NO
YES
Replace Instrument module. See 7.18 INSTRUMENT MODULE
Replace bulb.

CHECK ENGINE LAMP ON CONTINUOUSLY 4.10

GENERAL

If the engine stop switch is set to RUN with the engine off, and the ignition key switch is turned ON, the check engine lamp should illuminate for four seconds. See Figure 4-16.

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

DIAGNOSTICS

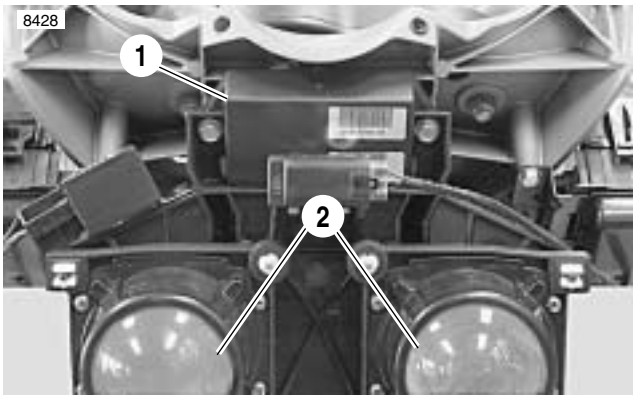
Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.10 flow chart.

1. See Figure 4-17. If the lamp goes off when the black ECM connector [10] is unplugged, the BK/Y wire is **not** shorted to ground.

1. Low fuel lamp
2. Check engine lamp

Figure 4-16. Check Engine Lamp (Typical)



1. ECM
2. Headlights

Figure 4-17. Electronic Control Module

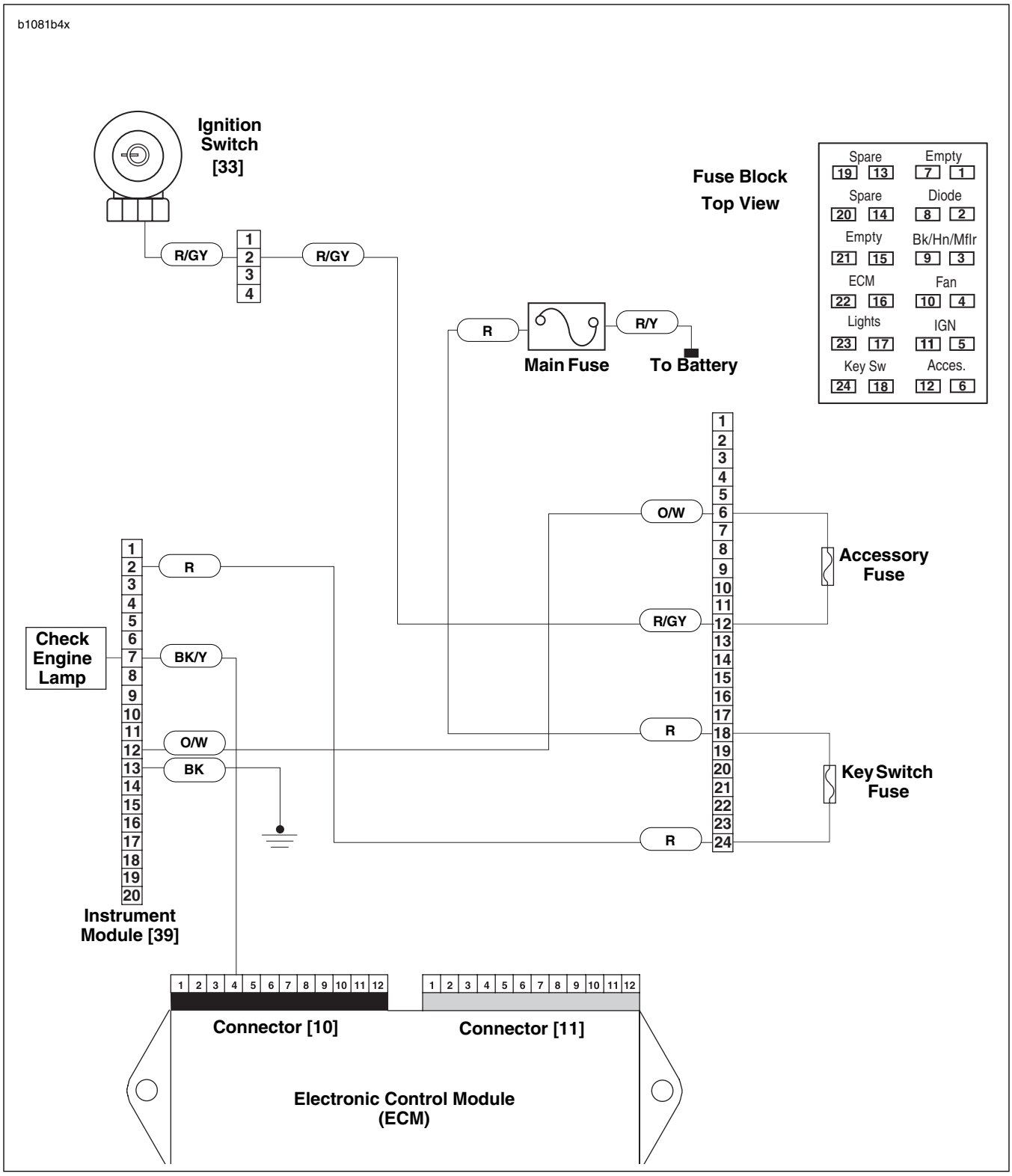
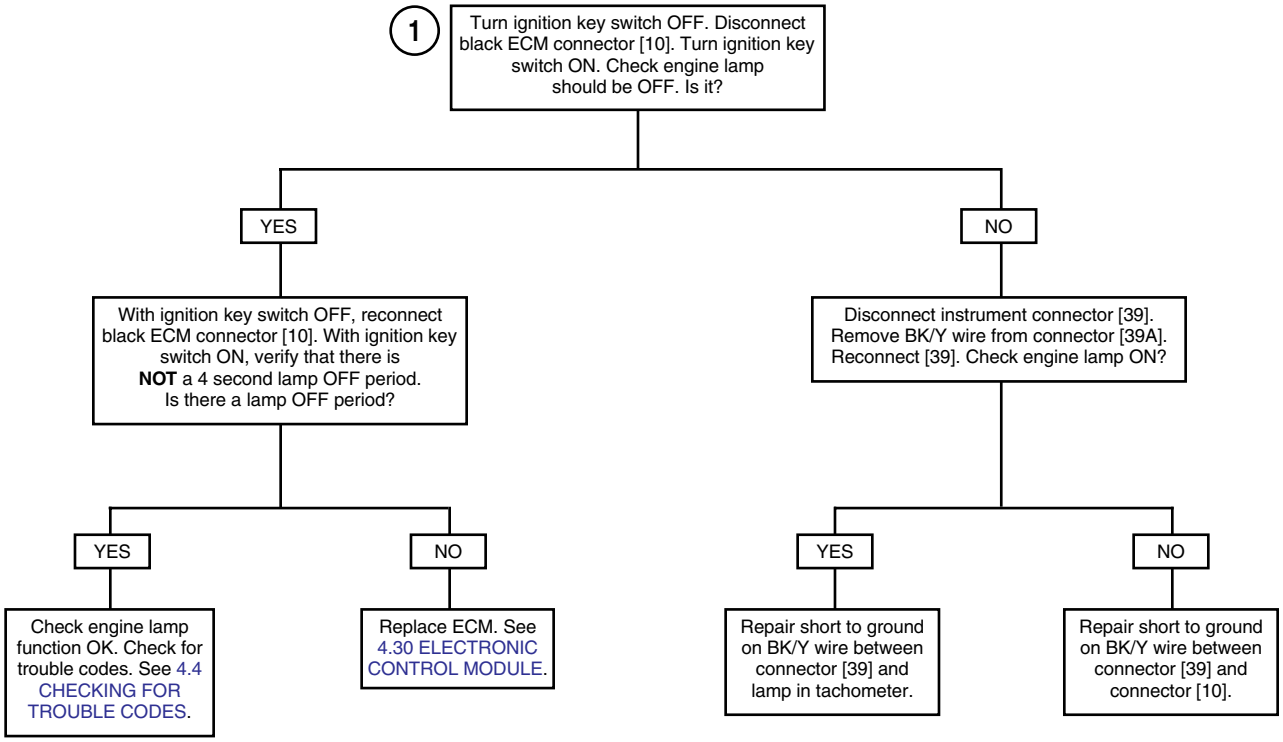


Figure 4-18. Check Engine Lamp Circuit

Table 4-10. Wire Harness Connectors in Figure 4-18.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[39]	instrument module	20-place Multilock	in fairing

Test 4.10


1
Turn ignition key switch OFF. Disconnect black ECM connector [10]. Turn ignition key switch ON. Check engine lamp should be OFF. Is it?
YES
NO
With ignition key switch OFF, reconnect black ECM connector [10]. With ignition key switch ON, verify that there is **NOT** a 4 second lamp OFF period. Is there a lamp OFF period?
Disconnect instrument connector [39]. Remove BK/Y wire from connector [39A]. Reconnect [39]. Check engine lamp ON?
YES
NO
YES
NO
Check engine lamp function OK. Check for trouble codes. See 4.4 CHECKING FOR TROUBLE CODES.
Replace ECM. See 4.30 ELECTRONIC CONTROL MODULE.
Repair short to ground on BK/Y wire between connector [39] and lamp in tachometer.
Repair short to ground on BK/Y wire between connector [39] and connector [10].

ENGINE CRANKS BUT WILL NOT START 4.11

GENERAL

If the starter will not crank engine, the problem is not ignition related. See Section 5-Electric Starter.

NOTE

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

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.11 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-42682) between harness and ECM. See 4.6 BREAKOUT BOX.
2. Check battery condition. Perform a voltage test and recharge if below 12.7 volts. Check battery connections and perform load test. Replace the battery if necessary.
3. Remove spark plug cable from spark plug.
   a. Visually check condition of plug.
   b. See Figure 4-19. Attach cable to SPARK PLUG TESTER (Part No. HD-26792). Clip tester to cylinder head bolt.
   c. While cranking starter, look for spark. Repeat procedure on other spark plug cable.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

4. Purge fuel line of high pressure gasoline. See 4.39 FUEL PUMP.

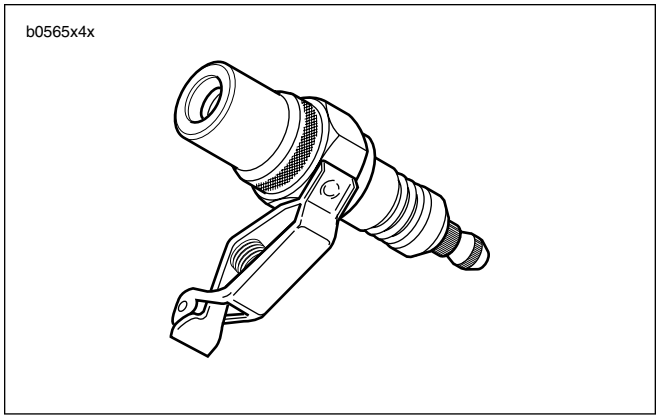


Figure 4-19. Spark Plug Tester (Part No. HD-26792)

Figure 4-20. Ignition Coil Circuit Test

5. Access fuel injectors.
   a. Remove right side air scoop. See 2.35 AIR SCOOPS.
   b. Remove airbox to access fuel injectors. See 4.44 AIR CLEANER ASSEMBLY.
6. See Figure 4-20. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. 34730-2C) into Breakout Box. Note that cranking the engine with test lamp in place of the ignition coil can sometimes cause a code 24 or 25. This condition is normal and does not by itself indicate a malfunction. Codes must be cleared if his condition occurs.
7. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) gray pin probe and patch cord.

Table 4-11. Wire Harness Connectors in Figure 4-21.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[11]	ECM (gray)	12-place Deutsch	in fairing
[14]	cam position sensor	3-place Deutsch	under sprocket cover
[83]	ignition coil	3-place Amp	beneath airbox base

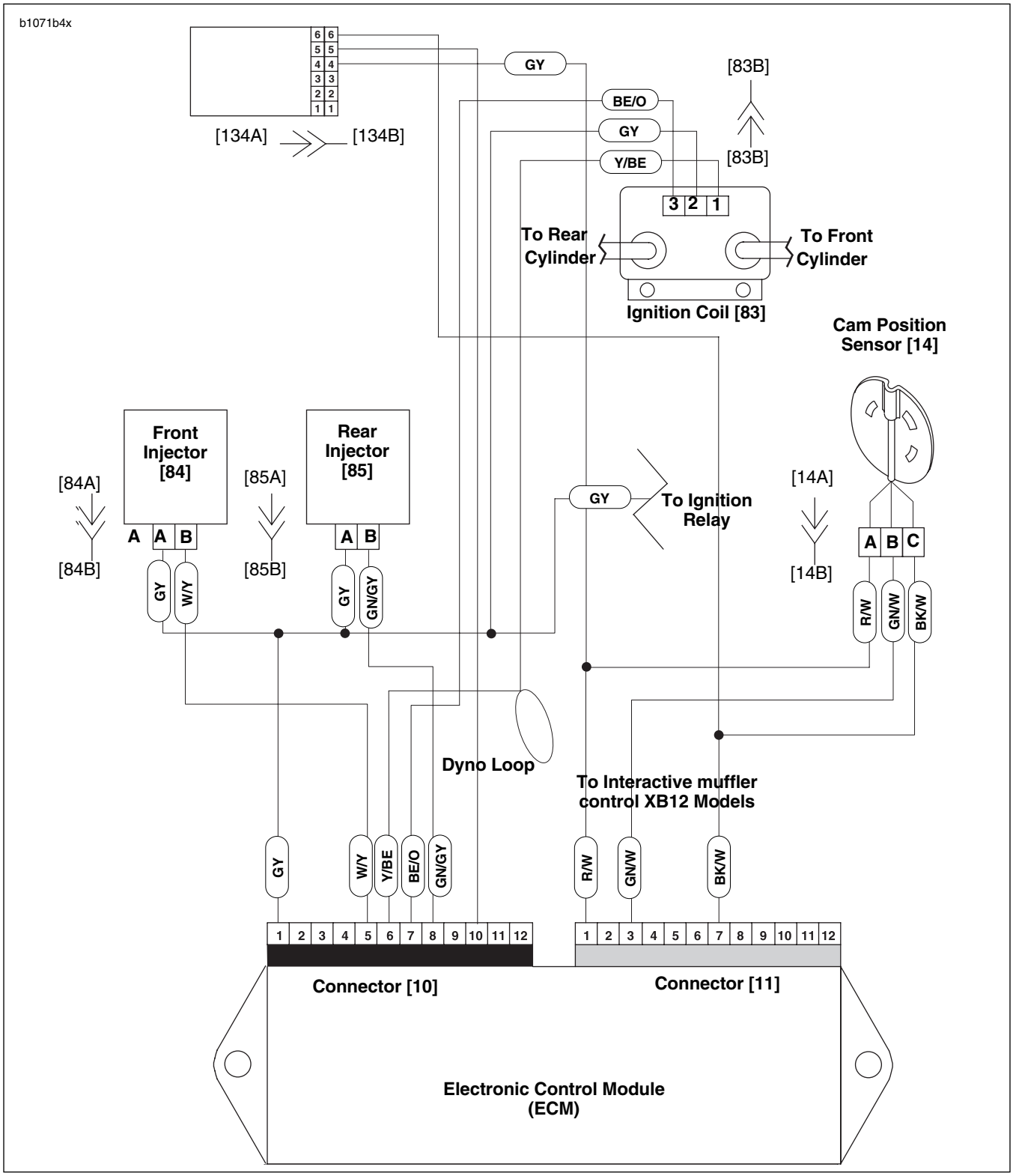
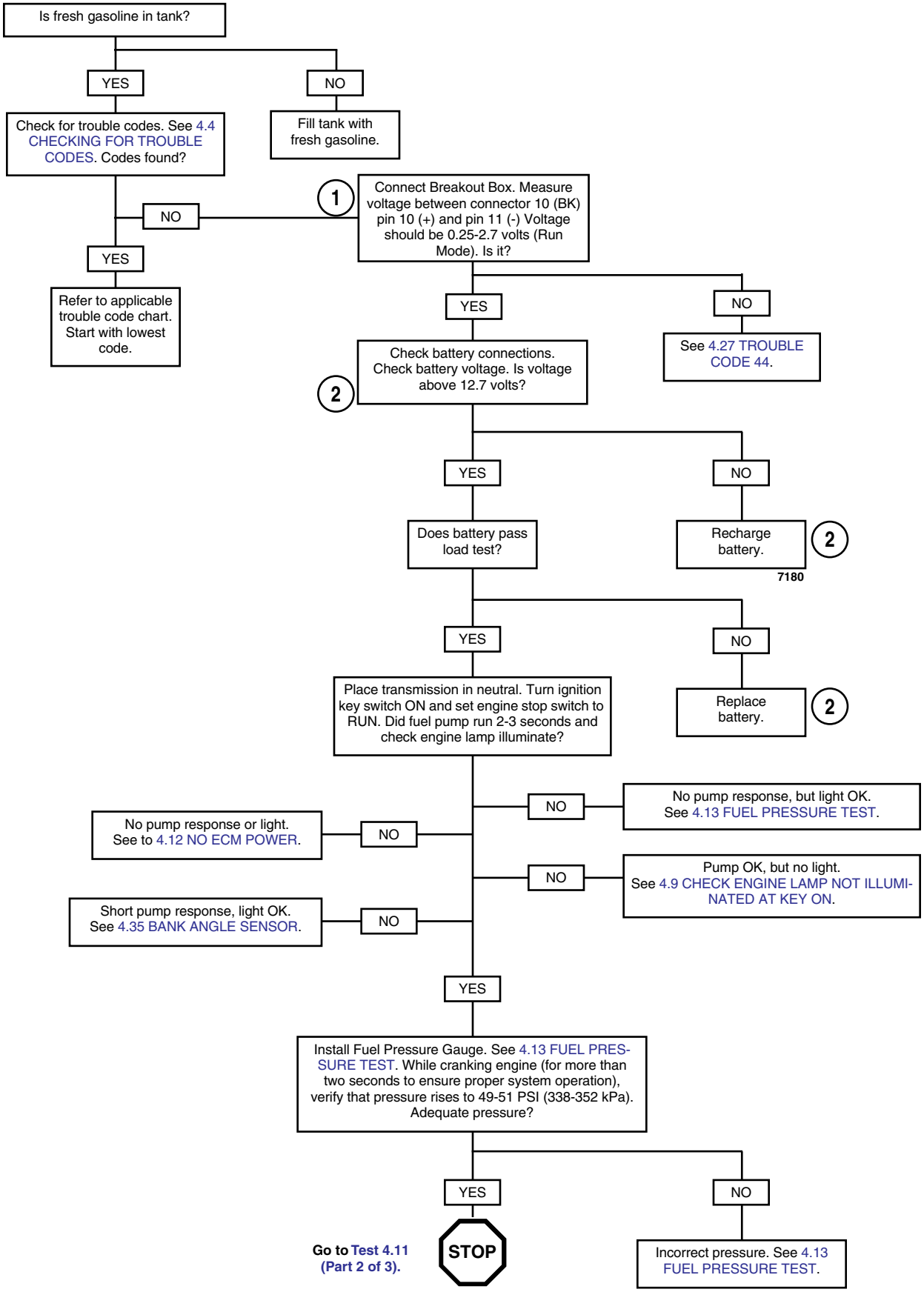
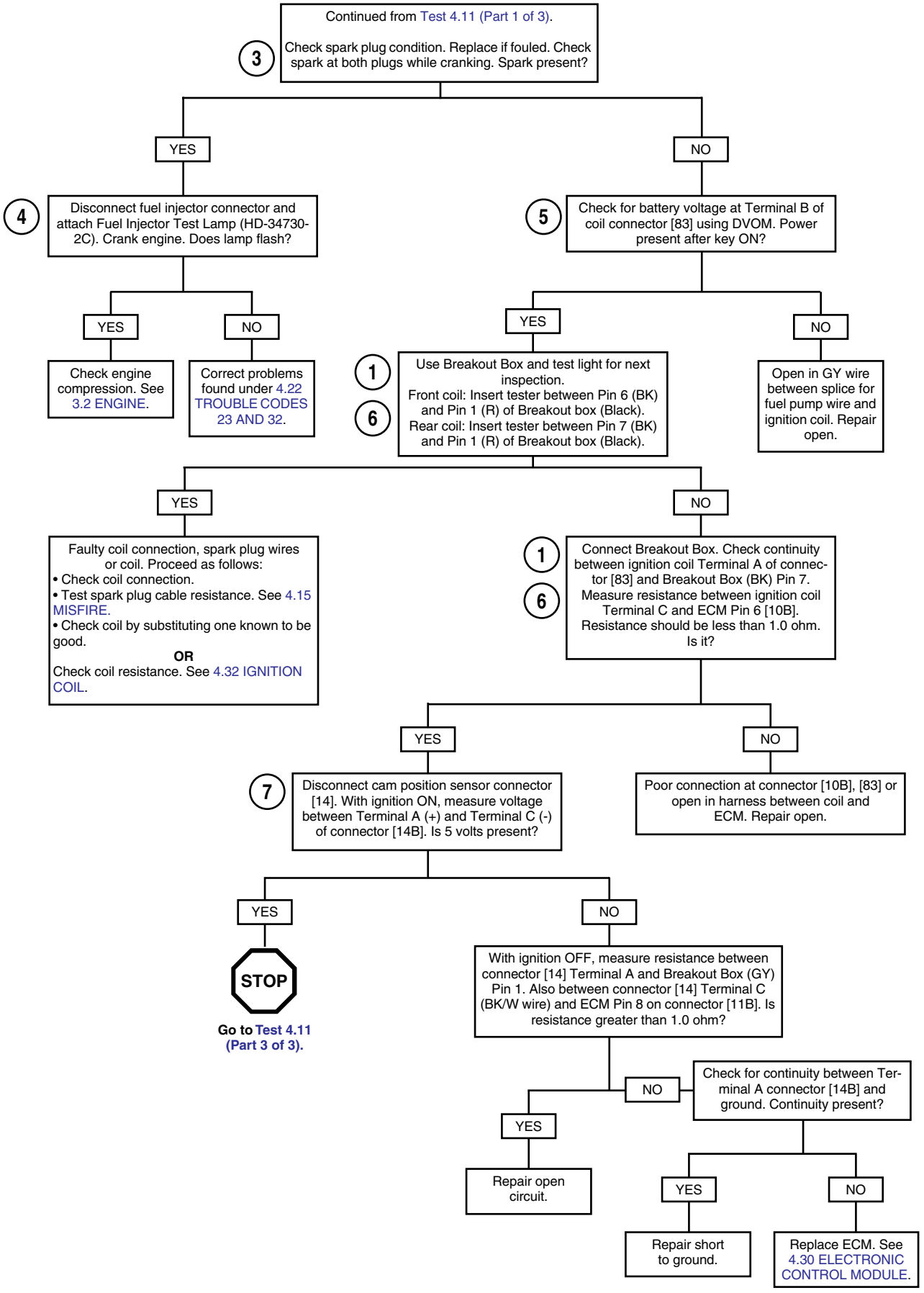


Figure 4-21. Ignition Circuit

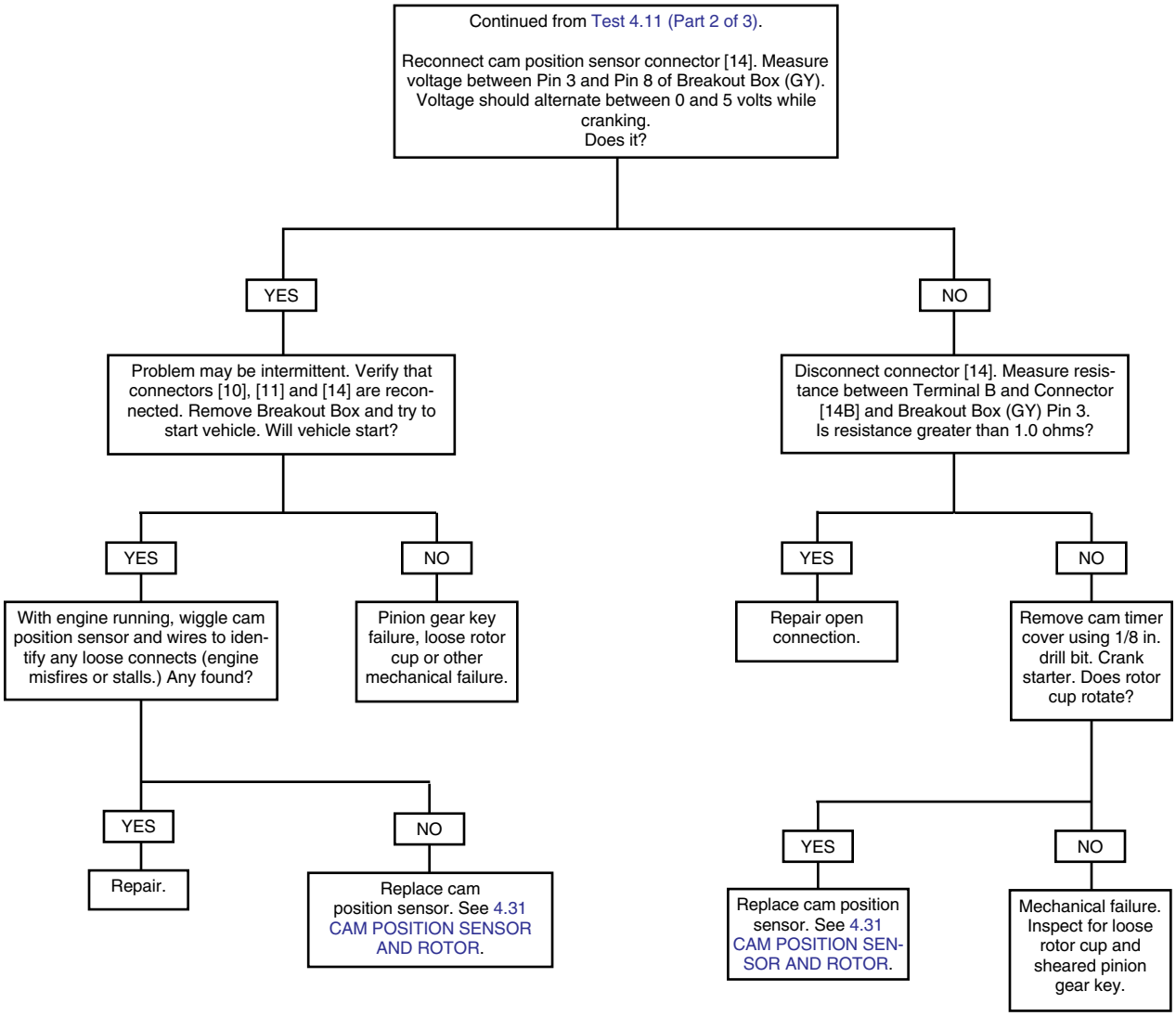
Test 4.11 (Part 1 of 3)



Test 4.11 (Part 2 of 3)



Test 4.11 (Part 3 of 3)



NO ECM POWER 4.12

GENERAL

A relay controlled by the engine stop switch supplies power to the ECM. The relay requires a ground to operate. If the ground is not established, the ECM will not receive power. If the ECM does not appear to be receiving power, check the ground sources. A blown ignition fuse can also disable the ECM.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.12 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-42682) to ECM. See 4.6 BREAKOUT BOX.

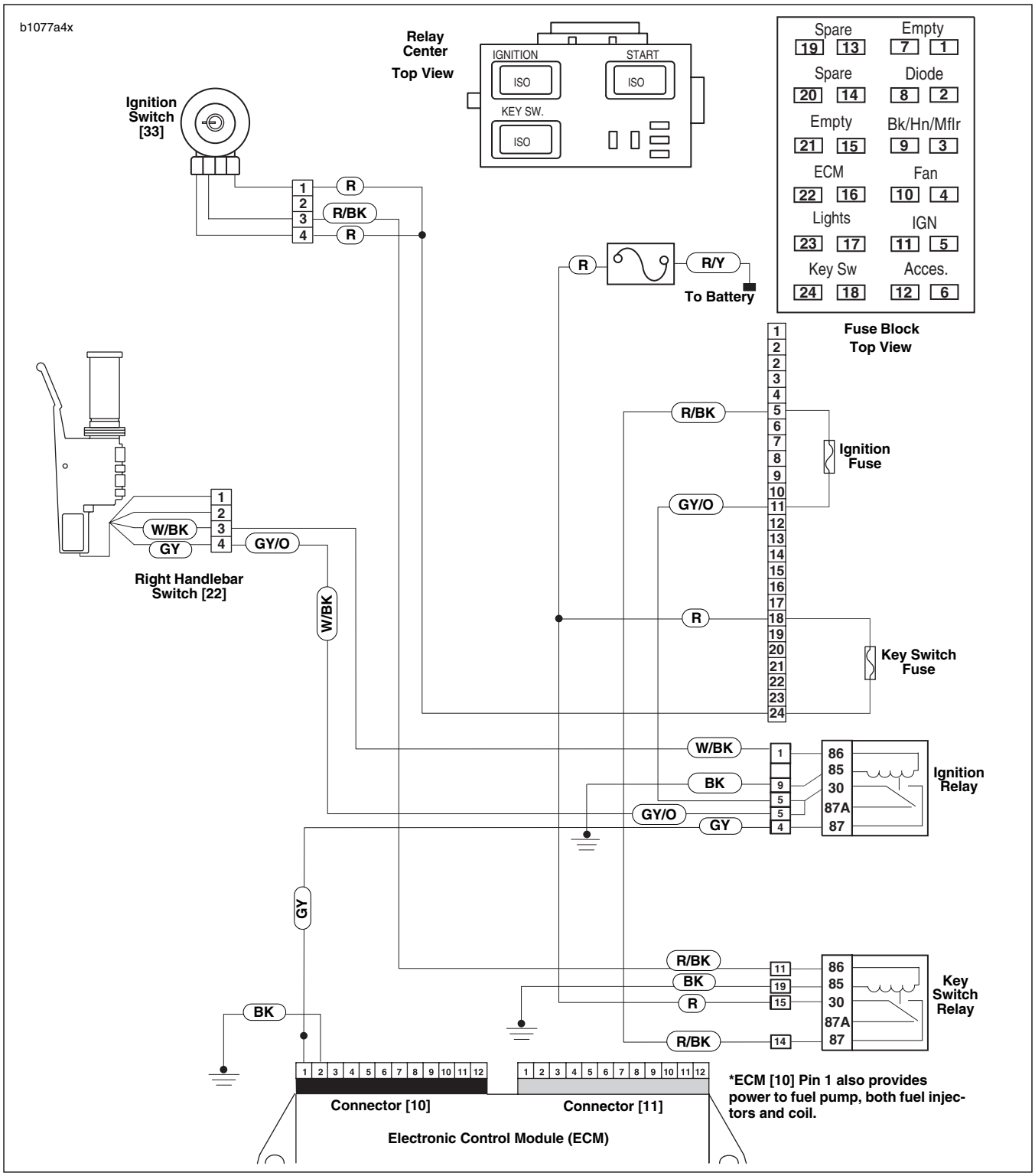


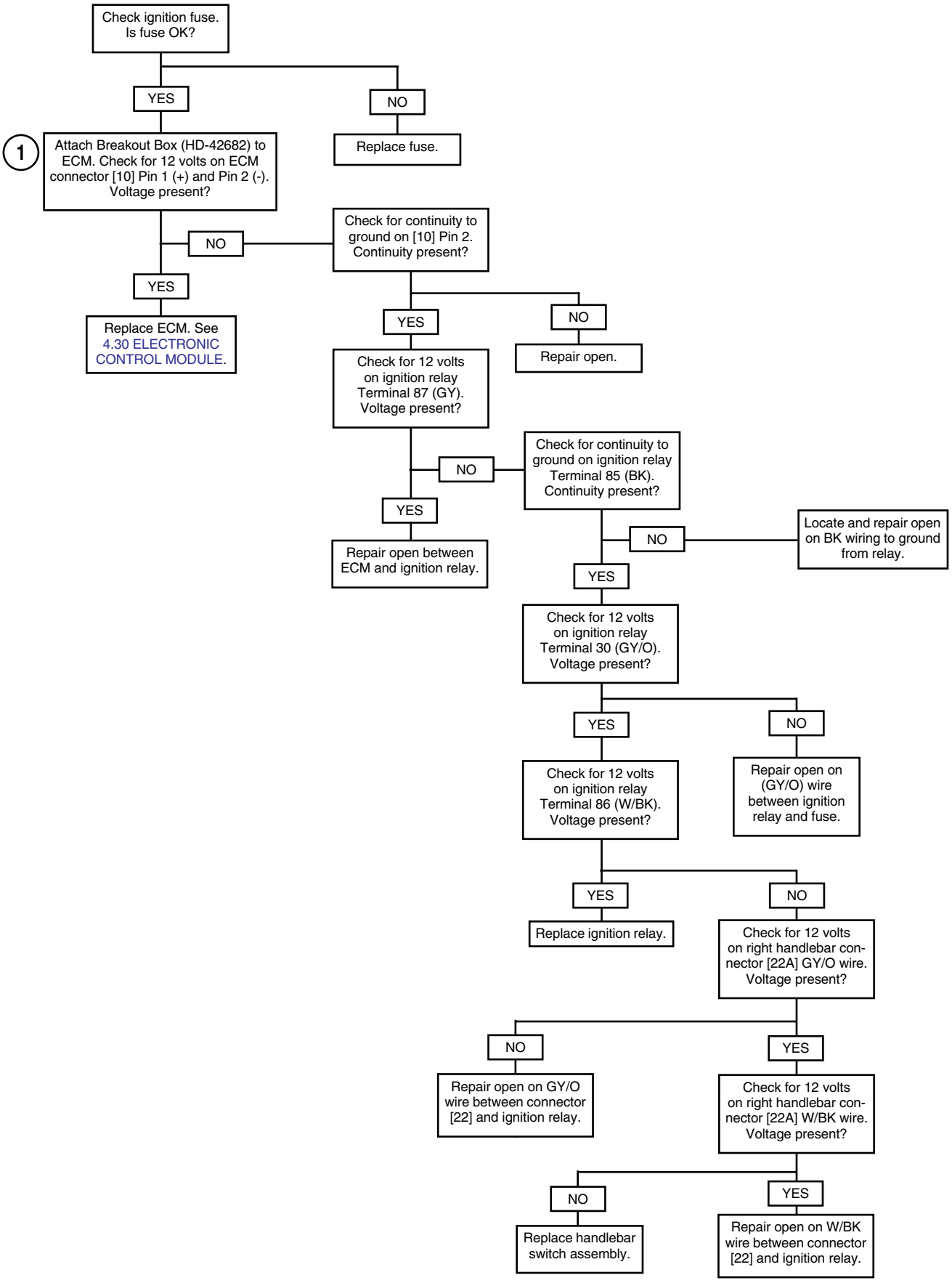
Figure 4-22. ECM Power

Table 4-12. Wire Harness Connectors in Figure 4-22.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[22]	right hand controls	4-place Multilock	beneath right side of fairing
[95]	clutch switch	2-place Multilock	beneath fairing

No ECM Power

CONDITION: Key ON and transmission in neutral



FUEL PRESSURE TEST 4.13

INSPECTION

PART NO.	SPECIALTY TOOL
B-45522	Fuel pressure gauge adapter
HD-41182	Fuel pressure gauge

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Remove airbox. See 4.44 AIR CLEANER ASSEMBLY.
2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-23. Disconnect the 4-place fuel pump connector [86]. The connector is located inside the left rear portion of the fuel tank/frame.
   b. With the motorcycle in neutral, start the engine and allow vehicle to run.
   c. When the engine stalls, press the starter button for 3 seconds to remove any remaining fuel from fuel line.

⚠WARNING

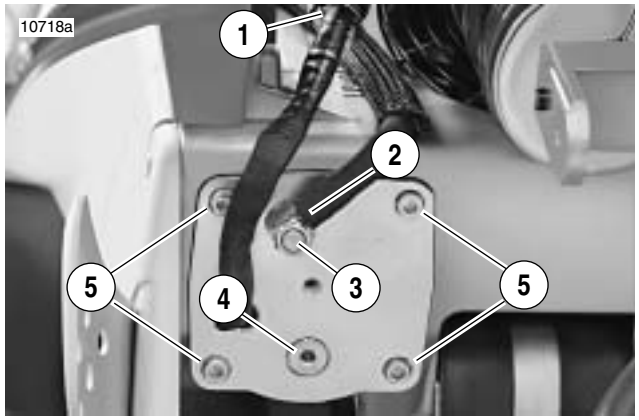
With fuel tank drained, gasoline can spill from bore when supply valve is loosened or removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00277a)

3. See Figure 4-24. Depress button (2) of fuel line connector and disconnect the fuel line (3) from throttle body inlet (1).
4. See Figure 4-25. Attach FUEL PRESSURE GAUGE ADAPTER (Part No. B-45522) (2) to throttle body inlet (1).
5. Connect the fuel line (3) to fuel pressure gauge adapter.

NOTE

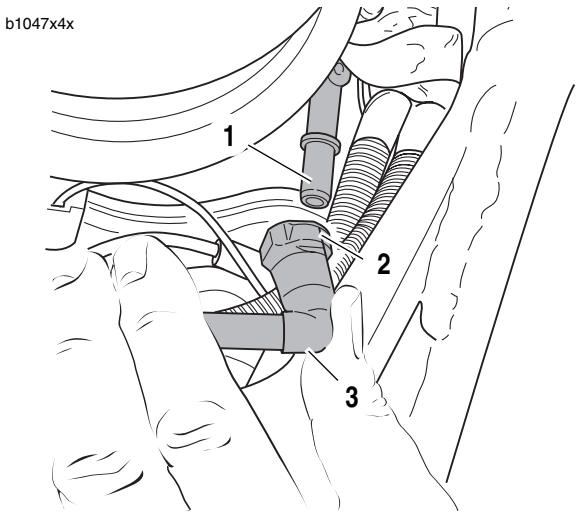
See Figure 4-26. Verify that fuel valve (2) and air bleed petcock (5) on the gauge are closed.

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



1. **Connector [86]**
2. **Fuel supply fitting**
3. **Fuel supply stud**
4. **Drain plug**
5. **Fasteners**

Figure 4-23. Fuel Pump Installation



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

Figure 4-24. Fuel Line

7. See Figure 4-23. Attach fuel pump connector [86] to main wiring harness.
8. See Figure 4-26. Pressurize the fuel system.
   a. Start and idle engine to pressurize the fuel system.
   b. Open fuel valve (2) on fuel pressure gauge to allow fuel to flow down the gauge hose.
   c. Position the air bleed tube (3) into proper container.
   d. Open and close the air bleed petcock (5) to purge the fuel pressure gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube.
   e. Close the air bleed petcock.
9. Open throttle and increase engine speed to 2500-3000 RPM. Note the reading on the pressure gauge.
   a. If pressure is 49-51 PSI (338-352 kPa) then system is operating within limits.
   b. If pressure is not within limits, see Test 4.13 (Part 1 of 2) flow chart after disconnecting pressure gauge.

⚠ WARNING

With fuel tank drained, gasoline can spill from bore when supply valve is loosened or removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00277a)

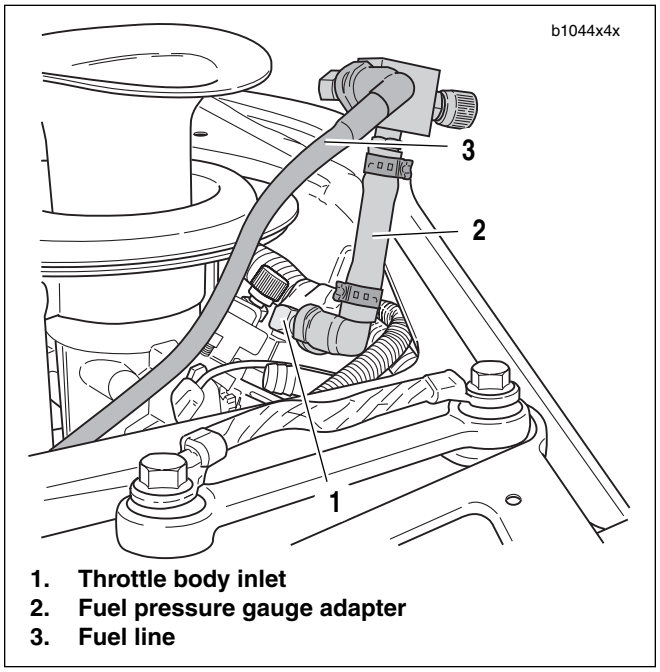
10. See Figure 4-26. Turn engine off. Detach pressure gauge (4) from adapter (1).
    a. Open the air bleed petcock (5) to relieve fuel system pressure and purge the pressure gauge of gasoline.
    b. Remove pressure gauge from adapter.
11. Detach adapter from vehicle.
12. Connect fuel line to throttle body inlet.

DIAGNOSTICS

Diagnostic Notes

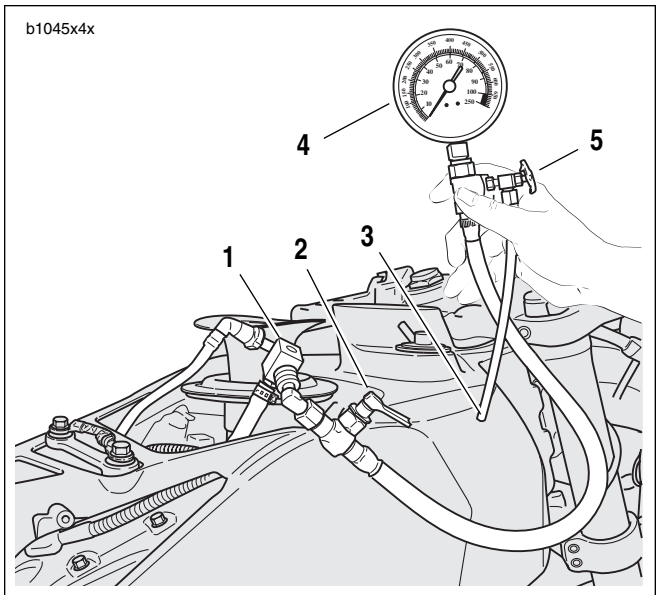
The reference numbers below correlate with the circled numbers on the Test 4.13 flow charts.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probe and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-42682) to ECM. See 4.6 BREAKOUT BOX.



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

Figure 4-25. Fuel Pressure Gauge Adapter



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

Figure 4-26. Fuel Pressure Gauge (Part No. HD-41182)

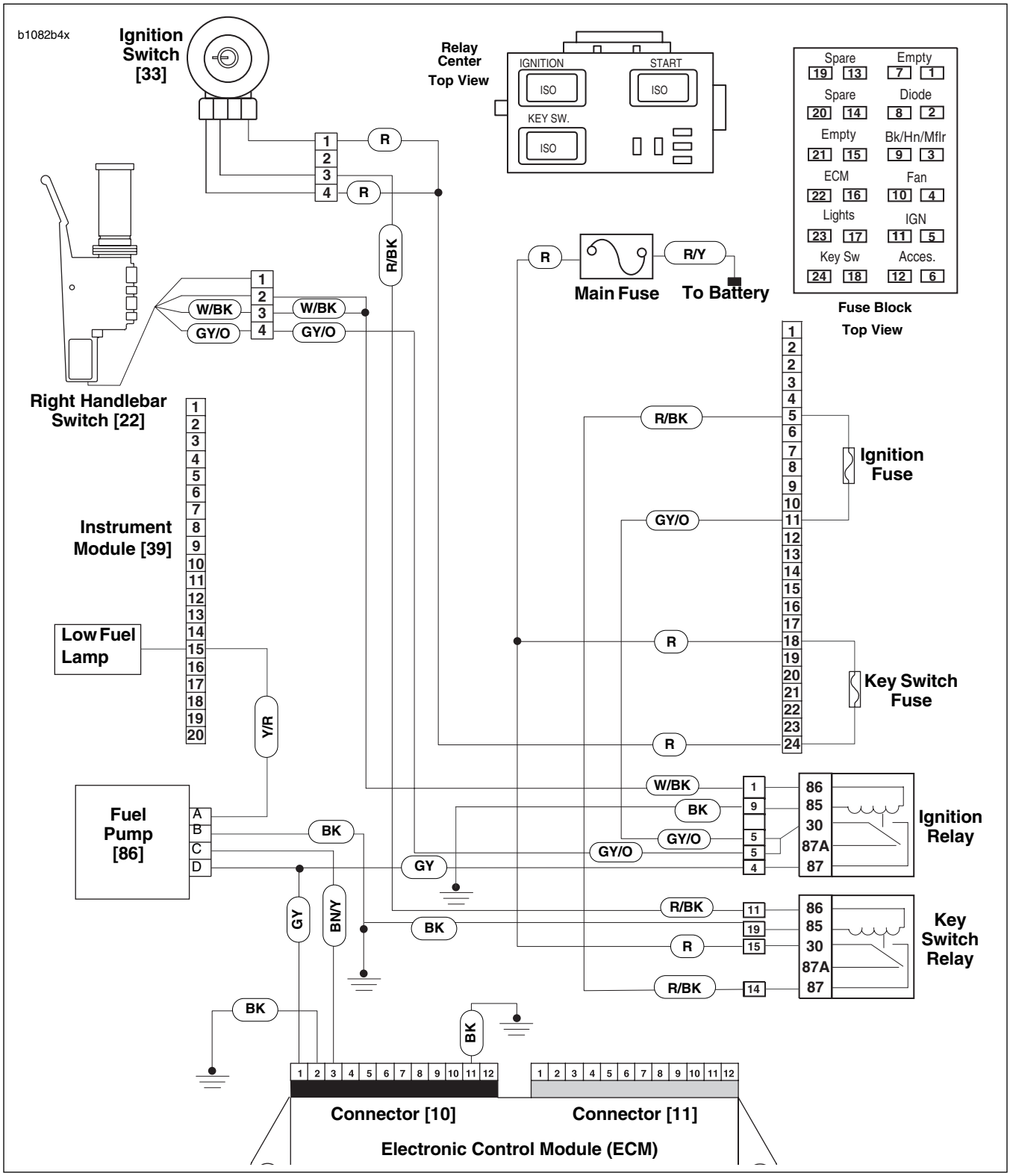
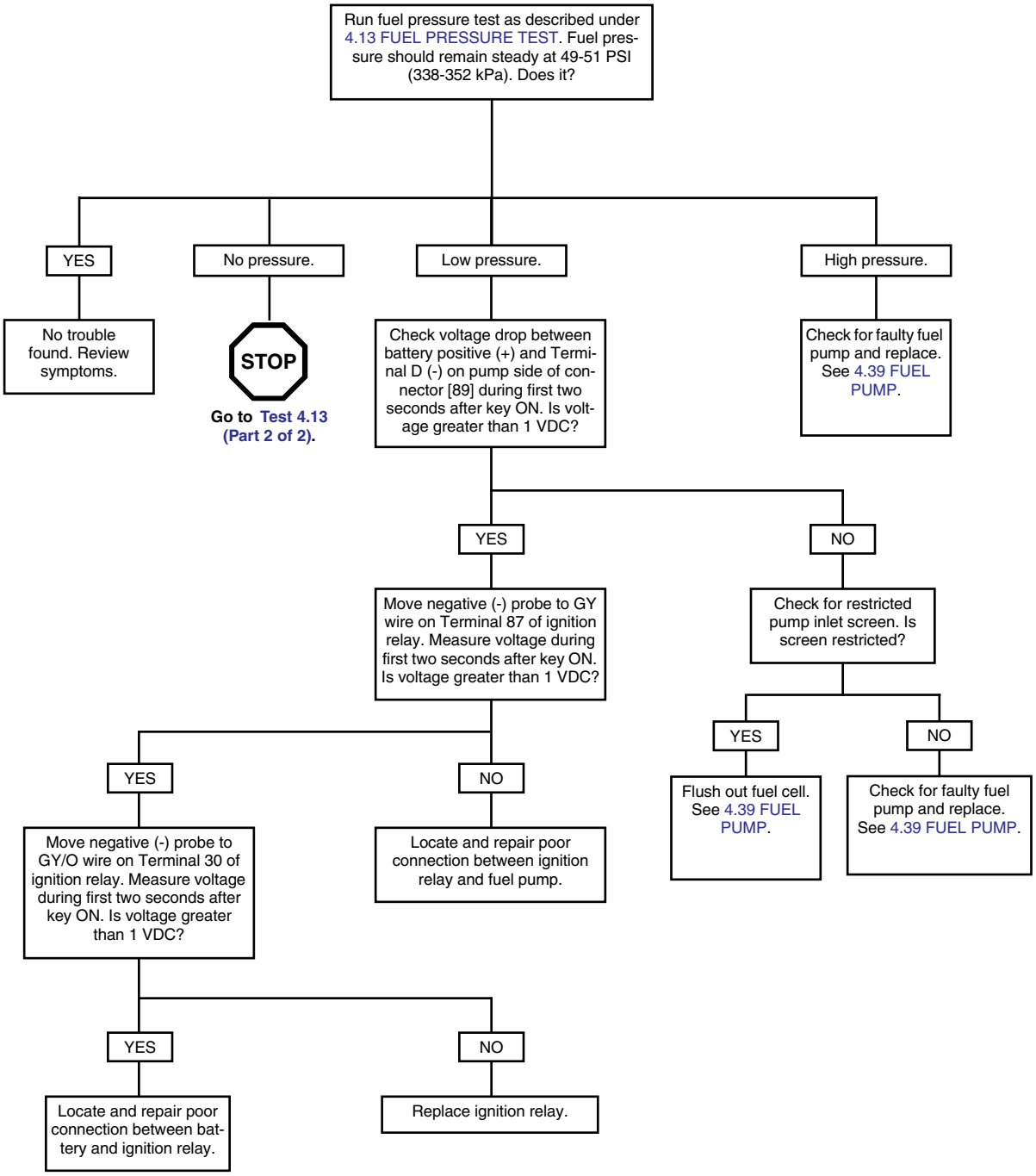


Figure 4-27. Fuel Pump Circuit

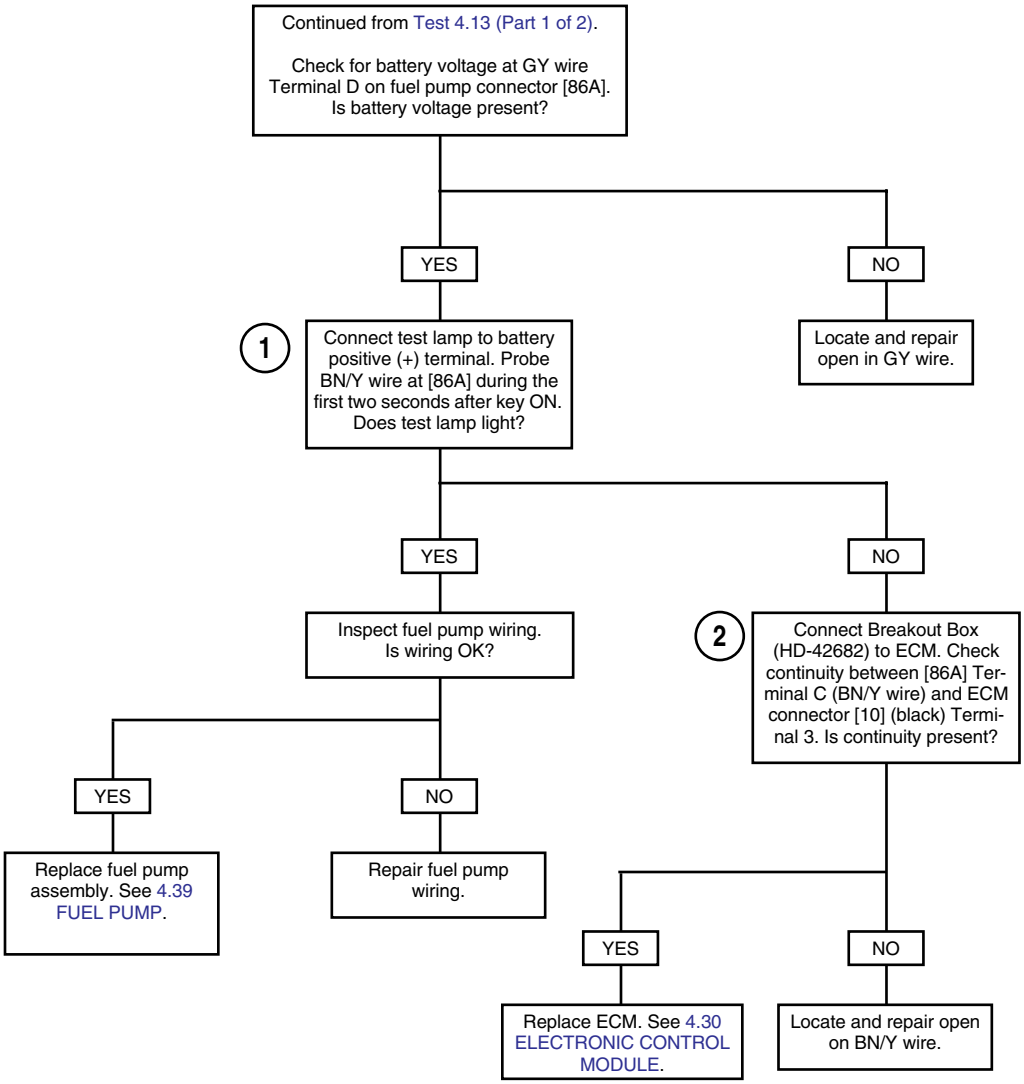
Table 4-13. Wire Harness Connectors in Figure 4-27.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[39]	instrument module	20-place Multilock	in fairing
[86]	fuel pump	4-place Multilock	left side of rear shock absorber

Test 4.13 (Part 1 of 2)



Test 4.13 (Part 2 of 2)



IDLE SPEED CONTROL 4.14

ADJUSTMENTS

NOTE

Setting the idle below the recommended speed can result in hard starting, especially in cold ambient temperatures.

See Figure 4-28. The idle speed control cable (1) is located on the left side of the vehicle between the front cylinder head and the ram air scoop assembly (2). Idle speeds are listed in 4.1 SPECIFICATIONS. A 3/16 in. allen wrench may be used to turn adjuster knob.

Table 4-14. Engine Idle Speeds

MODEL	REGULAR IDLE
All	1050-1150

NOTE

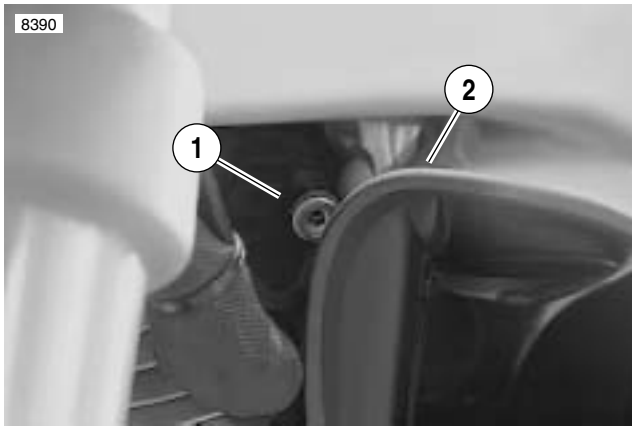
Idle adjuster is located near the engine and could be extremely hot. Use suggested tool for adjusting the idle speed. Failure to comply could result in minor or moderate injury.

The idle speed should be adjusted when the engine is at normal operating temperature 320° F (160° C).

NOTE

An idle speed too low can cause poor throttle response. An idle speed too high can cause a slow return to idle.

See 1.16 THROTTLE CABLE AND IDLE SPEED ADJUSTMENT for more information on idle speed adjustment.



1. Idle speed control cable
2. Ram air scoop

Figure 4-28. Idle Adjustment Cable

GENERAL

Misfire At Idle or Under Load

Misfire conditions may be caused by:

- Battery condition and connections.
- Fuel system problems. See tables under 4.8 INITIAL DIAGNOSTIC CHECK.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.15 flow charts.

⚠WARNING

Thoroughly wipe up any spilled fuel and dispose of rags in a suitable manner. Any open spark around gasoline or other combustibles could result in fire or explosion causing death or serious injury.

1. See Figure 4-29. A SPARK TESTER (Part No. HD-26792) must be used to verify adequate secondary voltage (25,000 volts) at the spark plug.
   a. Turn ignition switch OFF.
   b. Remove spark plug cable from spark plug. Visually check plug condition.
   c. Attach cable to SPARK TESTER. Clip tester to cylinder head bolt.
   d. While cranking engine, watch for spark to jump tester gap on leads.
   e. Reinstall and repeat procedure on other spark plug cable.
2. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. See 7.4 SPARK PLUG CABLES.
   b. Using an ohmmeter, touch probes to terminals on each end plug wire.
   c. Compare resistance values to Table 4-15. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

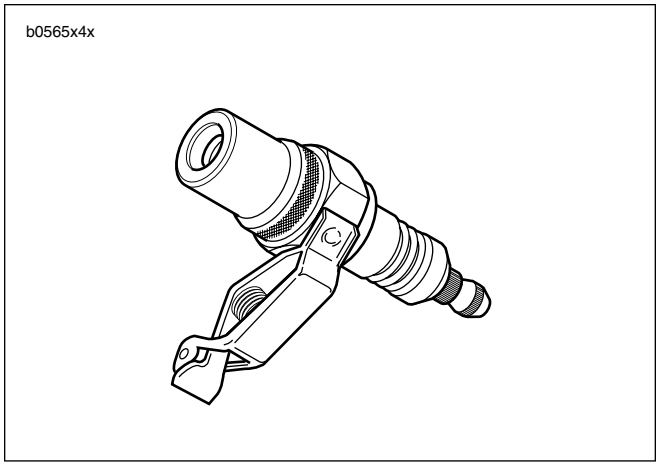


Figure 4-29. Spark Tester (Part No. HD-26792)

Table 4-15. Spark Plug Cables

SPECIFICATION	FRONT & REAR
Length-in. (mm)	5.75 (146)
Resistance -ohms	1,430-3,360

3. If carbon tracking is evident, replace ignition coil and inspect spark plug wires. Wires must be clean and tight. Excessive wire resistance or faulty connections can cause coil damage. See 4.32 IGNITION COIL.
4. This test can also be performed by substituting a known good coil for one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test. See 4.32 IGNITION COIL.
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) gray pin probe and patch cord.

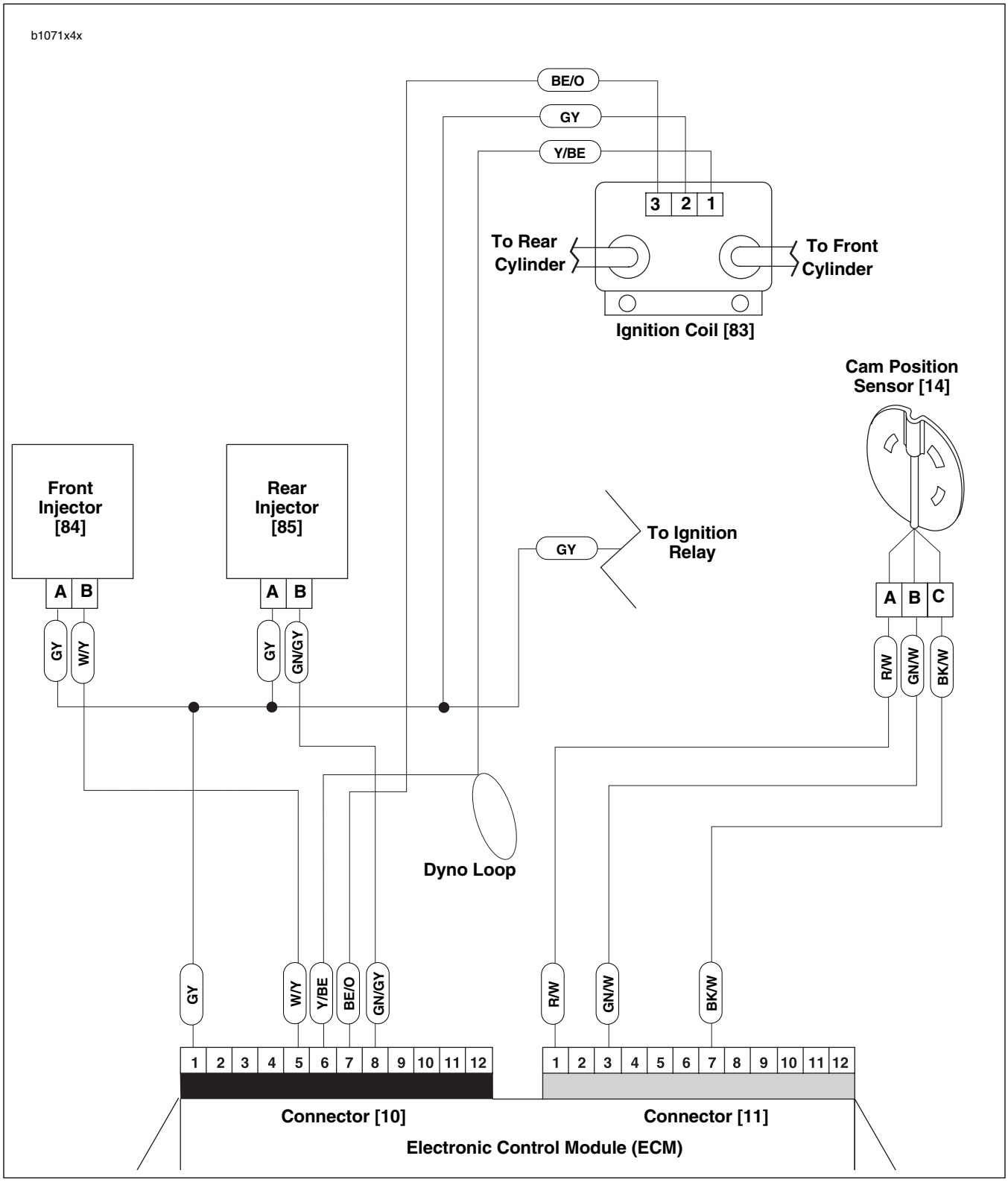
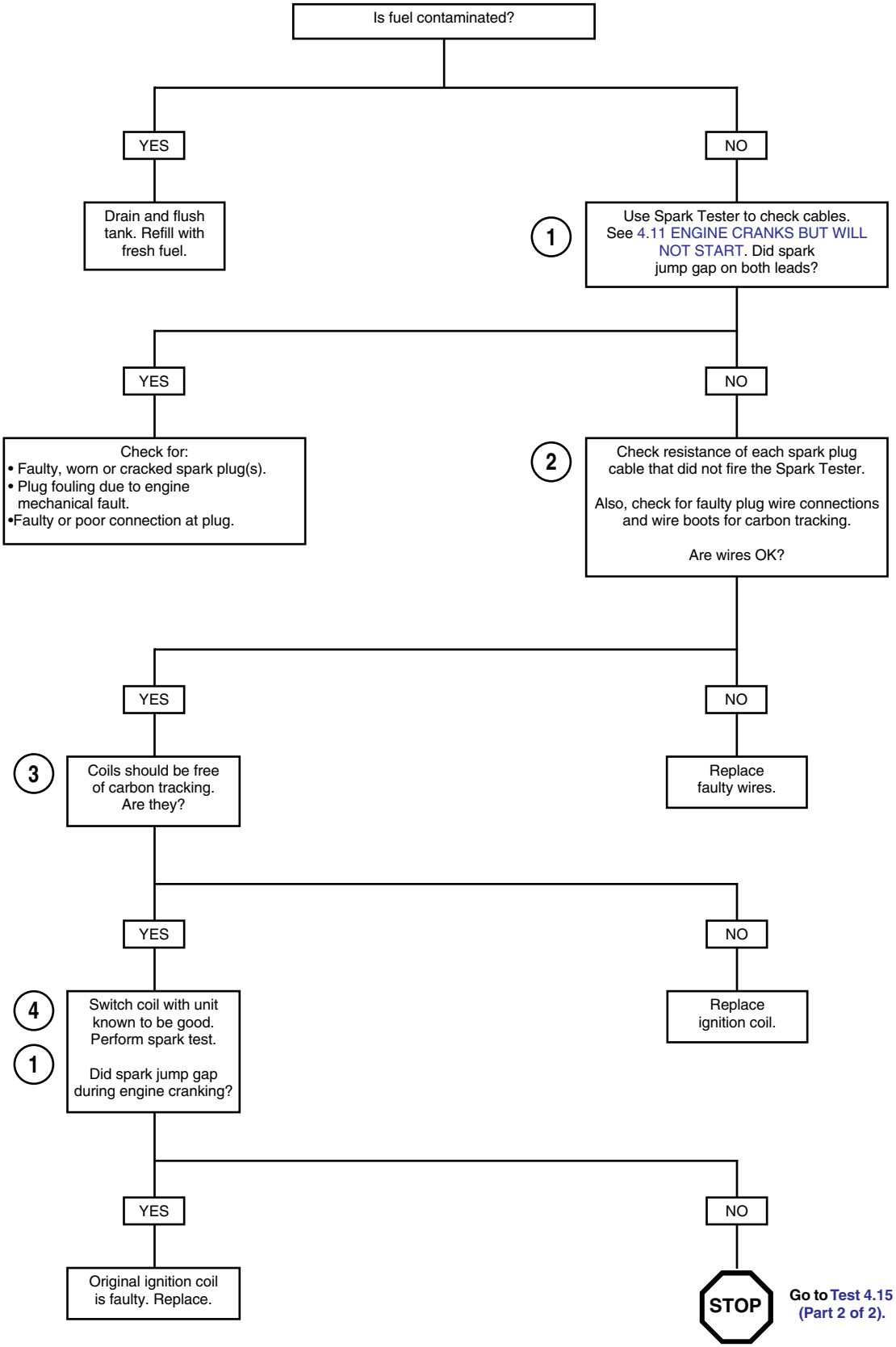


Figure 4-30. Ignition Coil Circuit

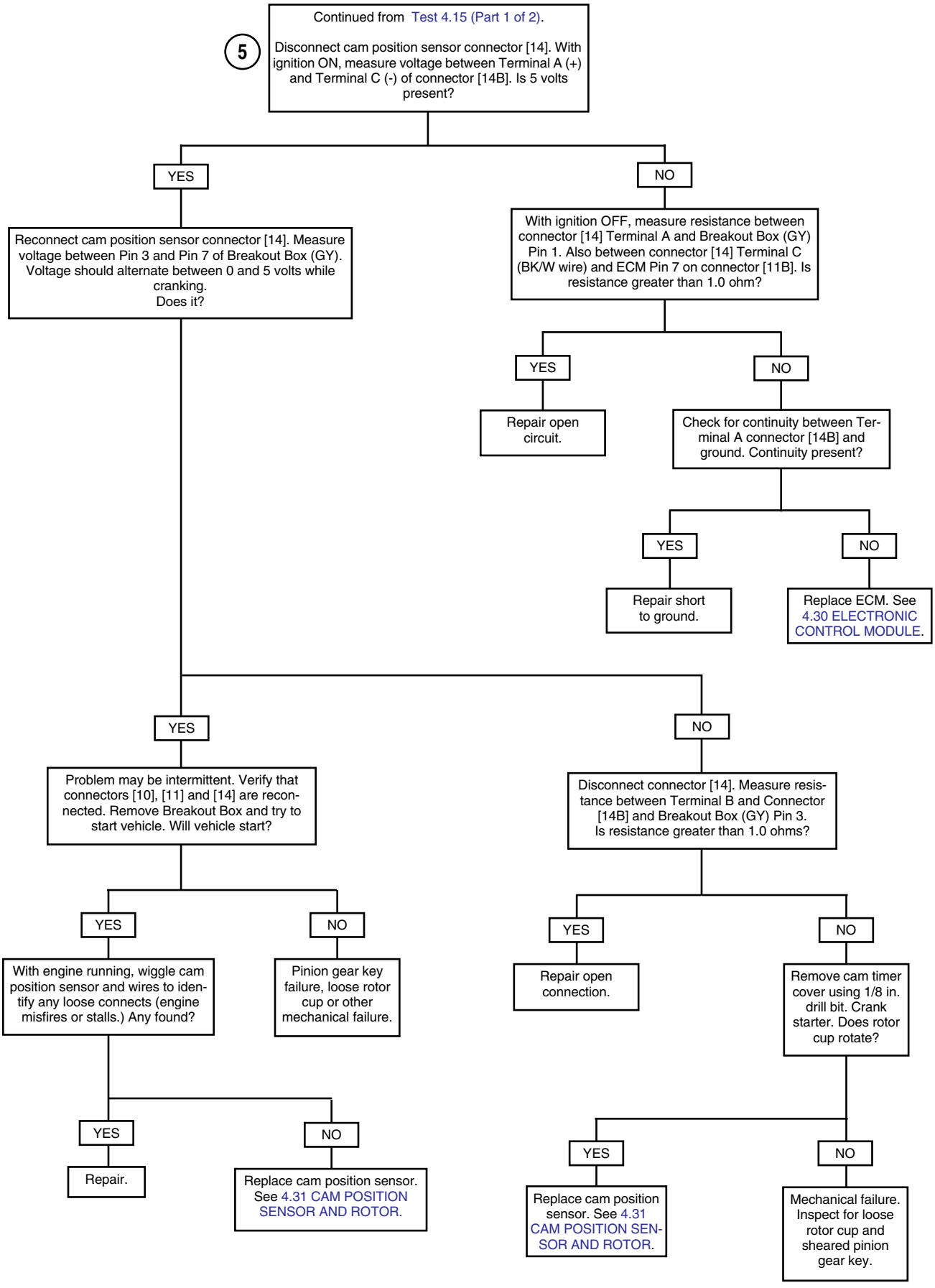
Table 4-16. Wire Harness Connectors in Figure 4-30.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	ECM (black)	12-place Deutsch	in fairing
[22]	right hand controls	4-place Multilock	beneath right side of fairing
[83]	ignition coil	3-place Packard	beneath airbox base

Test 4.15 (Part 1 of 2)



Test 4.15 (Part 2 of 2)



NOTES