SPORTSTER TROUBLESHOOTING MANUAL

Begin any troubleshooting procedure by defining the symptoms as precisely as possible. Gather as much information as possible to aid diagnosis. Never assume anything and do not overlook the obvious. Make sure there is fuel in the tank, and the fuel valve is in the on position. Make sure the engine stop switch is in the run position and the spark plug wires are attached to the spark plugs.

If a quick check does not reveal the problem, turn to the troubleshooting procedures described in this chapter. Identify the procedure that most closely describes the symptoms, and perform the indicated tests.

In most cases, expensive and complicated test equipment is not needed to determine whether repairs can be performed at home. A few simple checks could prevent an unnecessary repair charge. On the other hand, be realistic and do not attempt repairs beyond your capabilities. Many service departments will not take work that involves the assembly of damaged or abused equipment. If they do, expect the cost to be high.

Refer to **Tables 1-3**, at the end of this chapter, for electrical specifications and diagnostic trouble codes.

ENGINE OPERATING REQUIREMENTS

An engine needs three basics to run properly: correct air/fuel mixture, compression and a spark at the right time. If one basic requirement is missing, the engine will not run. Refer to **Figure 1** for four-stroke engine operating principles.

ENGINE STARTING

Engine Fails to Start (Spark Test)

Perform the following spark test to determine if the ignition system is operating properly:

CAUTION

Before removing the spark plugs in Step 1, clean all dirt and debris away from the plug base. Dirt that falls into the cylinder causes rapid engine wear.

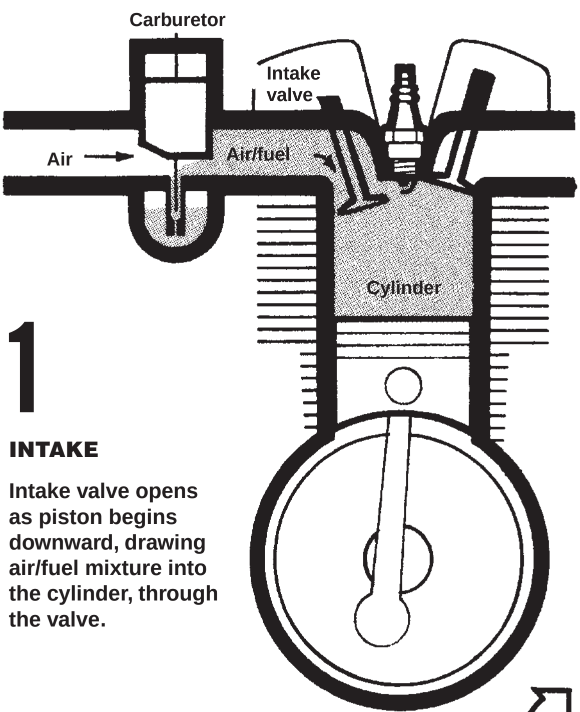
1. Disconnect the spark plug wire and remove the spark plug as described in Chapter Three.

NOTE

A spark tester is a useful tool for testing spark output. ***Figure 2*** *shows the Motion Pro Ignition System Tester (part No. 08-0122). This tool is inserted in the spark plug cap and its base is grounded against the cylinder head. The tool's air gap is adjustable, and it allows the visual inspection*

1

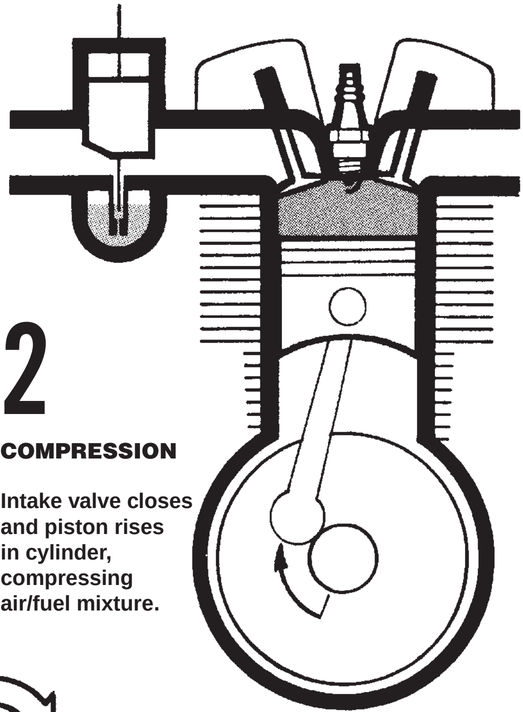
FOUR-STROKE ENGINE OPERATING PRINCIPLES



1

INTAKE

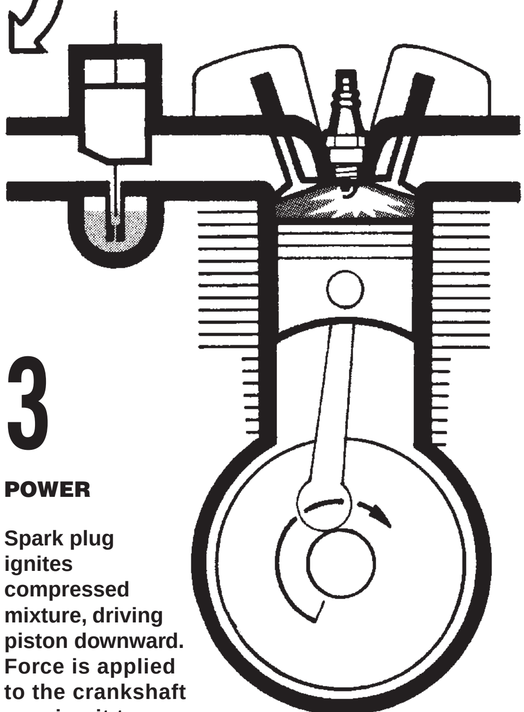
Intake valve opens as piston begins downward, drawing air/fuel mixture into the cylinder, through the valve.



2

COMPRESSION

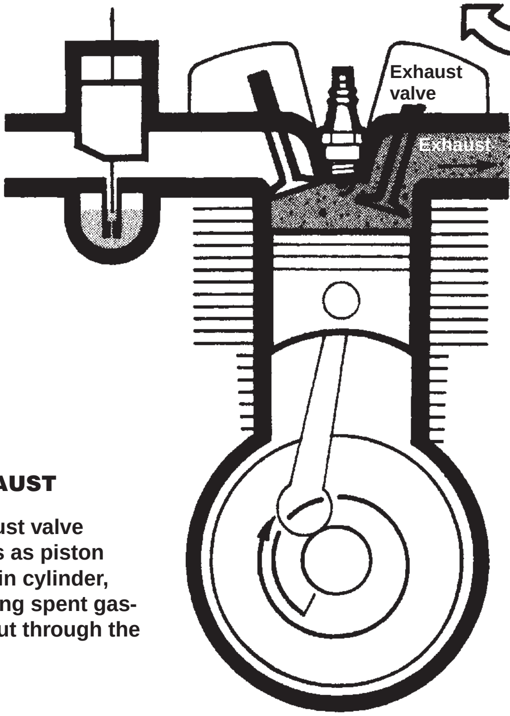
Intake valve closes and piston rises in cylinder, compressing air/fuel mixture.



3

POWER

Spark plug ignites compressed mixture, driving piston downward. Force is applied to the crankshaft causing it to rotate.



4

EXHAUST

Exhaust valve opens as piston rises in cylinder, pushing spent gasses out through the valve.

of the spark. This tool is available at motorcycle repair shops.

2. Cover the spark plug hole with a clean shop cloth to reduce the chance of gasoline vapors being emitted from the hole.
3. Insert the spark plug (**Figure 3**), or spark tester (**Figure 4**), into its plug cap and ground the spark plug base against the cylinder head. Position the spark plug so the electrode is visible.

WARNING
Mount the spark plug, or tester, away from the spark plug hole in the cylinder so the spark plug or tester cannot ignite the gasoline vapors in the cylinder. If the engine is flooded, do not perform this test. The firing of the spark plug can ignite fuel that is ejected through the spark plug hole.

4. Turn the ignition switch on.

WARNING
Do not hold the spark plug, wire or connector, or a serious electrical shock may result.

5. Turn the engine over with the starter. A crisp blue spark should be evident across the spark plug electrode or spark tester terminals. If there is strong sunlight on the plug, shade the plug to better see the spark.
6. If the spark is good, check for one or more of the following possible malfunctions:
   a. Obstructed fuel line or fuel filter.
   b. Low compression or engine damage.
   c. Flooded engine.
   d. Incorrect ignition timing.

NOTE
If the engine backfires during starting, the ignition timing may be incorrect due to a defective ignition component. Refer to ***Ignition Timing*** *in Chapter Three.*

7. If the spark is weak or if there is no spark, refer to *Engine is Difficult to Start* in this section.

Engine is Difficult to Start

Check for one or more of the following possible malfunctions:
1. Fouled spark plug(s).
2. Improperly adjusted enrichment valve.
3. Intake manifold air leak.
4. Plugged fuel tank filler cap.
5. Clogged fuel line.

6. Contaminated fuel system.
7. Improperly adjusted carburetor.
8. Defective ignition module.
9. Defective ignition coil.
10. Damaged ignition coil primary and/or secondary wires.
11. Incorrect ignition timing.
12. Low engine compression.
13. Discharged battery.
14. Defective starter.
15. Loose or corroded starter and/or battery cables.
16. Loose ignition sensor and module electrical connector.
17. Incorrect pushrod length (intake and exhaust valve pushrods interchanged).

Engine Does Not Crank

Check for one or more of the following possible malfunctions:
1. Ignition switch turned off.
2. Faulty ignition switch.
3. Engine run switch in off position.
4. Defective engine run switch.

5. Loose or corroded starter and battery cables (solenoid chatters).
6. Discharged or defective battery.
7. Defective starter.
8. Defective starter solenoid.
9. Defective starter shaft pinion gear.
10. Slipping overrunning clutch assembly.
11. Seized piston(s).
12. Seized crankshaft bearings.
13. Broken connecting rod.

ENGINE PERFORMANCE

If the engine runs, but is not operating at peak performance, refer to the following as a starting point from which to isolate a performance malfunction.

Spark Plugs Fouled

1. Severely contaminated air filter element.
2. Incorrect spark plug heat range. Refer to Chapter Three.
3. Rich fuel mixture.
4. Worn or damaged piston rings.
5. Worn or damaged valve guide oil seals.
6. Excessive valve stem-to-guide clearance.
7. Incorrect carburetor float level.

Engine Misfire

1. Fouled or improper spark plug gap.
2. Damaged spark plug cables.
3. Incorrect ignition timing.
4. Defective ignition components.
5. Obstructed fuel line or fuel shutoff valve.
6. Obstructed fuel filter.
7. Clogged carburetor jets.
8. Loose battery connection.
9. Wiring or connector damage.
10. Water or other contaminates in the fuel.
11. Weak or damaged valve springs.
12. Incorrect camshaft/valve timing.
13. Damaged valve(s).
14. Dirty electrical connections.
15. Intake manifold or carburetor air leak.
16. Plugged carburetor vent hose.
17. Plugged fuel tank vent system.

Engine Overheating

1. Incorrect carburetor adjustment or jet selection.
2. Incorrect ignition timing or defective ignition system components.
3. Improper spark plug heat range. Refer to Chapter Three.
4. Damaged or blocked cooling fins.
5. Low oil level.
6. Oil not circulating properly.
7. Leaking valves.
8. Heavy combustion chamber carbon deposits.

Engine Runs Rough with Excessive Exhaust Smoke

1. Clogged air filter element.
2. Rich carburetor adjustment.
3. Choke not operating correctly.
4. Water or other fuel contaminants.
5. Clogged fuel line and/or filter.
6. Spark plug(s) fouled.
7. Defective ignition coil.
8. Defective ignition module or sensor(s).
9. Loose or defective ignition circuit wire.
10. Short circuits from damaged wire insulation.
11. Loose battery cable connections.
12. Incorrect camshaft/valve timing.
13. Intake manifold or air filter air leak.

Engine Lacks Power

1. Incorrect carburetor adjustment.
2. Clogged fuel line.
3. Incorrect ignition timing.
4. Dragging brake(s).
5. Engine overheating.
6. Incorrect ignition timing.
7. Incorrect spark plug gap.

Valve Train Noise

1. Bent pushrod(s).
2. Defective hydraulic lifter(s).
3. Bent valve(s).
4. Rocker arm seizure or damage (binding on shaft).
5. Worn or damaged camshaft gear bushing(s).
6. Worn or damaged camshaft gear(s).

STARTING SYSTEM

The starting system consists of the battery, starter, starter relay, solenoid, start button, and related wiring.

When the ignition switch is turned on and the start button is pushed in, current is transmitted from the battery to the starter relay. When the relay is activated, it activates the starter solenoid that mechanically engages the starter with the engine.

Starting system problems are most often related to a loose or corroded electrical connection.

Refer to **Figure 5** for starter and solenoid terminal identification.

Troubleshooting Preparation

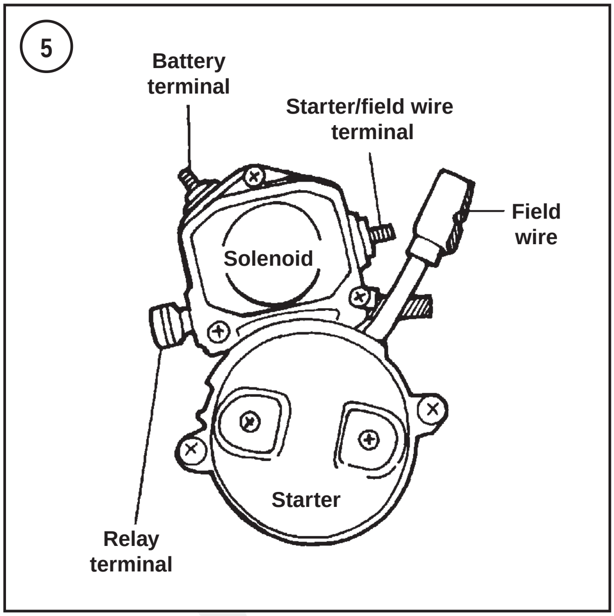
Before troubleshooting the starting system, check for the following:

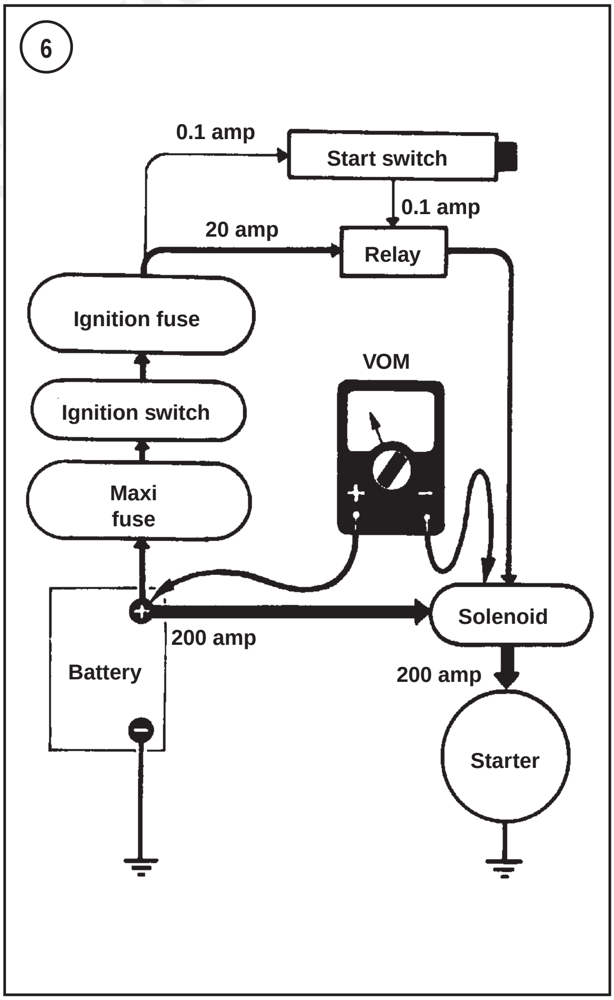
1. The battery is fully charged.
2. Battery cables are the proper size and length. Replace damaged or undersized cables.
3. All electrical connections are clean and tight. High resistance caused from dirty or loose connectors can affect voltage and current levels.
4. The wiring harness is in good condition, with no worn or frayed insulation or loose harness sockets.
5. The fuel tank is filled with an adequate supply of fresh gasoline.
6. The spark plugs are in good condition and properly gapped.
7. The ignition system is working correctly.

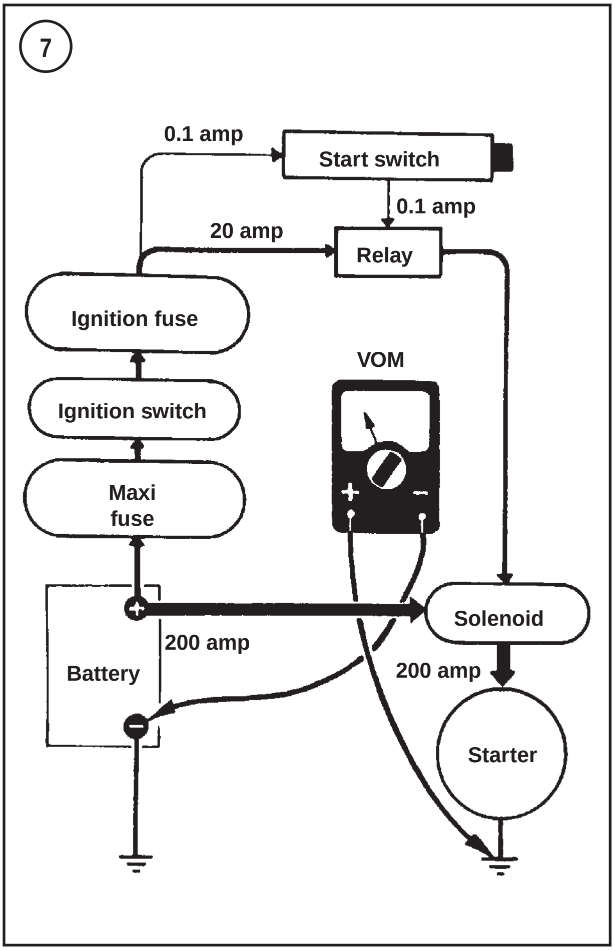
Voltage Drop Test

Prior to performing procedures in the *Starter Testing* section, perform a voltage drop test.

1. To check voltage drop in the solenoid circuit, connect the positive voltmeter lead to the positive battery terminal. Connect the negative voltmeter lead to the solenoid terminal (**Figure 6**).
2. Turn the ignition switch on and push the starter button while reading the voltmeter scale. Note the following:







a. The circuit is operating correctly if the voltmeter reading is 1.0 volt or less. A voltmeter reading of 12 volts indicates an open circuit.
b. A voltage drop of more than 1.0 volt indicates a problem in the solenoid circuit.
c. If the voltage drop reading is correct, continue with Step 3.

3. To check the starter ground circuit, connect the negative voltmeter lead to the negative battery terminal. Connect the positive voltmeter lead to the starter housing (**Figure 7**).
4. Turn the ignition switch on and push the starter button while reading the voltmeter scale. The voltage drop must not exceed 0.2 volt. If it does, check the ground connections between the meter leads.
5. If the problem is not found, refer to the *Starter Testing* section.

NOTE
Step 3 and Step 4 check the voltage drop across the starter ground circuit. To check any ground circuit in the starting circuit, repeat this test and leave the negative voltmeter lead connected to the battery and connect the positive voltmeter lead to the ground in question.

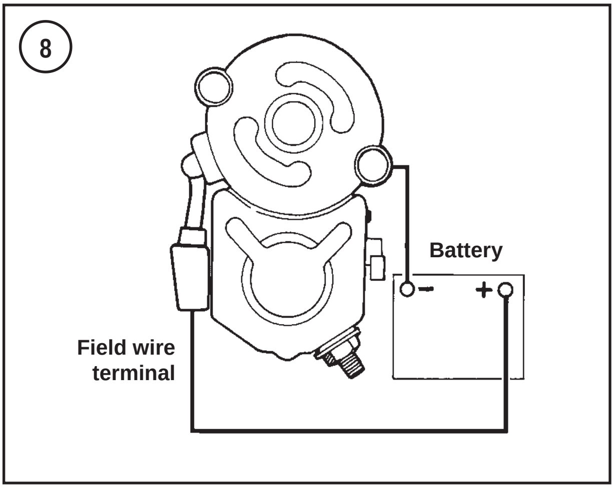
Starter Testing

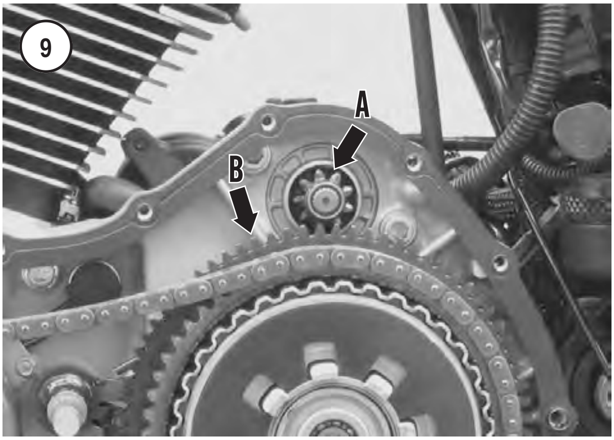
CAUTION
Never operate the starter for more than 30 seconds at a time. Allow the starter to cool before reusing it. Failing to allow the starter to cool after continual starting attempts can damage the starter.

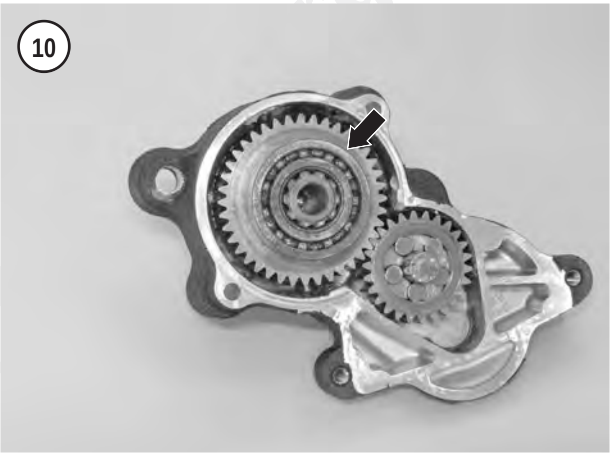
The basic starter-related troubles are:
1. Starter does not spin.
2. Starter spins but does not engage.
3. The starter does not disengage after the start button is released.
4. Loud grinding noises when starter turns.
5. Starter stalls or spins too slowly.

Starter does not spin

1. Turn the ignition switch on and push the starter button while listening for a click at the starter relay. Turn the ignition switch off and note the following:
   a. If the starter relay clicks, test the starter relay as described in this section. If the starter relay test readings are correct, continue with Step 2.
   b. If the solenoid clicks, go to Step 3.
   c. If there was no click, go to Step 5.
2. Check the wiring connectors between the starter relay and solenoid. Note the following:
   a. Repair any dirty, loose-fitting or damaged connectors or wiring.
   b. If the wiring is in good condition, remove the starter as described in Chapter Nine. Perform the solenoid and starter bench tests as described in this section.
3. Perform a voltage drop test between the battery and solenoid terminals as described in *Voltage Drop Test* in this section. The normal voltage drop is less than 1.0 volt. Note the following:
   a. If the voltage drop is less than 1.0 volt, perform Step 4.
   b. If the voltage drop is more than 1.0 volt, check the solenoid and battery wires and connections for dirty or loose fitting terminals; clean and repair as required.
4. Remove the starter as described in Chapter Nine. Momentarily connect a fully charged 12-volt battery to the







starter as shown in **Figure 8**. If the starter is operational, it will turn when connected to the battery. Disconnect the battery and note the following:

a. If the starter turns, perform the solenoid pull-in and hold-in tests as described in *Solenoid Testing (Bench Tests)* in this section.

b. If the starter does not turn, disassemble the starter as described in Chapter Nine, and check it for opens, shorts and grounds.

5. If there is no click when performing Step 1, measure voltage between the starter button and the starter relay. The voltmeter must read battery voltage. Note the following:

a. If there is battery voltage, continue with Step 6.

b. If there is no voltage, go to Step 6.

6. Check for voltage at the starter button. Note the following:

a. If there is voltage at the starter button, test the starter relay as described in this section.

b. If there is no voltage at the starter button, check continuity across the starter button. If there is voltage leading to the starter button, but no voltage leaving the starter button, replace the button switch and retest. If there is no voltage leading to the starter button, check the starter button wiring for dirty or loose-fitting terminals or damaged wiring; clean and/or repair as required.

Starter spins but does not engage

If the starter spins but the pinion gear does not engage the clutch shell ring gear, perform the following:

1. Remove the primary drive cover as described in Chapter Six.

2. Check the starter pinion gear (A, **Figure 9**). If the teeth are chipped or worn, inspect the clutch shell ring gear (B, **Figure 9**) for the same problems. Note the following:

a. If the starter pinion gear or clutch ring gear is damaged, service the parts.

b. If the starter pinion gear and clutch shell ring gear are not damaged, continue with Step 3.

c. Make sure the pinion does not run in overrunning direction.

3. Remove and disassemble the starter as described in Chapter Nine. Then check the overrunning clutch assembly (**Figure 10** and **Figure 11**) components for wear and/or damage:

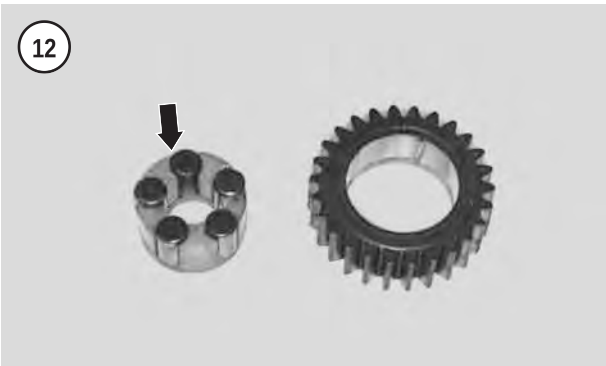
a. Rollers (**Figure 12**).

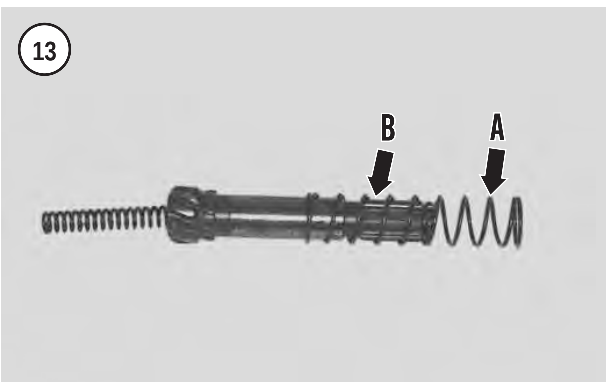
b. Compression spring (A, **Figure 13**).

c. Pinion teeth.

d. Clutch shaft splines (B, **Figure 13**).

4. Replace worn or damaged parts as required.





Starter does not disengage after releasing the start button

1. A sticking solenoid, caused by a worn solenoid compression spring (A, **Figure 13**), can cause this problem. Replace the solenoid if damaged.

2. On high-mileage motorcycles, the starter pinion gear (A, **Figure 9**) can jam on a worn clutch ring gear (B). Unable to return, the starter will continue to run. This condition usually requires ring gear replacement.

3. Check the start button switch and starter relay for internal damage. Test the start switch as described in Chapter Eight. Test the starter relay as described in this chapter.

Loud grinding noises when the starter turns

Incorrect starter pinion gear and clutch shell ring gear engagement (B, **Figure 9**) or a broken overrunning clutch mechanism (**Figure 11**) can cause this problem. Remove and inspect the starter as described in Chapter Nine.

Starter stalls or spins too slowly

1. Perform a voltage drop test between the battery and solenoid terminals as described under *Voltage Drop Test* in this section. The normal voltage drop is less than 1.0 volt. Note the following:
   a. If the voltage drop is less than 1.0 volt, continue with Step 2.
   b. If the voltage drop exceeds 1.0 volt, check the solenoid and battery wires and connections for dirty or loose-fitting terminals; clean and repair as required.

2. Perform a voltage drop test between the solenoid terminals and the starter. The normal voltage drop is less than 1.0 volt. Note the following:
   a. If the voltage drop is less than 1.0 volt, continue with Step 3.
   b. If the voltage drop exceeds 1.0 volt, check the solenoid and starter wires and connections for dirty or loose-fitting terminals; clean and repair as required.

3. Perform a voltage drop test between the battery ground wire and the starter as described under *Voltage Drop Test* in this section. The normal voltage drop is less than 0.2 volt. Note the following:
   a. If the voltage drop is less than 0.2 volt, continue with Step 4.
   b. If the voltage drop exceeds 0.2 volt, check the battery ground wire connections for dirty or loose-fitting terminals; clean and repair as required.

4. Refer to *Starter Current Draw Testing* in this section and perform the first test. Note the following:
   a. If the current draw is excessive, check for a damaged starter. Remove the starter as described in Chapter Nine and perform the second test.
   b. If the current draw reading is correct, continue with Step 5.

5. Remove the primary cover as described in Chapter Six. Check the starter pinion gear (A, **Figure 9**). If the teeth are chipped or worn, inspect the clutch ring gear (B, **Figure 9**) for the same problem.

a. If the starter pinion gear or clutch ring gear is damaged, service it.
b. If the starter pinion gear and clutch ring gear are not damaged, continue with Step 6.

6. Remove and disassemble the starter as described in Chapter Nine. Check the disassembled starter for opens, shorts and grounds.

Starter Current Draw Testing

A short circuit in the starter or a damaged pinion gear assembly can cause excessive current draw. If the current draw is low, suspect an undercharged battery or an open circuit in the starting circuit.

Refer to **Table 1** for current draw specifications.

Starter installed

This test requires a fully charged battery and an inductive ammeter.

1. Shift the transmission into neutral.
2. Disconnect the two spark plug caps from the spark plugs. Then ground the plug caps with two extra spark plugs. Do not remove the spark plugs from the cylinder heads.
3. Connect an inductive ammeter between the battery terminal and positive battery terminal (**Figure 14**). Connect a jumper cable from the negative battery terminal to ground.
4. Turn the ignition switch on and press the start button for approximately ten seconds. Note the ammeter reading.

NOTE
The current draw is high when the start button is first pressed, then it will drop and stabilize at a lower reading. Refer to the lower stabilized reading during this test.

5. If the current draw exceeds the specification in **Table 1**, check for a defective starter or starter drive mechanism. Remove and service these components as described in Chapter Nine.
6. Disconnect the ammeter and jumper cables.

Starter removed

This test requires a fully charged 12-volt battery, an inductive ammeter, a jumper wire (14-gauge minimum) and three jumper cables (6-gauge minimum).

Refer to **Figure 15**.

1. Remove the starter as described in Chapter nine.

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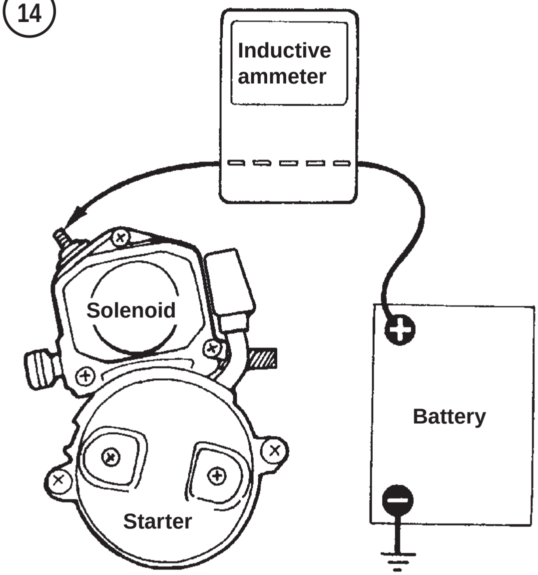

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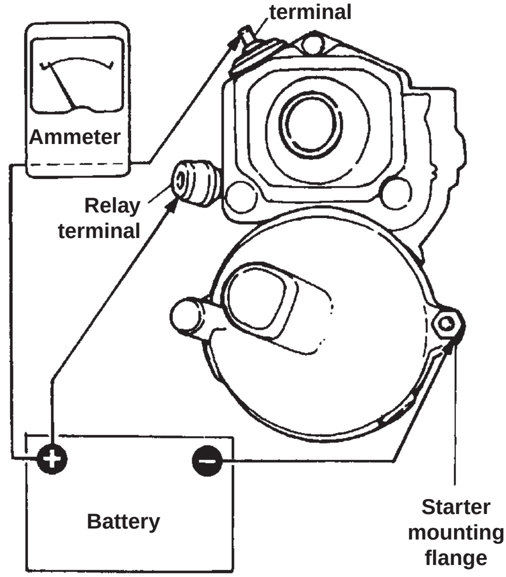

NOTE
The solenoid must be installed on the starter during the following tests.

2. Mount the starter in a vise with soft jaws.
3. Connect the 14-gauge jumper cable between the positive battery terminal and the solenoid relay terminal.

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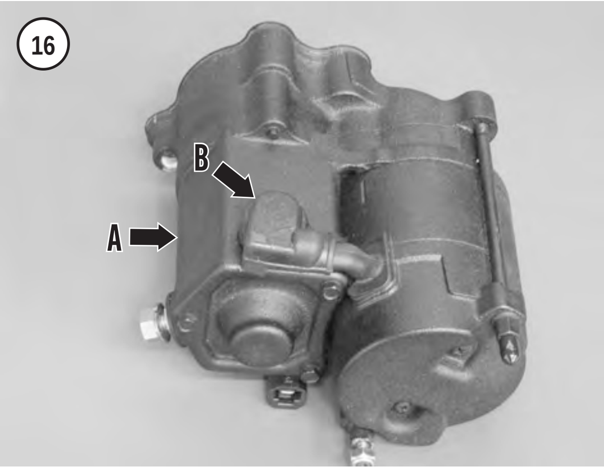

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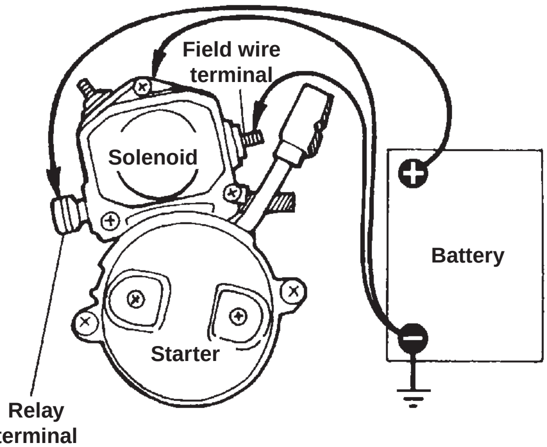

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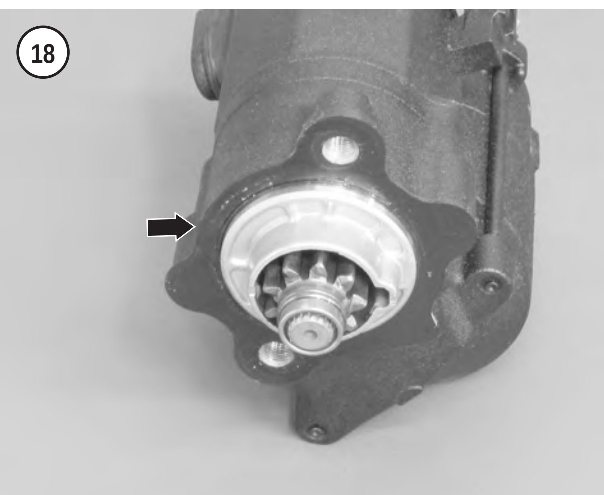

4. Connect a jumper cable (6-gauge minimum) between the positive battery terminal and the ammeter.
5. Connect the second jumper cable between the ammeter and the battery terminal on the starter solenoid.
6. Connect the third jumper cable between the battery ground terminal and the starter mounting flange.
7. Read the ammeter and refer to the maximum no-load current specification in **Table 1**. A damaged pinion gear assembly will cause an excessively high current draw reading. If the current draw reading is low, check for an undercharged battery, or an open field winding or armature in the starter.

Solenoid Testing (Bench Tests)

This test requires a fully charged 12-volt battery and three jumper wires.

1. Remove the starter as described in Chapter Nine.

NOTE
*The solenoid (A, **Figure 16**) must be installed on the starter during the following tests.*

2. Disconnect the field wire (B, **Figure 16**) from the solenoid before performing the following tests. Insulate the end of the wire terminal so it cannot short out on any of the test connectors.

CAUTION
Because battery voltage is being applied directly to the solenoid and starter in the following tests, do not leave the jumper cables connected to the solenoid for more than three-five seconds; otherwise, the voltage will damage the solenoid.

NOTE
Thoroughly read the following procedure to become familiar with and understand the procedures and test connections, then perform the tests in the order listed and without interruption.

3. Refer to **Figure 17** and perform the solenoid pull-in test as follows:
   a. Connect one jumper wire from the negative battery terminal to the field wire terminal on the solenoid.
   b. Connect one jumper wire from the negative battery terminal to the solenoid housing (ground).
   c. Touch a jumper wire from the positive battery terminal to the starter relay terminal. The pinion shaft (**Figure 18**) should pull into the housing.

d. Leave the jumper wires connected and continue with Step 4.

4. To perform the solenoid hold-in test, perform the following:

a. With the pinion shaft pulled in (Step 3), disconnect the field wire terminal jumper wire from the negative battery terminal and connect it to the positive battery terminal (**Figure 19**). The pinion shaft should remain in the housing. If the pinion shaft returns to its original position, replace the solenoid.

b. Leave the jumper wires connected and continue with Step 5.

5. To perform the solenoid return test, perform the following:

a. Disconnect the jumper wire from the starter relay terminal (**Figure 20**); the pinion shaft should return to its original position.

b. Disconnect all the jumper wires from the solenoid and battery.

6. Replace the solenoid if the starter shaft failed to operate as described in Steps 3-5. Refer to *Solenoid Replacement* in Chapter Nine.

Starter Relay Test

Check the starter relay operation with an ohmmeter, jumper wires and a fully charged 12-volt battery.

1. Remove the starter relay as described in Chapter Nine.

CAUTION
The battery negative lead must be connected to the relay terminal No. 2 to avoid internal diode damage.

2. Connect an ohmmeter and 12-volt battery between the relay terminals as shown in **Figure 21**. This setup will energize the relay for testing.

3. Check for continuity through the relay contacts using an ohmmeter while the relay coil is energized. The correct reading is 0 ohm. If resistance is excessive or if there is no continuity, replace the relay.

4. If the starter relay passes this test, reinstall the relay.

CHARGING SYSTEM

The charging system consists of the battery, alternator and voltage regulator/rectifier.

The alternator generates alternating current (AC) which the rectifier converts to direct current (DC). The regulator maintains the voltage to the battery and load (lights, ignition and accessories) at a constant voltage despite variations in engine speed and load.

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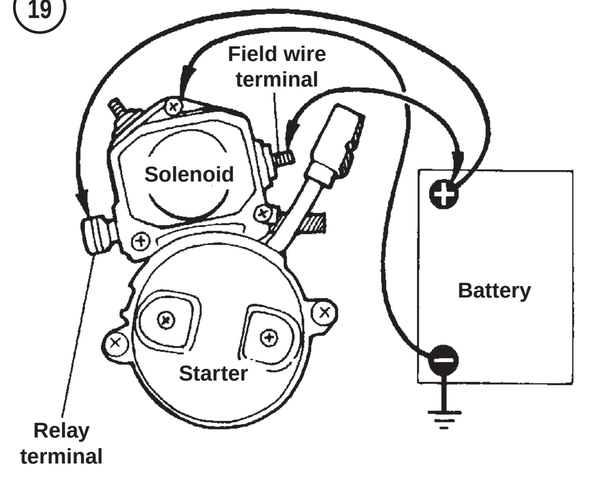

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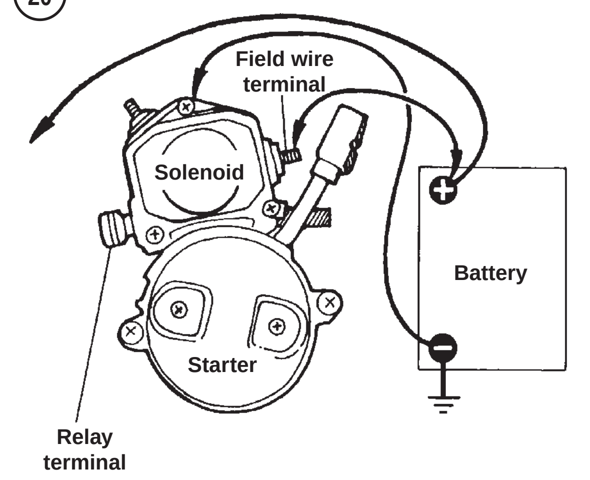
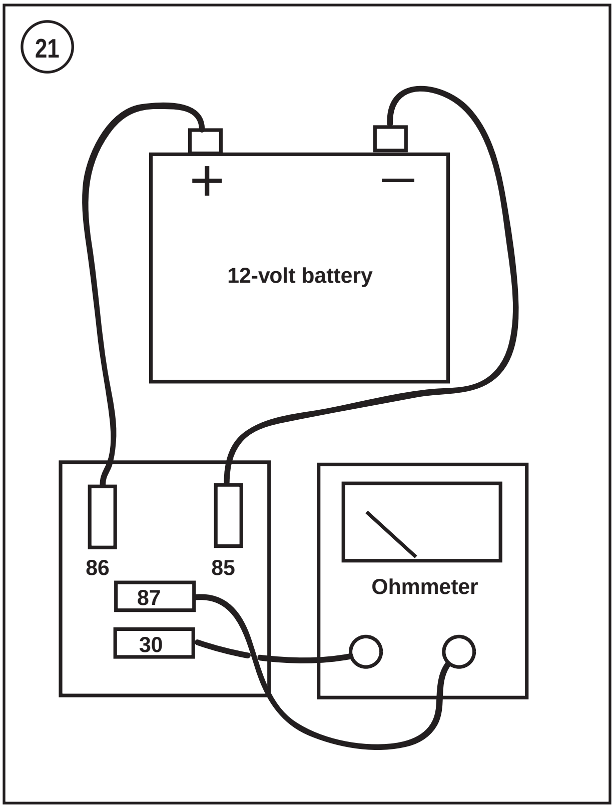


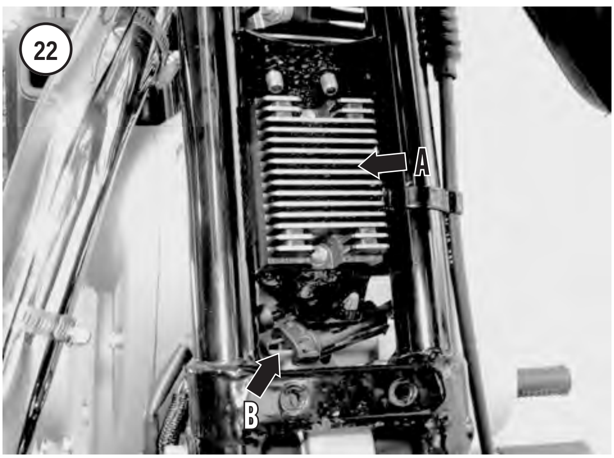
A malfunction in the charging system generally causes the battery to remain undercharged.

Precautions

Before testing the charging system, observe the following precautions to prevent damage to the system:

1. Never reverse battery connections.
2. Do not short across any connection.
3. Never start the engine with the alternator disconnected from the voltage regulator/rectifier unless instructed to do so during testing.
4. Never start or run the engine with the battery disconnected.





5. Never use a high-output battery charger to help start the engine.

6. Before charging the battery, remove it from the motorcycle as described in Chapter Nine.

7. Never disconnect the voltage regulator/rectifier connector with the engine running. The voltage regulator/rectifier (A, **Figure 22**) is mounted on the front frame cross member.

8. Do not mount the voltage regulator/rectifier in another location.

9. Make sure the negative battery terminal is connected to the terminal on the engine.

Troubleshooting Sequence

If the battery is discharged, perform the following:

1. Test the battery as described in Chapter Nine. Charge the battery if necessary. If the battery does hold a charge while riding, perform the *Charging System Output Test*.
2. If the charging system output is within specification, determine the total amount of current demand by the electrical system and all accessories as described in *Electrical System Current Load Test*.
3. If the charging system output exceeds the current demand and the battery continues to not hold a charge, perform the *Battery Current Draw Test*.
4. If the charging system output is not within specification, test the stator and voltage regulator as described in Chapter Nine.

Charging System Output Test

CAUTION

When using a load tester, refer to the manufacturer's instructions. To prevent tester damage caused by overheating, do not leave the load switch on for more than 20 seconds at a time.

This test requires a load tester.

1. To perform this test, the battery must be fully charged.
2. Connect the load tester negative and positive leads to the battery terminals. Then place the load tester's induction pickup around the Maxi-fuse to voltage regulator red wire (B, **Figure 22**).
3. Start the engine and slowly bring the speed up to 3000 rpm while reading the load tester scale. With the engine running at 3000 rpm, operate the load tester switch until the voltage scale reads 13.0 volts. The tester should show a regulated (DC) current output reading of 19-23 amps.
4. With the engine still running at 3000 rpm, turn the load off and read the load tester voltage scale. Battery voltage should not exceed 15 volts. Turn the engine off and disconnect the load tester from the motorcycle.
5. Refer to *Alternator* in Chapter Nine and test the stator. If the stator tests acceptable, there is a defective voltage regulator/rectifier or a wiring short circuit. Make sure to eliminate the possibility of a poor connection or damaged wiring before replacing the voltage regulator/rectifier.

Electrical System Current Load Test

CAUTION
When using a load tester, refer to the manufacturer's instructions. To prevent tester damage caused by overheating, do not leave the load switch on for more than 20 seconds at a time.

This test, requiring a load tester, measures the total current load of the electrical system and any additional accessories while the engine is running. Perform this test if the battery is continually discharged, yet the charging system output is within specification.

If aftermarket electrical components have been added to the motorcycle, the increased current demand may exceed the charging system's capacity and cause a discharged battery.

1. Connect a load tester to the battery per the manufacturer's instructions.
2. Turn the ignition switch on, but do not start the engine. Then turn on all electrical accessories and switch the headlight beam to HIGH.
3. Read the ampere reading (current draw) on the load tester and compare it to the *Charging System Output Test*. The charging system output test results (current reading) must exceed the electrical system current load by 3.5 amps for the battery to remain sufficiently charged.
4. If aftermarket accessories have been added to the motorcycle, disconnect them and repeat Step 3. If the electrical system current load is now within the specification, the problem is with the additional accessories.
5. If no accessories have been added to the motorcycle, a short circuit may be causing the battery to discharge.

Battery Current Draw Test

This test measures the current draw on the battery when all electrical systems and accessories are off. Perform this test if the battery does not hold a charge when the motorcycle is not being used. A current draw that exceeds 3.5 mA will discharge the battery. The voltage regulator (0.5 mA), TSM (0.5 mA) and TSSM (2.5 mA) account for a 3.5 mA current draw. The battery must be fully charged to perform this test.

1. Disconnect the negative battery cable as described in Chapter Nine.
2. Connect an ammeter between the negative battery cable end and the ground stud on the engine crankcase as shown in **Figure 23**.
3. With the ignition switch, lights and all accessories turned off, read the ammeter. If the current exceeds 3.5 mA, continue with Step 4.

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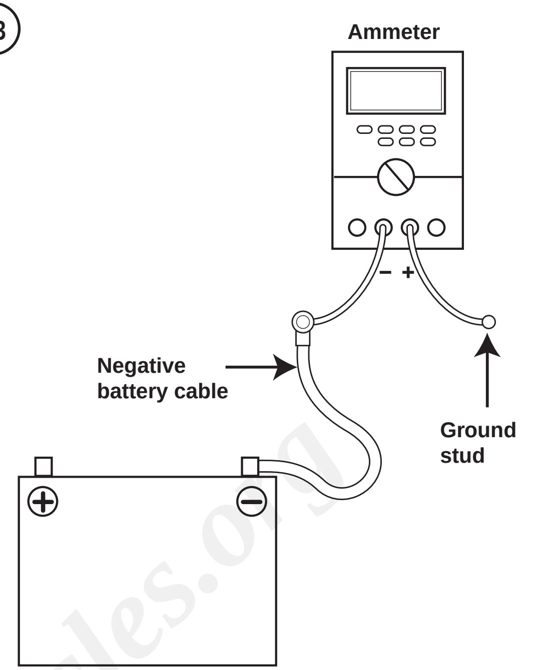

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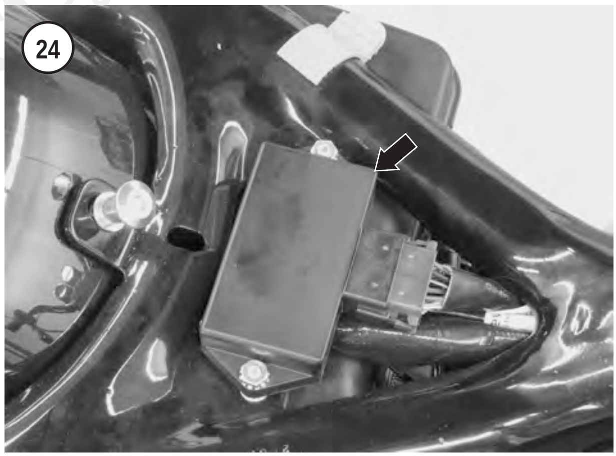
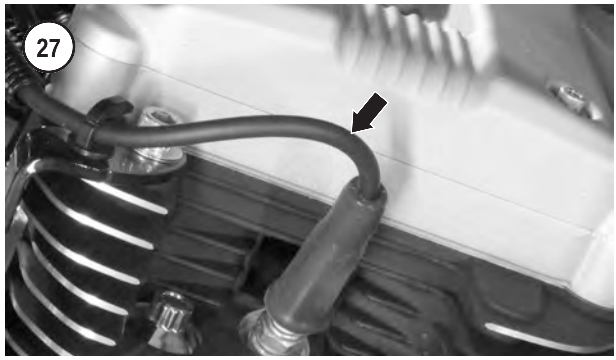
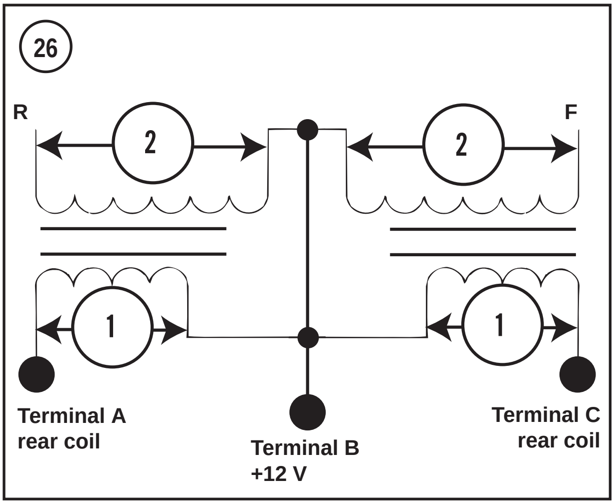


4. Refer to the appropriate wiring diagram at the end of this manual. Check the charging system wires and connectors for shorts or other damage.

5. Unplug each electrical connector separately and check for a reduction in the current draw. If the meter reading changes after a connector is disconnected, the source of the current draw has been found. Check the electrical connectors carefully before testing the individual component.

6. After completing the test, disconnect the ammeter and reconnect the negative battery cable.





IGNITION SYSTEM

Precautions

Before testing the ignition system, observe the following precautions to prevent damage to the system.

1. Never disconnect any of the electrical connectors while the engine is running.
2. Apply dielectric grease to all electrical connectors prior to reconnecting them. This will help seal out moisture.
3. Make sure all electrical connectors are free of corrosion and are completely coupled to each other.
4. The ignition module (**Figure 24**) must always be mounted securely to the mounting bracket under the seat.

Troubleshooting Preparation

1. Refer to the wiring diagram at the end of this manual for the specific model.
2. Check the wiring harness for visible signs of damage.
3. Make sure all connectors are properly attached to each other and locked in place.
4. Check all electrical components for a good ground to the engine.
5. Check all wiring for short circuits or open circuits.
6. Remove the rear fender inner panel as described in Chapter Fourteen.
7. Remove the left side cover and check for a blown ignition circuit fuse (**Figure 25**).
8. Make sure the fuel tank has an adequate supply of fresh gasoline.
9. Check the spark plug cable routing and the connections at the spark plugs. If there is no spark or only a weak one, repeat the test with new spark plugs. If the condition remains the same with new spark plugs and if all external wiring connections are good, the problem is most likely in the ignition system. If a strong spark is present, the problem is probably not in the ignition system. Check the fuel system.

Ignition Coil Testing

Use an ohmmeter to check the ignition coil secondary and primary resistance. Test the coil twice: first when it is cold (room temperature), then at normal operating temperature. If the engine does not start, heat the coil with a hair dryer, then test with the ohmmeter.

1. Remove the ignition coil as described in Chapter Nine.
2. Measure the ignition coil primary resistance between the primary coil terminals. Refer to **Figure 26**. Compare the reading to the specification in **Table 2**. Replace the ignition coil if the reading is not within specification.
3. Measure the resistance between the secondary terminals. Refer to **Figure 26**. Compare the reading to the specification in **Table 2**. Replace the ignition coil if the reading is not within specification.

Spark Plug Cable and Cap Inspection

All models are equipped with resistor-type spark plug cables (**Figure 27**). These cables reduce radio interference. The cable's conductor consists of a carbon-impregnated fabric core material instead of solid wire.

Spark plug cable resistance will increase in a corroded, broken or otherwise damaged cable. Excessive cable resistance will cause engine misfire and other ignition or drivability problems.

When troubleshooting the ignition system, inspect the spark plug cables for:

1. Corroded or damaged connector ends.
2. Breaks in the cable insulation that could allow arcing.
3. Split or damaged plug caps that could allow arcing to the cylinder heads.
4. Replace damaged or questionable spark plug cables.

ELECTRONIC DIAGNOSTIC SYSTEM

All models are equipped with an electronic diagnostic system that monitors the operating condition of the speedometer, ignition control module (ICM), turn signal/security module (TSM/TSSM) and tachometer, if so equipped. A serial data bus connects the components. If a malfunction occurs, a diagnostic trouble code (DTC) may be generated.

The DTC identifies an anamoly detected by an electrical component. The trouble code is retained in the memory of the ICM, TSM/TSSM, speedometer and tachometer, if so equipped. A DTC is categorized as current or historic.

A current DTC identifies a problem that affects present motorcycle operation.

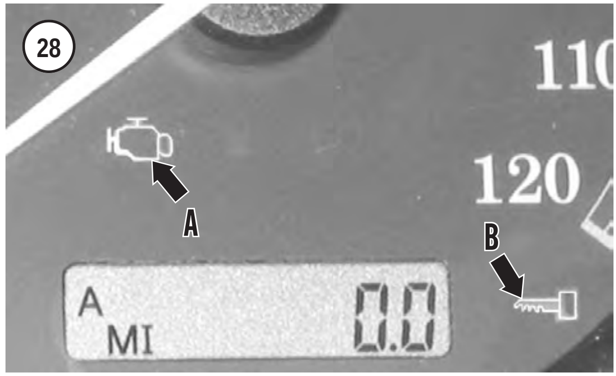
A historic DTC identifies a problem that has been resolved either through servicing or a changed condition. Historic DTCs are retained to provide information should an intermittent problem exist. A historic DTC is retained in memory until fifty start/run cycles have occurred, at which point the DTC is erased.

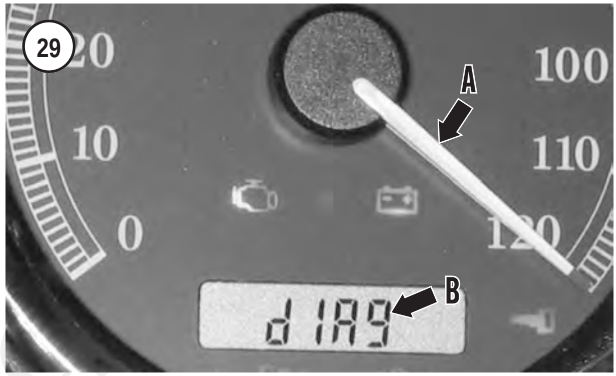
Not all malfunctions cause the generation of a DTC. Refer to *No-DTC Fault*.

Startup Check

The diagnostic system indicates a normal condition or an operating problem each time the ignition key is turned on (ignition).

1. During normal startup, the following occurs after the key is turned on:
   a. The *check engine* symbol (A, **Figure 28**) illuminates for four seconds, then goes out.
   b. The *security* symbol (B, **Figure 28**) illuminates for four seconds, then goes out.





2. Note the following indications of potential problems during startup:
   a. If the check engine symbol or security symbol does not illuminate, an instrument may be faulty. Refer to *Initial Diagnostic Check*.
   b. If the check engine symbol or security symbol illuminates after 20 seconds, a serial data bus problem may exist. Check for a DTC.
   c. If the check engine symbol or security symbol stays on, an instrument may be faulty or a DTC exists. Refer to *Initial Diagnostic Check*.

DTC Retrieval

Trouble codes are configured in a five digit format consisting of a letter prefix followed by four numbers.

NOTE
*The message **BusEr** is a trouble code which may appear during diagnostic troubleshooting. **BusEr** indicates a problem in the serial bus data circuit.*

Two methods may be used to retrieve trouble codes, either through performing the retrieval sequence at the speedometer or using the H-D Digital Technician tool. The following

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describes using the speedometer to retrieve DTCs. If necessary, take the motorcycle to a dealership equipped with the H-D Digital Technician.

Perform the following to read a DTC:

NOTE
Make sure the run/stop handlebar switch is in the run position.

1. Push and hold in the odometer reset button on the back of the speedometer.
2. Turn the ignition key on, then release the reset button. The following should occur:
   a. The speedometer backlighting comes on.
   b. The speedometer needle rotates to full deflection position (A, **Figure 29**).

NOTE
The security symbol may come on even though the motorcycle is not equipped with a security system.

   c. The check engine, battery and security symbols illuminate.
3. The message *diag* appears in the odometer window on the speedometer (B, **Figure 29**).
4. Press and release the odometer reset button. The letters *PSSPt* appear in the odometer window (**Figure 30**). The letter *P* will flash indicating that information concerning the ICM is obtainable. The letters *PSSPt* identify the following components:
   a. The letter *P* identifies the ICM.
   b. The letter *S* identifies the TSM/TSSM.
   c. The letters *SP* identify the speedometer.
   d. The letter *t* identifies the tachometer.
5. To cycle through the PSSPt letter identifiers, push and quickly release the odometer reset button. The selected component letter identifier will flash.
6. To obtain a DTC, select a component (identifier letter(s) flashes) then push and hold in the odometer reset button for at least 5 seconds. Release the button. The code will appear in the odometer window (**Figure 31**), or *none*. Record the DTC.

NOTE
When reading codes in Step 7 push in and release the reset button only long enough to retreive the next code. Holding in the reset button for more than 5 seconds will erase the codes.

7. Press and release the reset button as needed to read additional trouble codes until *end* appears.

NOTE
On models not equipped with a tachometer, ***No Rsp*** *will appear when the tachometer identifier is selected.*

8. If *none* appears, pushing and releasing the reset button will cause the display of the component part number. For instance, the display may read *Pn 32478-04* for the ICM.
9. Push and release the reset button to return to the PSSPt display.
10. Turn off the ignition key to exit the diagnostic program.

Diagnostic Tools

The troubleshooting steps in some of the flowcharts in this chapter require using H-D breakout box part No. HD-42682 (**Figure 32**) and adapters HD-46601.

The H-D computer program Digital Technician (part No. HD-44750) must be used to read historic DTCs, and to erase them. The Digital Technician is also necessary to reprogram a new ICM.

The H-D breakout box is separated into two panels (black and gray). The panel colors relate to the box connector colors: one pair black and one pair gray.

Refer to the following when connecting the breakout box:
1. Speedometer/tachometer—Refer to Chapter Nine and remove the back of the speedometer or tachometer. Disconnect the connector (**Figure 33**) and attach the adapters. Connect the black breakout box connectors to the adapters. Use the sockets on the black breakout box panel during testing.
2. TSM/TSSM—Refer to Chapter Nine and remove the TSM/TSSM. Connect the gray breakout box connectors to the TSM/TSSM and to the connector. Use the sockets on the gray breakout box panel during testing. Reinstall the battery.
3. ICM—Remove the seat. Disconnect the ICM connector (**Figure 34**). Connect the black breakout box connectors to the ICM and to the connector. Use the sockets on the black breakout box panel during testing.

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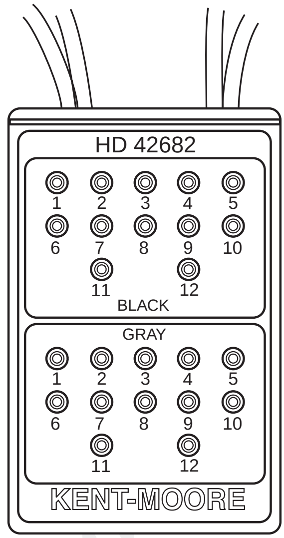


Data Link Connector

A data link connector provides access to the data bus and provides a testing terminal when troubleshooting. The connector is located behind the left side cover. Remove the connector cap (**Figure 35**) for access to the connector terminals.

DTC Troubleshooting

A list of DTCs is found in **Table 3** at the end of this chapter, which also identifies the possible problem and a troubleshooting flowchart. Refer to the applicable flowchart in **Figures 36-60**. Note the following before beginning troubleshooting:
1. Before retrieving DTCs, refer to *Initial Diagnostic Check* in this section.
2. Not all malfunctions will set a DTC. If this occurs, refer to Chapter Nine and the wiring diagrams at the end of this manual to assist in troubleshooting.
3. Check for obvious causes before undertaking what may be a complicated troubleshooting procedure. Look for loose or disconnected connectors, damaged wiring and other possible causes.
4. The DTCs are prioritized according to importance. If multiple DTCs occur, correct the DTC with the highest priority listed in **Table 3**. It is possible for one fault to trigger more than one DTC.
5. Refer to the wiring diagrams at the end of this manual to identify connectors. Each connector is noted with a corresponding number on the wiring diagram. This connector number is noted in the flow charts. Refer to the appropriate sections in this chapter and Chapter Nine for additional component testing.

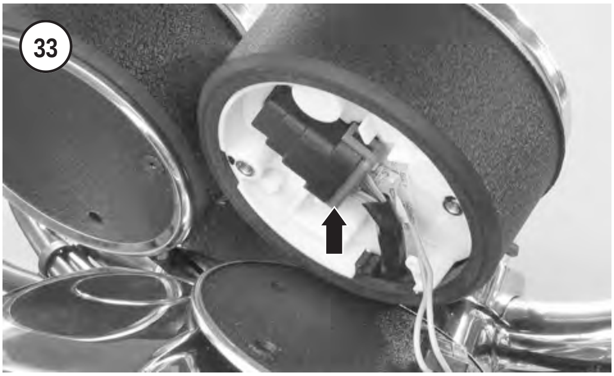
No-DTC fault

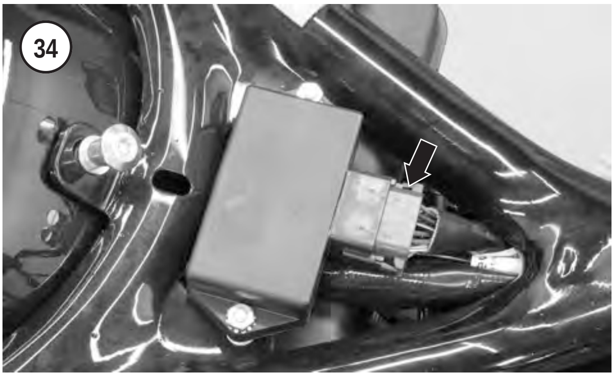
Some malfunctions, such as fuel and starting system problems, do not trigger a DTC. In those cases, the troubleshooting guidelines found in this chapter will serve to locate the problem. However, there are faults that can be diagnosed using the procedures implemented when diagnosing a DTC. The following faults may not generate a DTC, but the specified flowchart will help identify the problem.
1. No spark or ICM power—**Figure 55**.
2. Tachometer faulty—**Figure 56**.
3. No security lamp—**Figure 57**.
4. Security lamp always on—**Figure 58**.
5. Key fob signal weak to TSSM—**Figure 59**.
6. Turn signal cancels improperly—**Figure 60**.

Initial diagnostic check

Because the speedometer provides the DTCs, it may be necessary to troubleshoot it before initiating a diagnostic sequence. Check speedometer operation as described, then refer to **Figure 36** and follow the *Initial Checks* flowchart.
1. During normal operation the speedometer should operate as follows when the ignition key is turned on (make sure the run/stop handlebar switch is in the run position):
   a. The speedometer backlighting comes on.

NOTE
The security symbol may come on even though the motorcycle is not equipped with a security system.





b. The check engine and security symbols illuminate.
c. The odometer display illuminates.

2. If the speedometer performs normally during startup, perform the following WOW test:

a. Push in the odometer reset button on the back of the speedometer.
b. Turn the ignition key on and release the odometer reset button.
c. The speedometer backlighting should come on.
d. The speedometer needle should rotate to the full deflection position (A, **Figure 29**).

NOTE
The security symbol may come on even though the motorcycle is not equipped with a security system.

e. The check engine, battery and security symbols should illuminate.
f. The message *diag* should appear in the odometer window on the speedometer (B, **Figure 29**).

3. If the speedometer operates abnormally, check the wiring for the battery, ground, ignition, odometer reset switch and accessories.

FUEL SYSTEM

WARNING
Gasoline is highly flammable. When servicing the fuel system, work in a well-ventilated area. Do not expose gasoline and gasoline vapors to sparks or other ignition sources.

Begin fuel system troubleshooting with the fuel tank and work through the system, reserving the carburetor as the final point. Most fuel system problems result from an empty fuel tank, a plugged fuel filter or fuel valve, old fuel, a dirty air filter or clogged carburetor jets. Do not assume the carburetor is the problem. Unnecessary carburetor adjustment can compound the problem.

Running Conditions

Refer to the following conditions to identify whether the engine is running lean or rich.

Rich

1. Fouled spark plugs.
2. Engine misfires and runs rough under load.
3. Excessive exhaust smoke as the throttle is increased.
4. An extreme rich condition causes a choked or dull sound from the exhaust and an inability to clear the exhaust with the throttle held wide open.

Lean

1. Blistered or very white spark plug electrodes.
2. Engine overheats.
3. Slow acceleration and engine power is reduced.
4. Flat spots on acceleration that are similar in feel to when the engine starts to run out of gas.
5. Engine speed fluctuates at full throttle.

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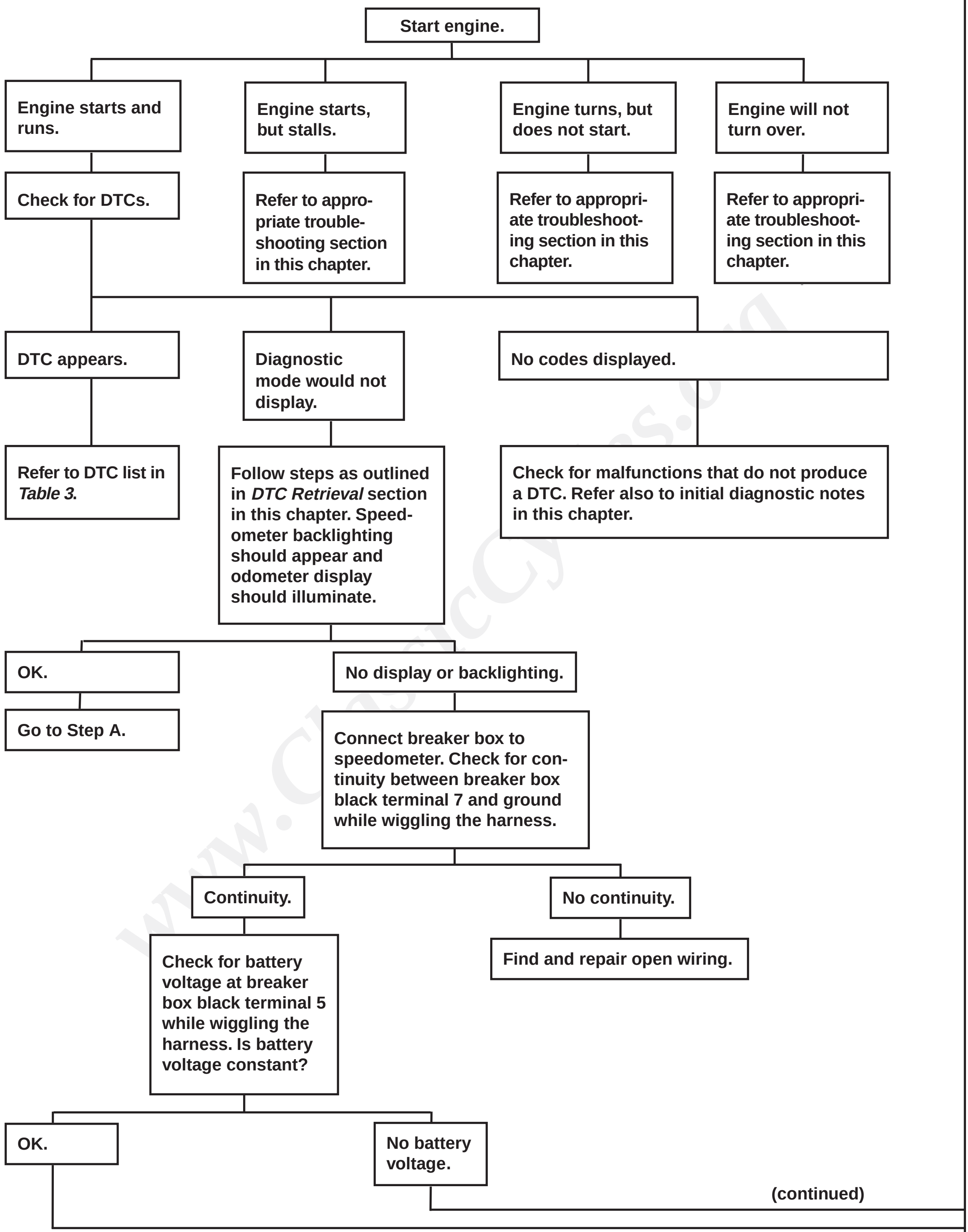
INITIAL CHECKS



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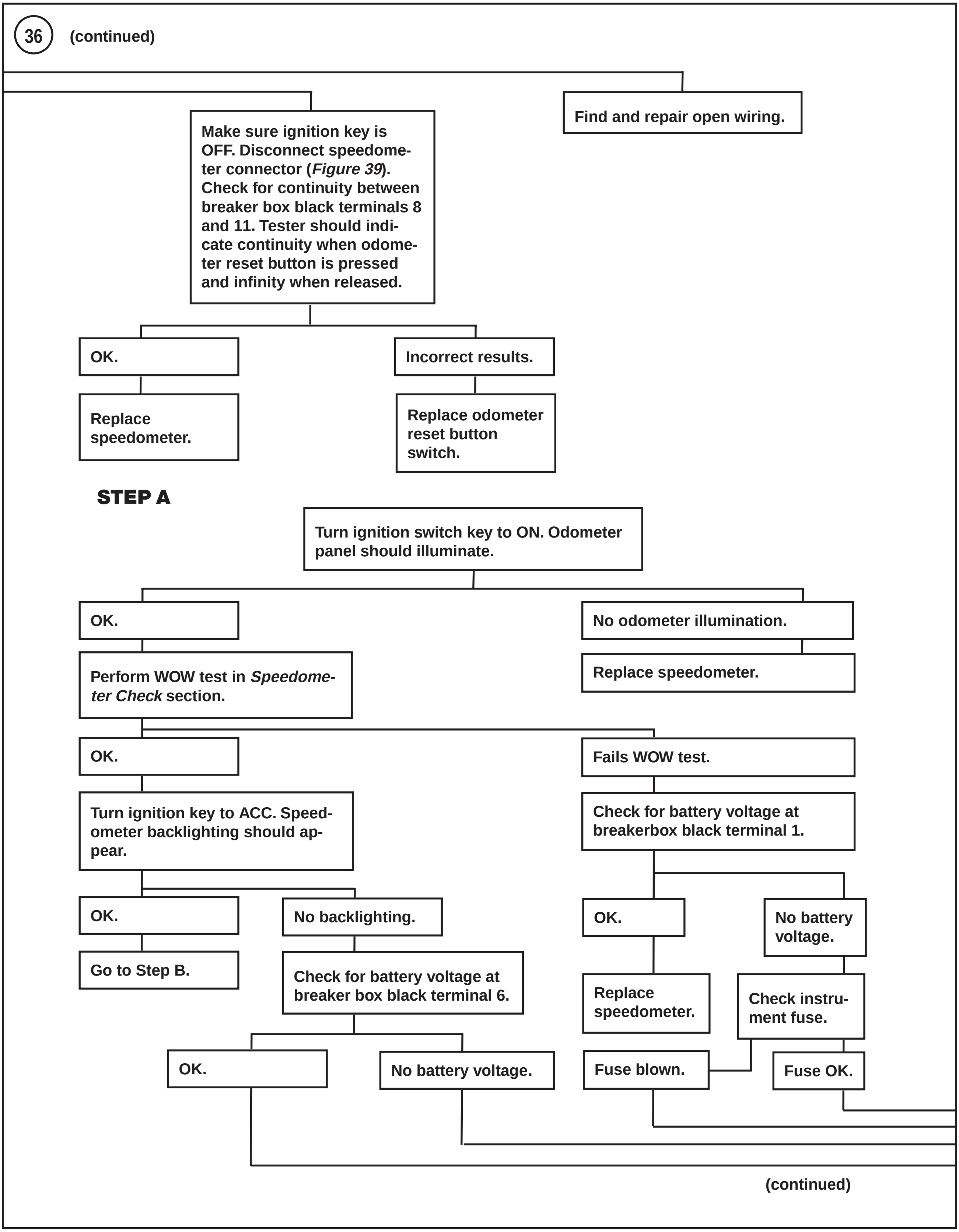

36
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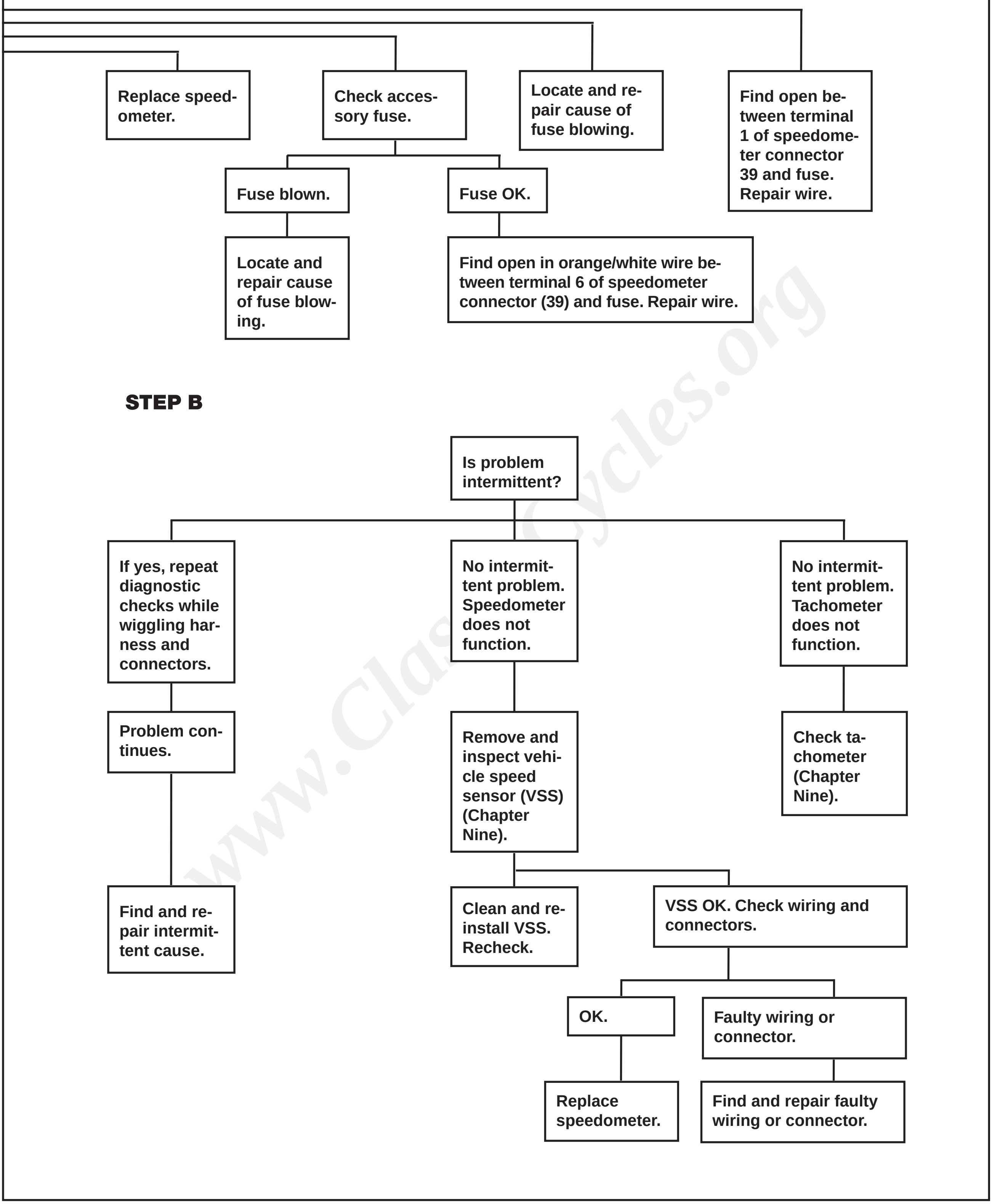
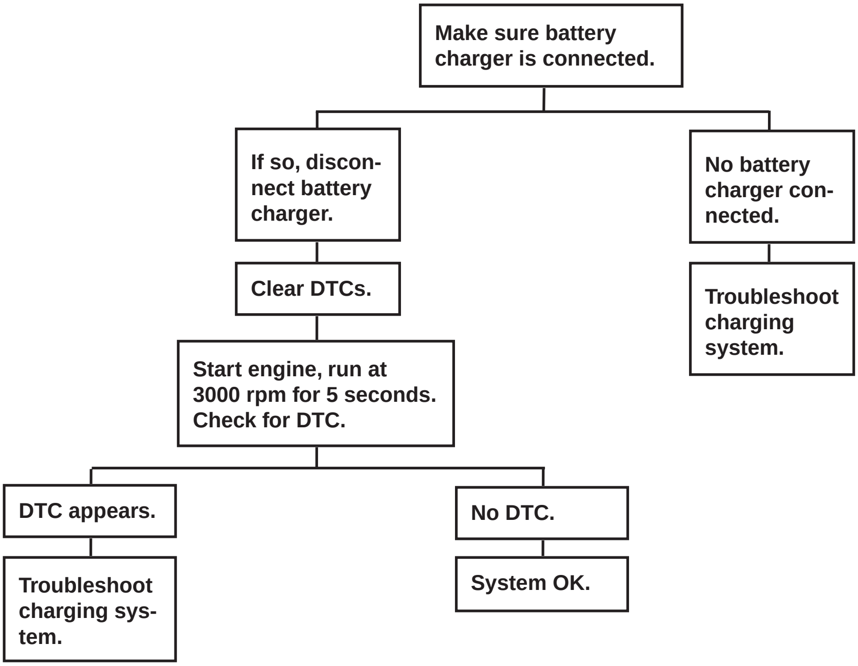
Make sure ignition key is OFF. Disconnect speedometer connector (Figure 39). Check for continuity between breaker box black terminals 8 and 11. Tester should indicate continuity when odometer reset button is pressed and infinity when released.
Find and repair open wiring.
OK.
Replace speedometer.
Incorrect results.
Replace odometer reset button switch.
STEP A
Turn ignition switch key to ON. Odometer panel should illuminate.
OK.
Perform WOW test in Speedometer Check section.
No odometer illumination.
Replace speedometer.
OK.
Turn ignition key to ACC. Speedometer backlighting should appear.
Fails WOW test.
Check for battery voltage at breakerbox black terminal 1.
OK.
Go to Step B.
No backlighting.
Check for battery voltage at breaker box black terminal 6.
OK.
No battery voltage.
OK.
Replace speedometer.
No battery voltage.
Check instrument fuse.
Fuse blown.
Fuse OK.
(continued)

36 (continued)



37

DTC B1006, B1007: ACCESSORY OR IGNITION LINE OVERVOLTAGE



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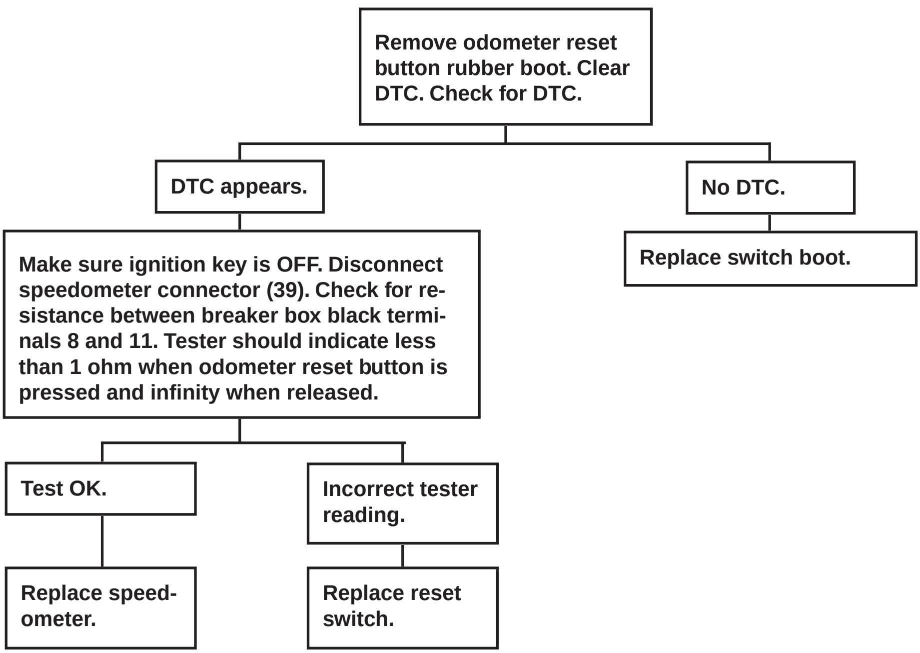
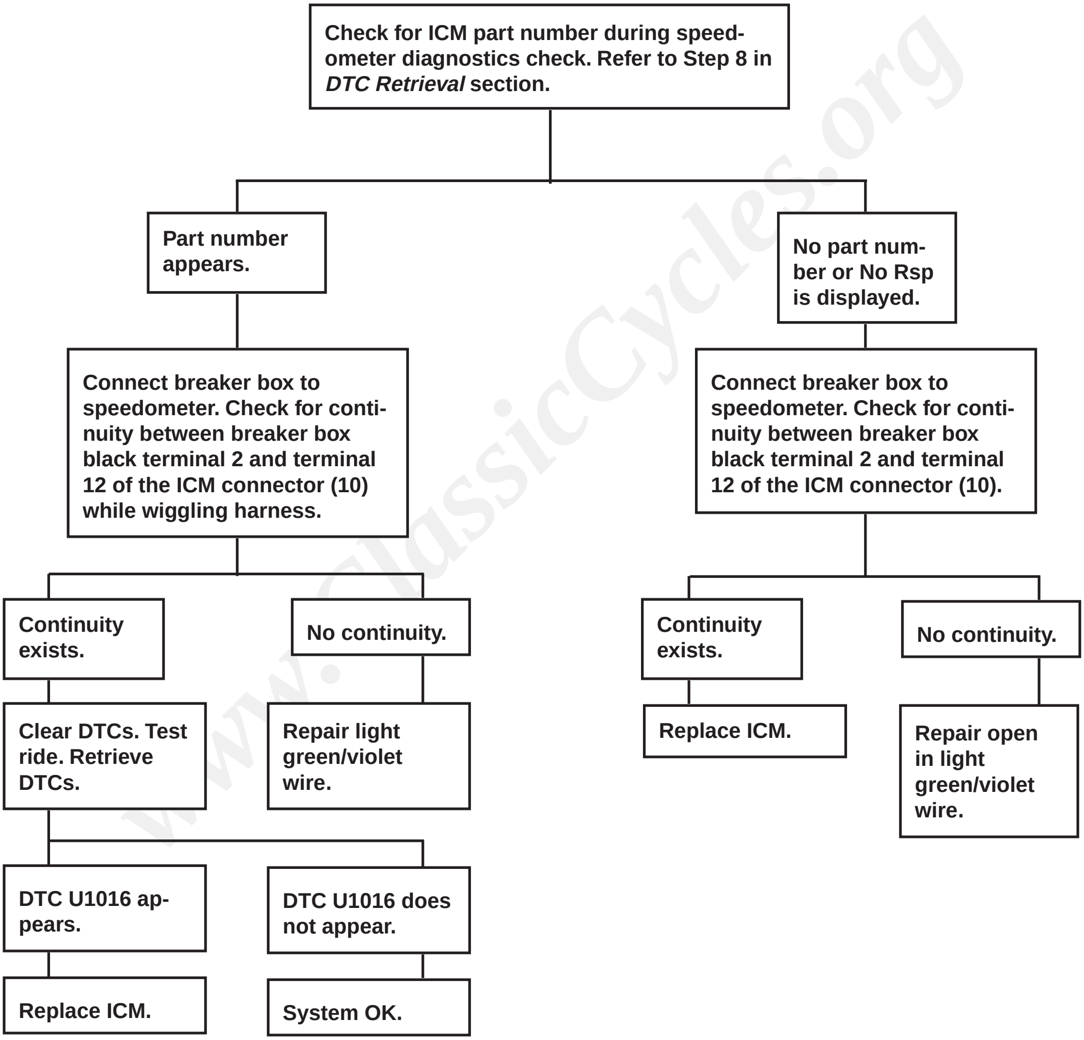
DTC B1008: RESET SWITCH CLOSED



39

DTC U1016, U1255: LOSS OF ICM SERIAL DATA

NOTE: This procedure applies to loss of serial data communication between the ICM and speedometer. Refer to *Figure 40* for DTC U1016 and U1255 related to the ICM and TSM/TSSM.



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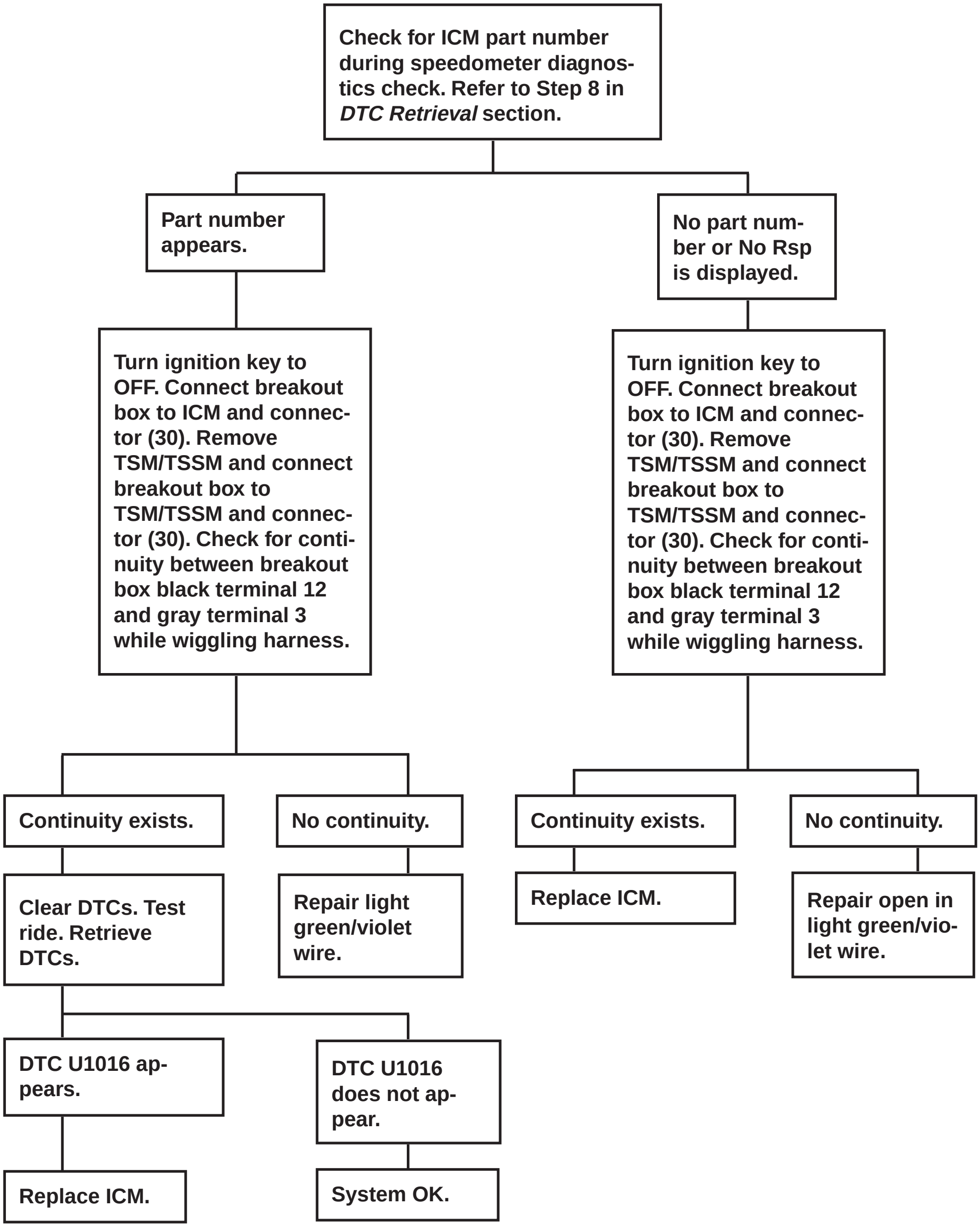
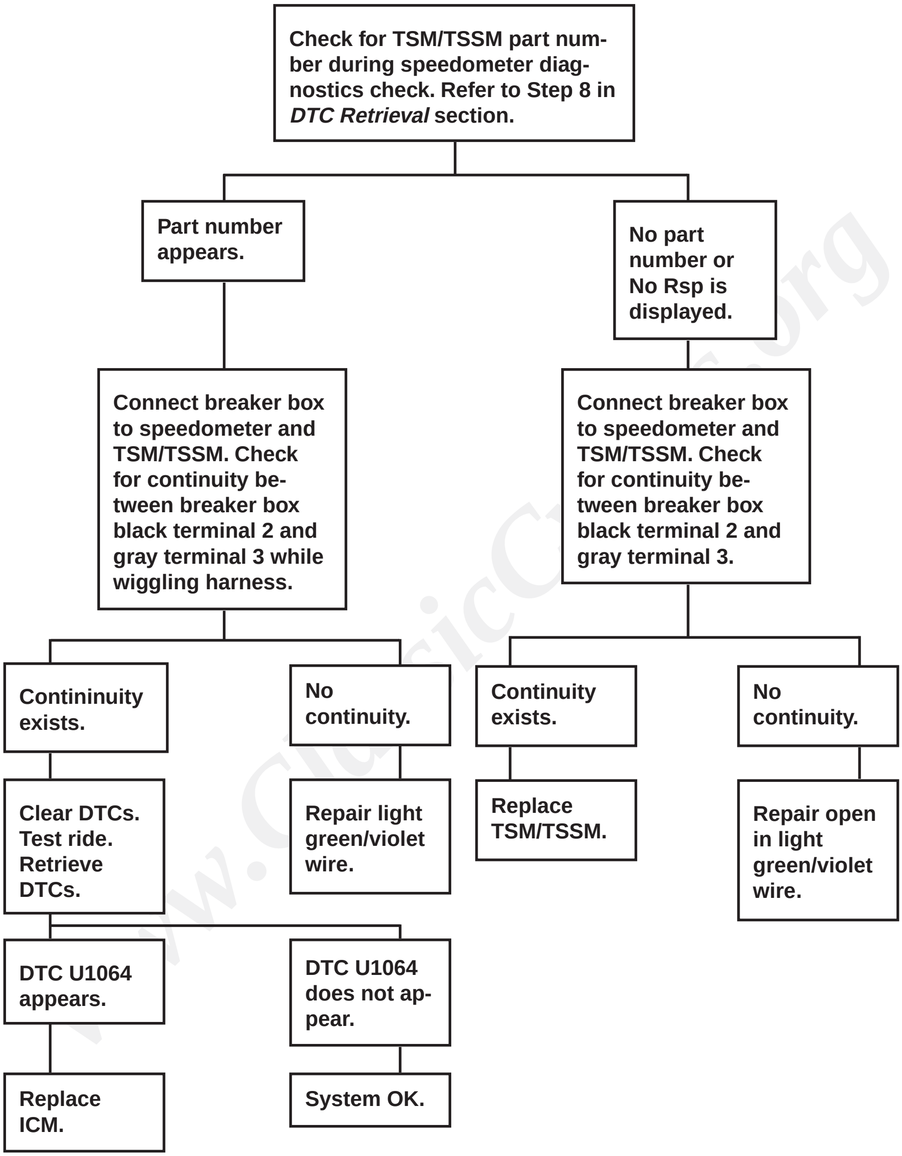
DTC U1016, U1255: LOSS OF ICM SERIAL DATA

NOTE: This procedure applies to loss of serial data communication between the ICM and TSM/TSSM. Refer to *Figure 39* for DTC U1016 and U1255 related to the ICM and speedometer.

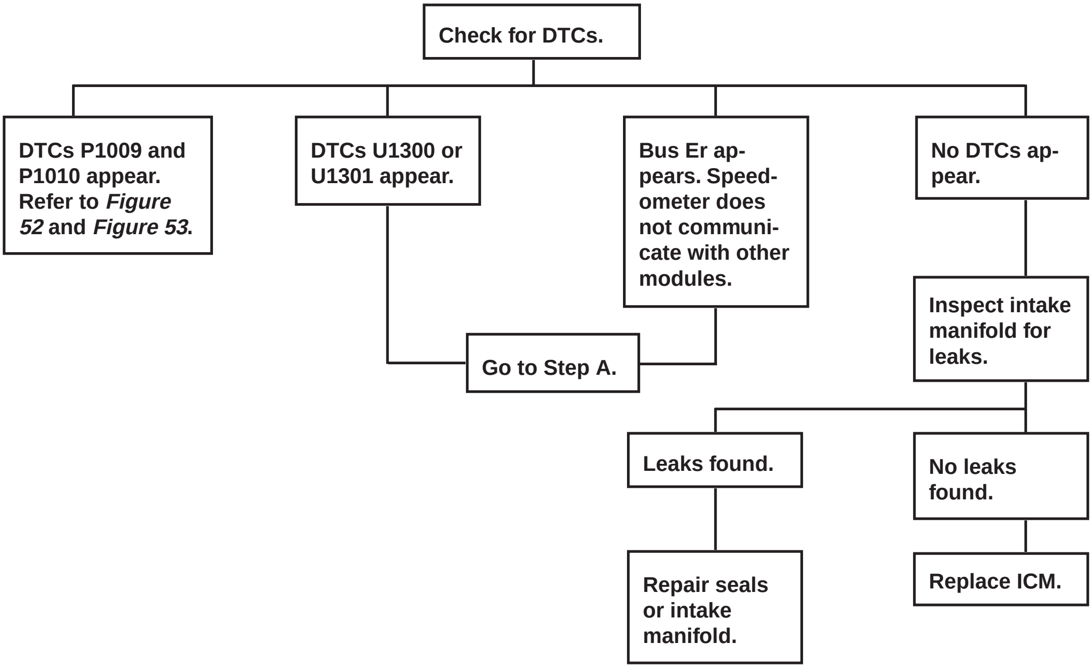


DTC U1064, U1255: LOSS OF TSM/TSSM SERIAL DATA

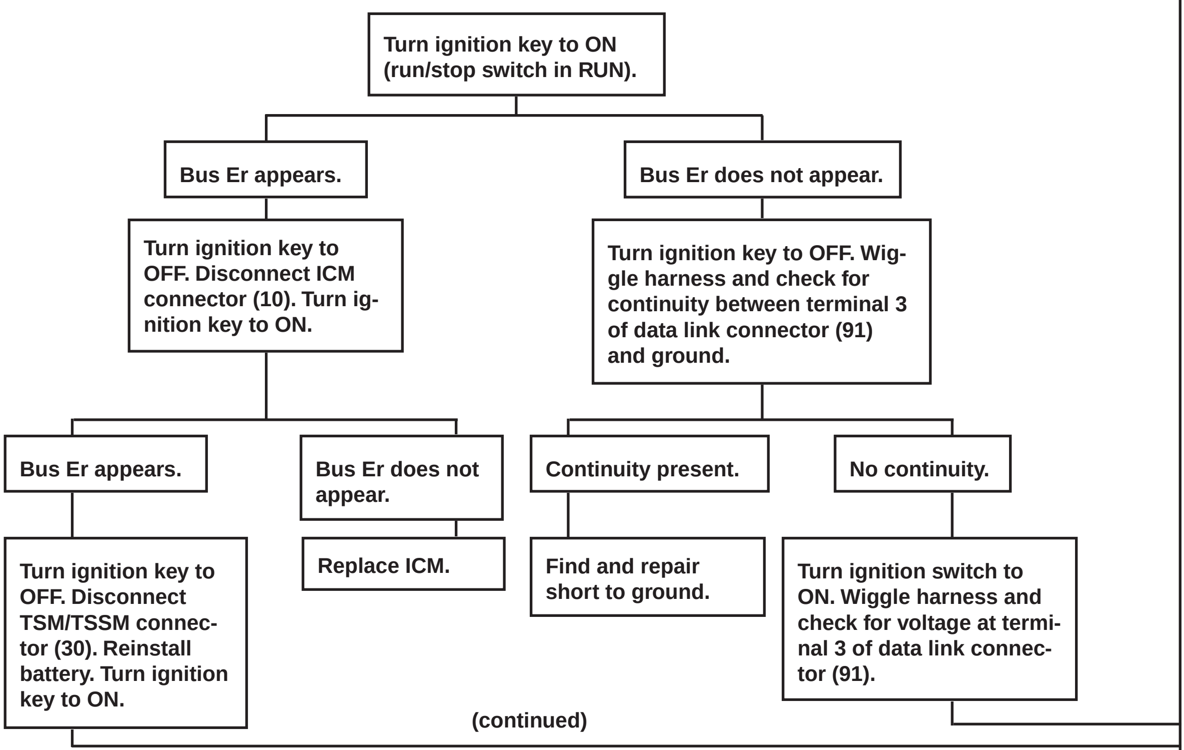


42

DTC U1300, U1301, BUS ER: SERIAL DATA LOW OR SERIAL DATA OPEN/HIGH



STEP A



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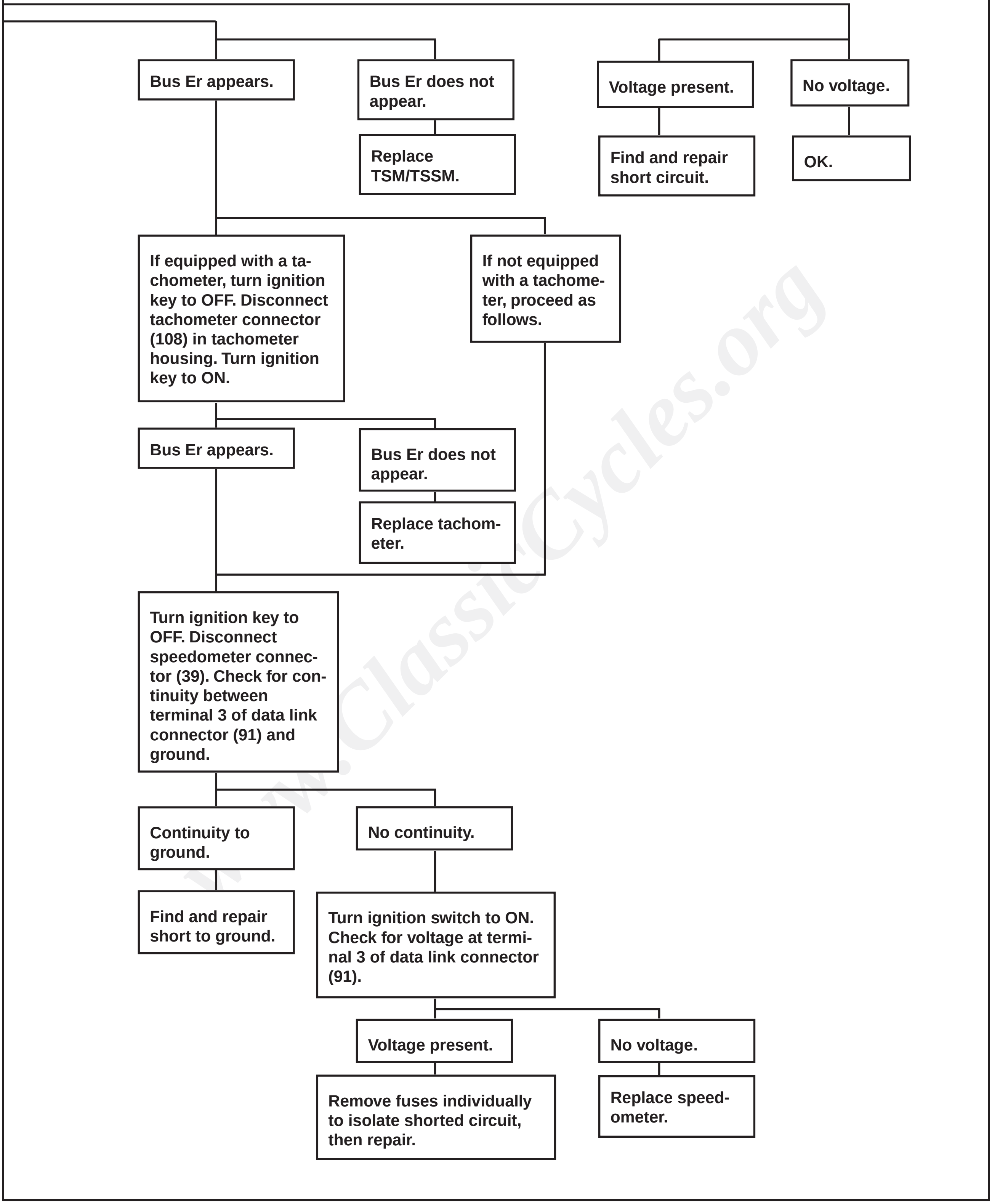
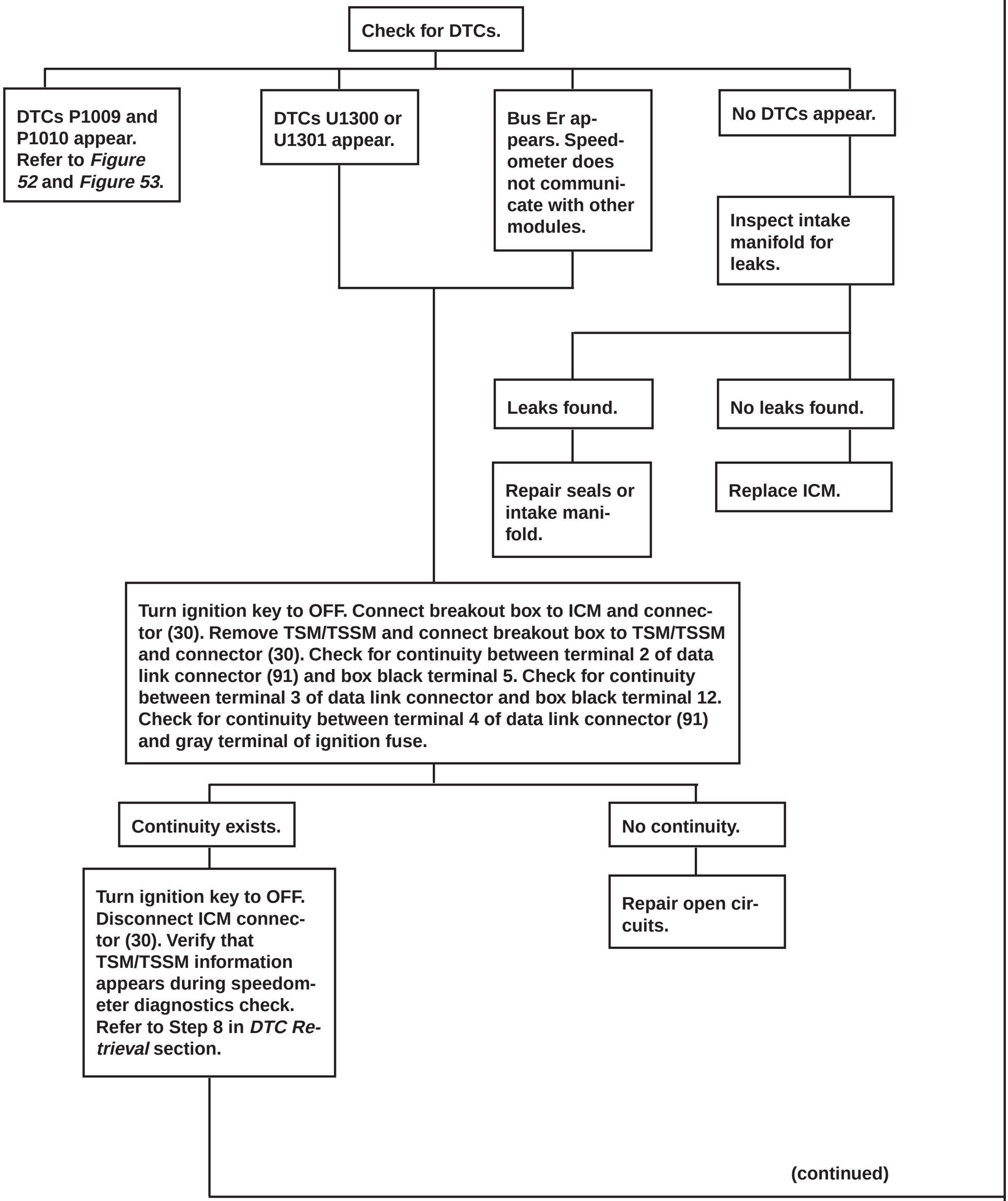
42 (continued)



43

DTC U1300, U1301, BUS ER: ENGINE STARTS, THEN STALLS

NOTE: If problem is not resolved, refer also to *Figure 42*.



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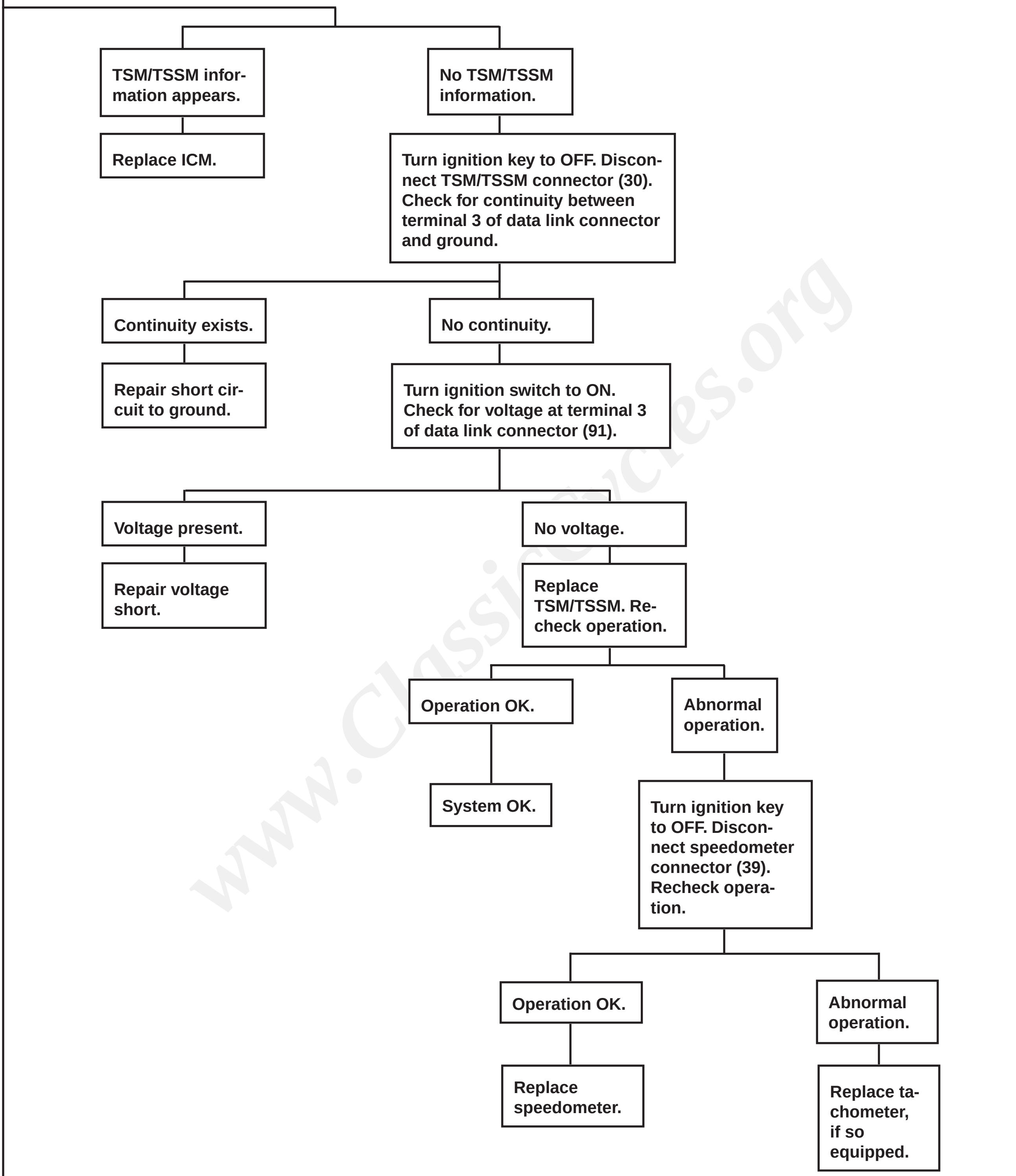
43 **(continued)**



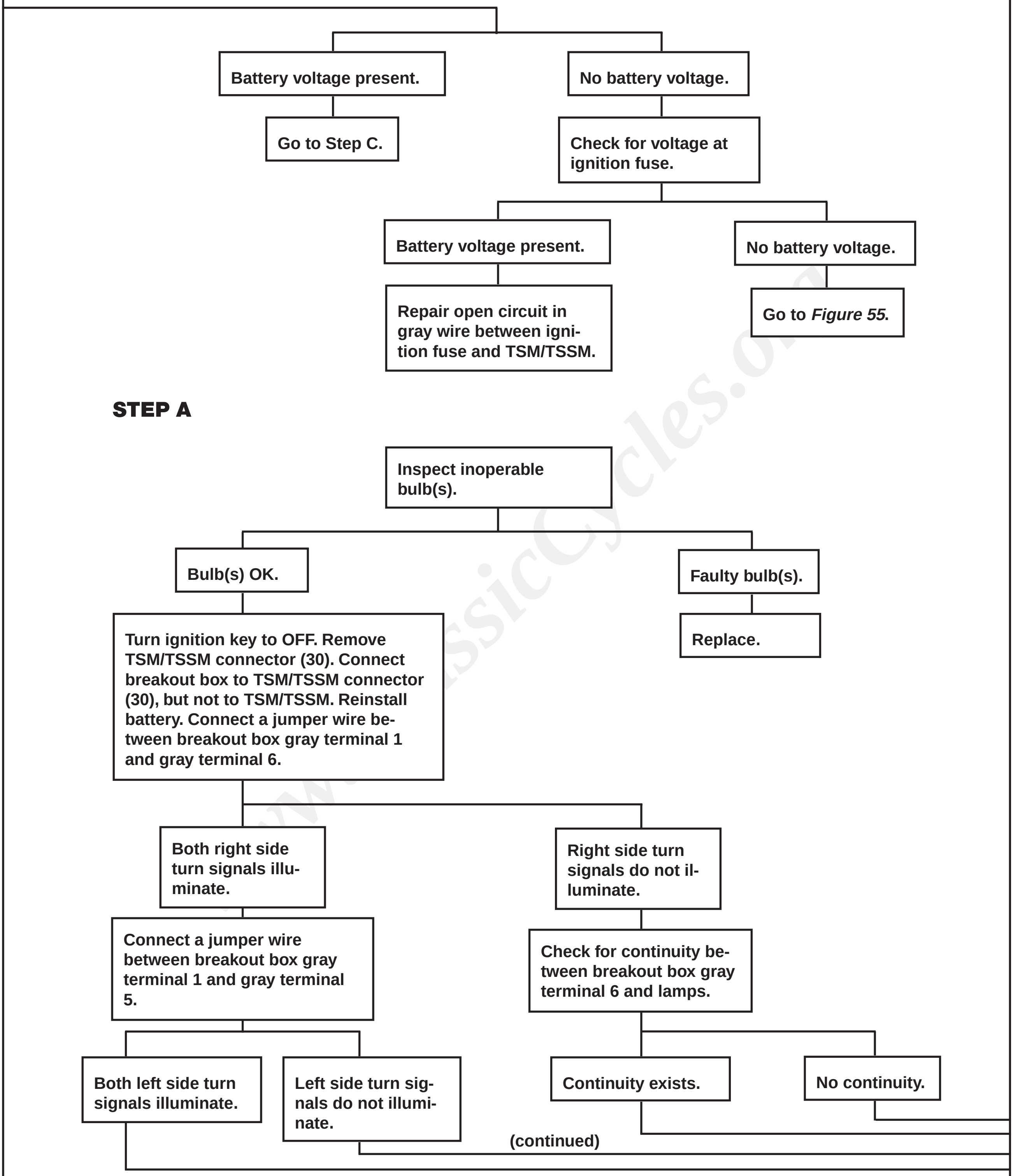
44

DTC B1121, B1122, B1141: TURN SIGNALS WILL NOT FLASH; 4-WAY FLASHERS INOPERABLE

- Turn ignition key to ON.
  - Turn signals on continuously.
    - Turn ignition key to OFF. Remove TSM/TSSM connector (30). Connect breakout box to TSM/TSSM connector (30), but not to TSM/TSSM. Reinstall battery. Turn ignition key to ON. Check for battery voltage at breakout box gray terminal 5 (left turn signals) or gray terminal 6 (right turn signals).
      - Battery voltage present.
        - Find and repair short.
      - No battery voltage.
        - Replace TSM/TSSM.
  - Turn signals not on.
    - Operate 4-way flasher.
      - Lamps illuminate.
        - Go to Step A.
      - Lamps not on.
        - Check TSM/TSSM connector (30).
          - Connector OK.
            - Turn ignition key to OFF. Remove TSM/TSSM connector (30). Connect breakout box to TSM/TSSM connector (30), but not to TSM/TSSM. Reinstall battery. Check for battery voltage at breakout box gray terminal 1 (positive) and gray terminal 12 (negative).
              - Battery voltage present.
                - Check for battery voltage at breakout box gray terminal 2 (positive) and gray terminal 12 (negative).
              - No battery voltage.
                - Go to Step B.
          - Faulty connection.
            - Mate connector correctly.

(continued)

44 (continued)



44 (continued)

Go to Step D.

Check for continuity between breakout box gray terminal 5 and lamps.

- Continuity exists.
  - Repair open ground circuit.
- No continuity.
  - Repair open between TSM/TSSM connector (30) and lamps.

Repair open ground circuit.

Repair open between TSM/TSSM connector (30) and lamps.

STEP B

Turn ignition key to OFF. Disconnect the TSM/TSSM connector (30). Connect breakout box to TSM/TSSM connector (30), but not to TSM/TSSM. Reinstall battery. Check resistance between breakout box gray terminal 12 and ground.

- Resistance less than 1 ohm.
  - Check for battery voltage at both 15 amp battery fuse terminals.
    - Voltage present at both terminals.
      - Repair open in brown/gray wire between TSM/TSSM and battery fuse.
    - No voltage.
      - Voltage present at one terminal.
      - No voltage at either terminal.
- Resistance greater than 1 ohm.
  - Repair ground circuit.

(continued)

Replace fuse.

Repair open circuit between fuse block and 30 amp Maxi-fuse.

STEP C

Turn ignition key to OFF. Disconnect TSM/TSSM connector (30). Connect breakout box to TSM/TSSM and connector (30). Reinstall battery. Turn ignition key to ON. Check for battery voltage at breakout box gray terminal 7 when right turn signal button is depressed.

Battery voltage present.

Check for battery voltage at breakout box gray terminal 8 when left turn signal button is depressed.

Battery voltage present.

Go to Step A.

No voltage.

Remove fuel tank and connect breakout box and adapters between left handlebar switch connectors (24). Turn ignition switch to ON. Check voltage at breakout box black terminal 5 when left turn signal button is depressed.

No voltage.

Remove fuel tank and connect breakout box and adapters between right handlebar switch connectors (22). Turn ignition switch to ON. Check voltage at breakout box black terminal 5 when right turn signal button is depressed.

Battery voltage present.

Repair open circuit between TSM/TSSM and right handlebar switch connector (22).

No voltage.

Turn ignition switch to OFF. Check for continuity between breakout box black terminal 5 and ground.

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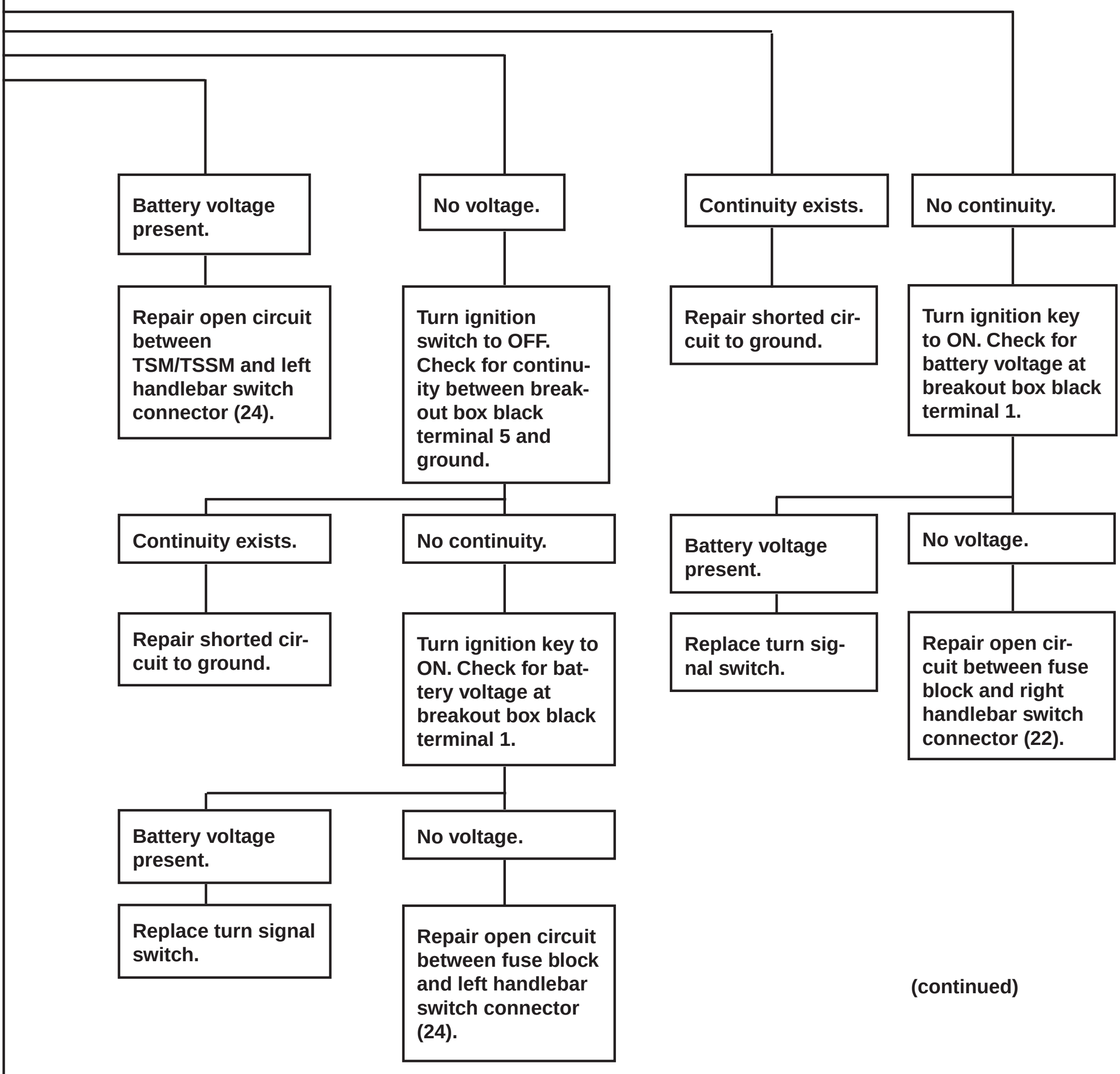
44 (continued)



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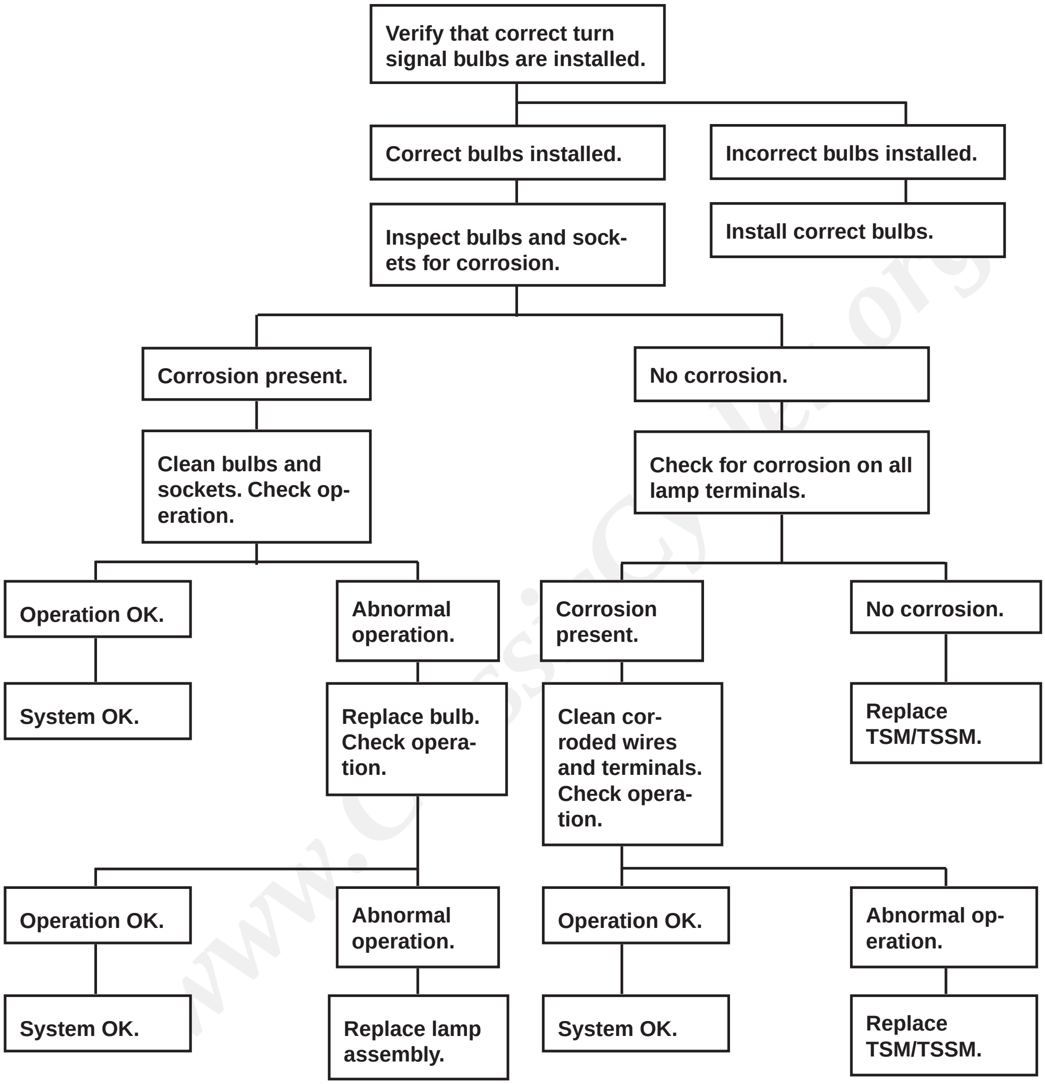
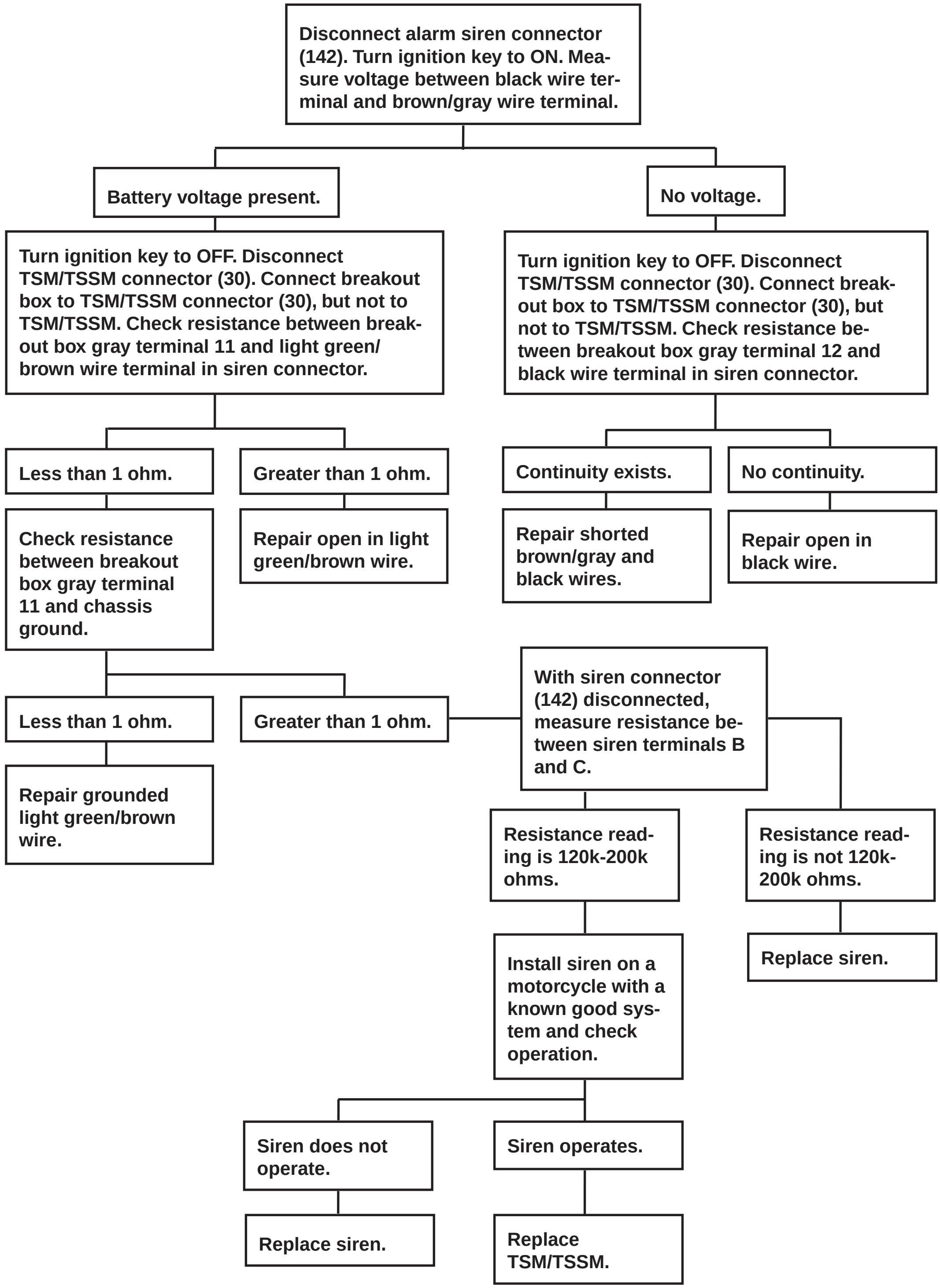
44 (continued)

STEP D



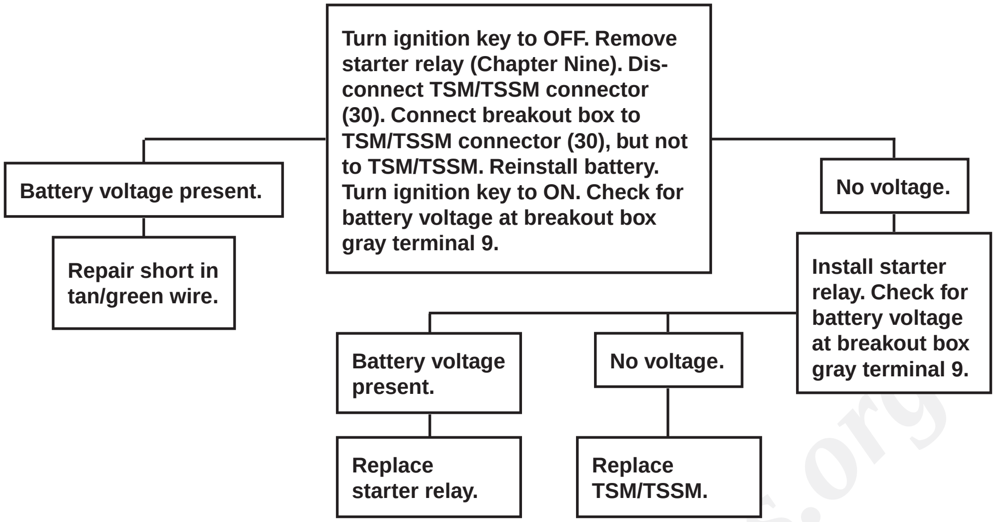
45

DTC B1131, B1132: ALARM OUTPUT



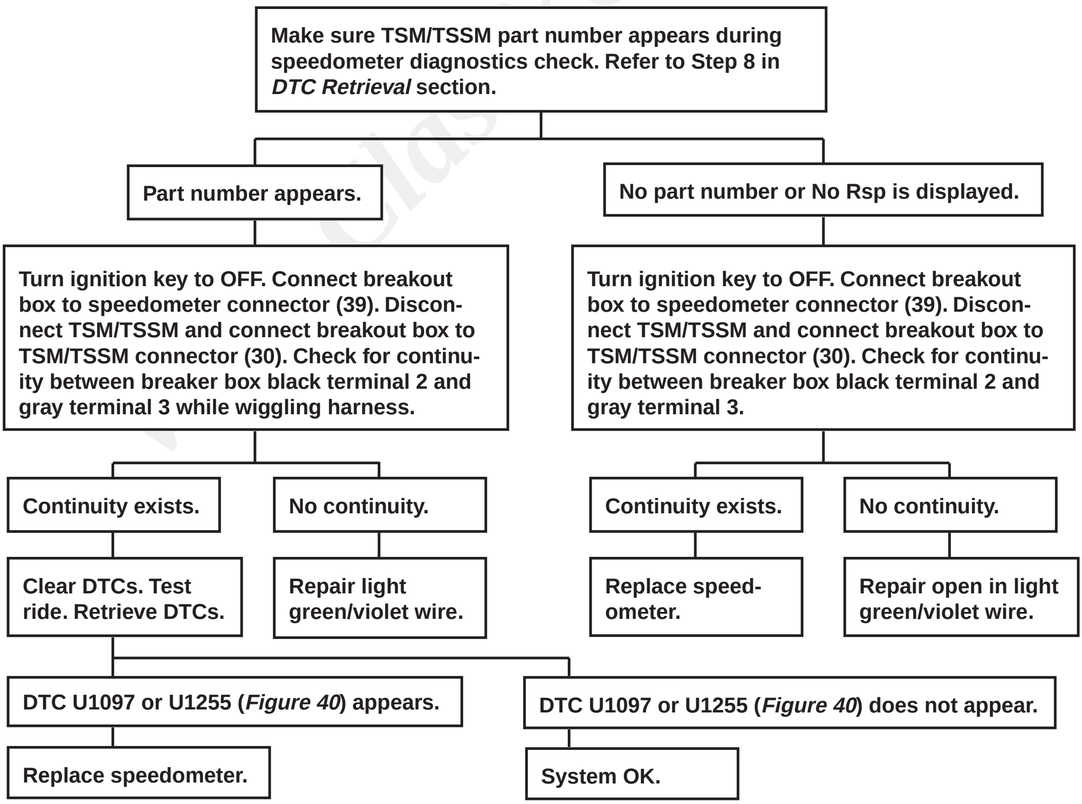
46

DTC B1134: STARTER OUTPUT HIGH

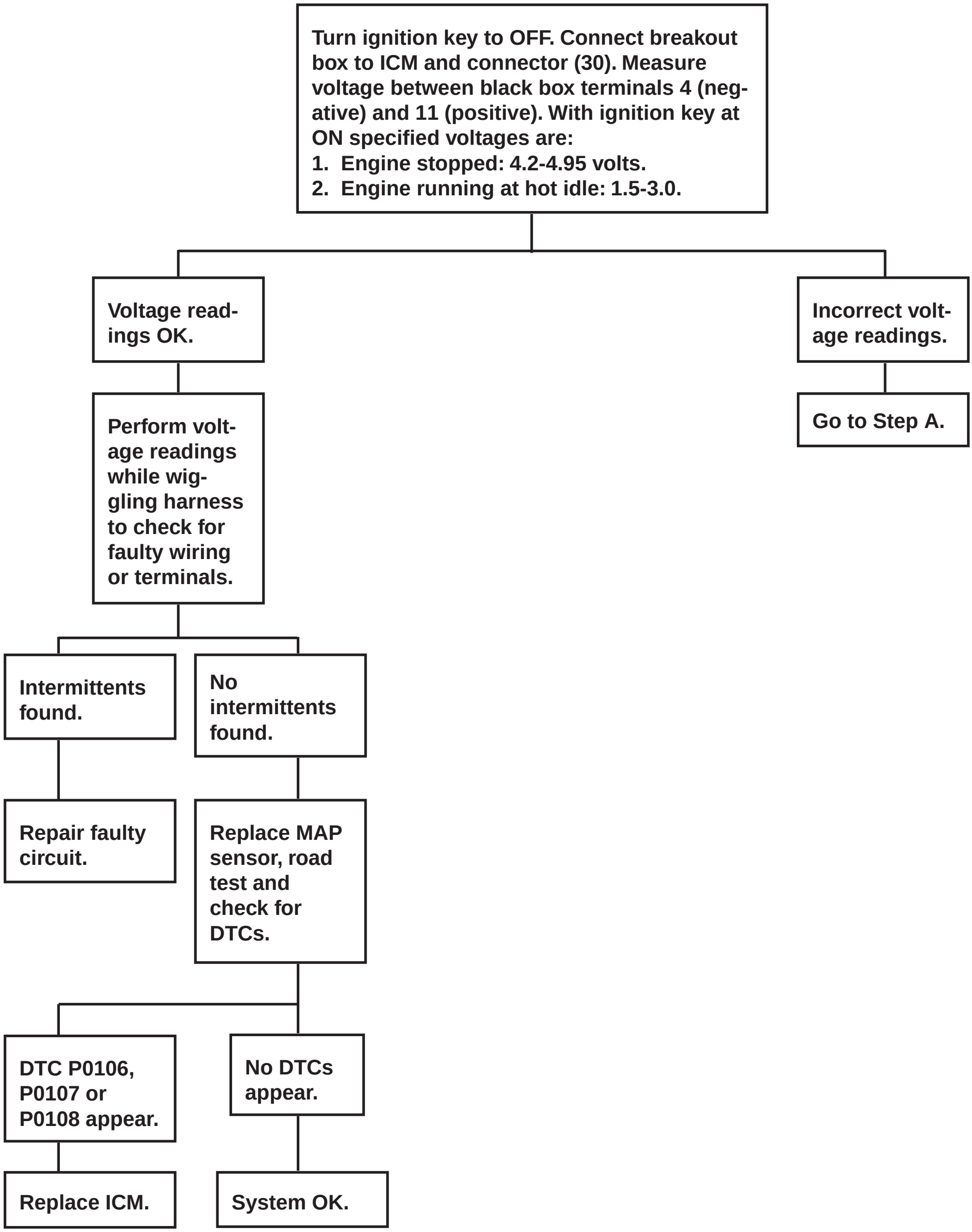


47

DTC U1097, U1255: LOSS OF SPEEDOMETER OR TSM/TSSM SERIAL DATA



DTC P0106, P0107, P0108: MAP SENSOR



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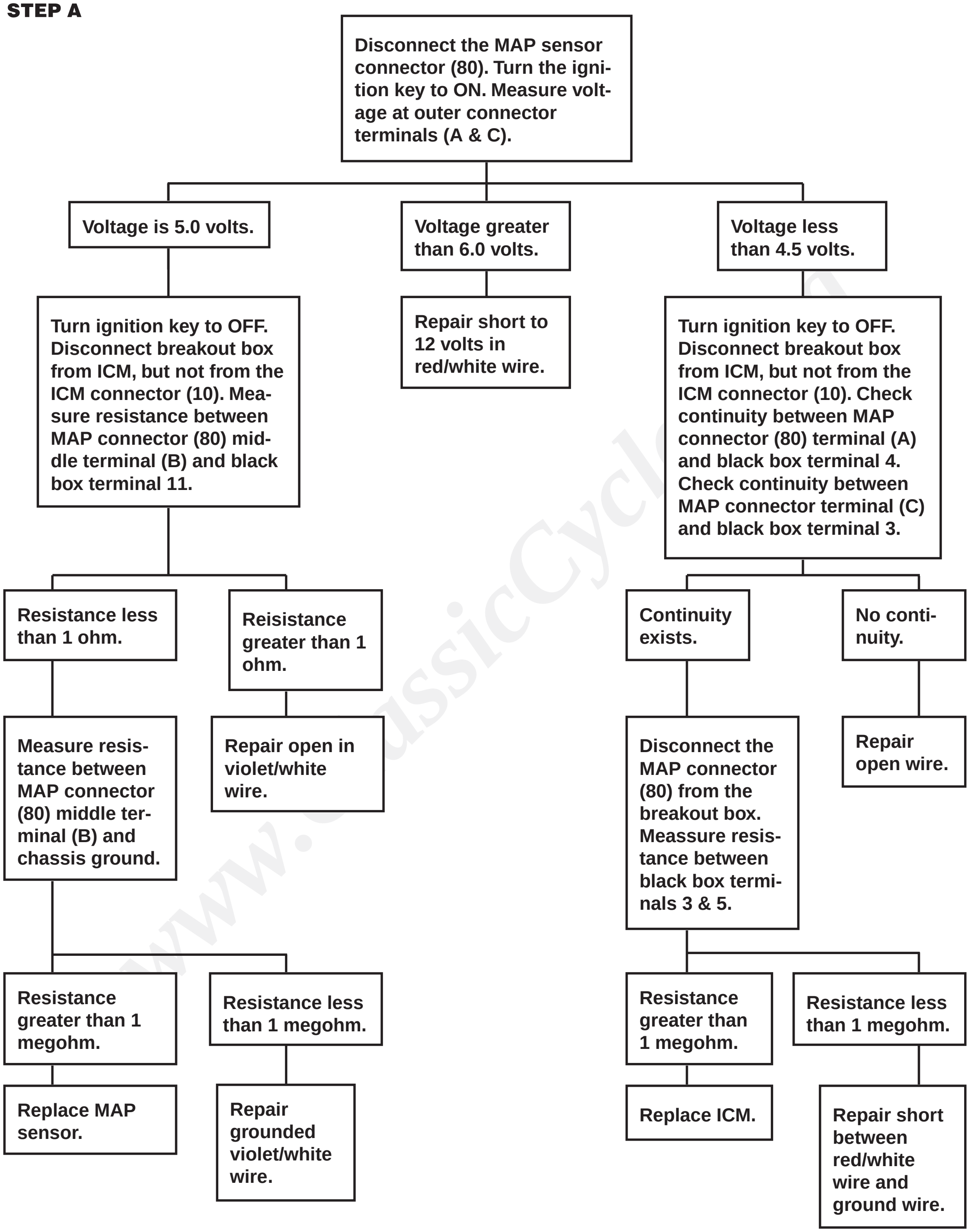
STEP A



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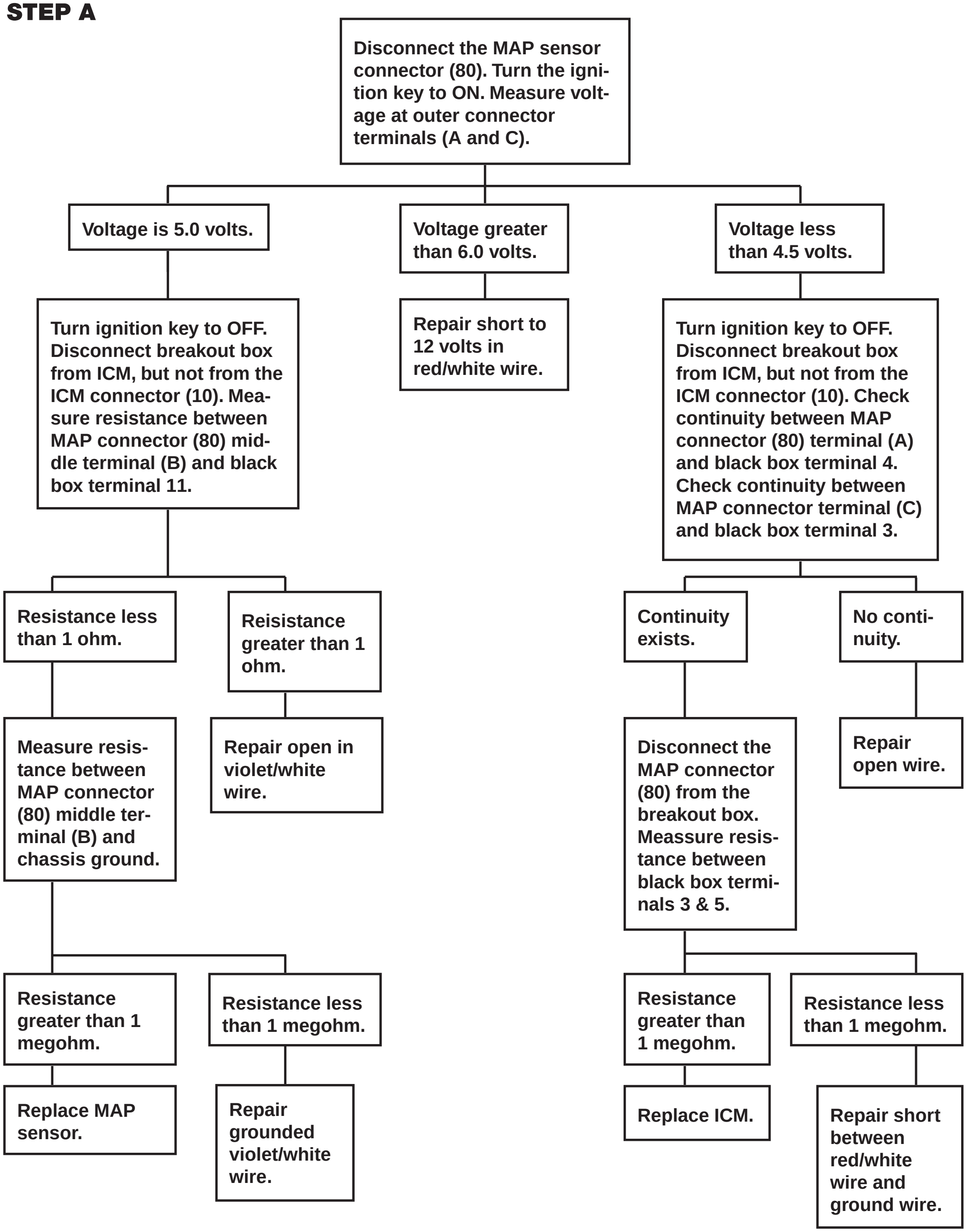
STEP A



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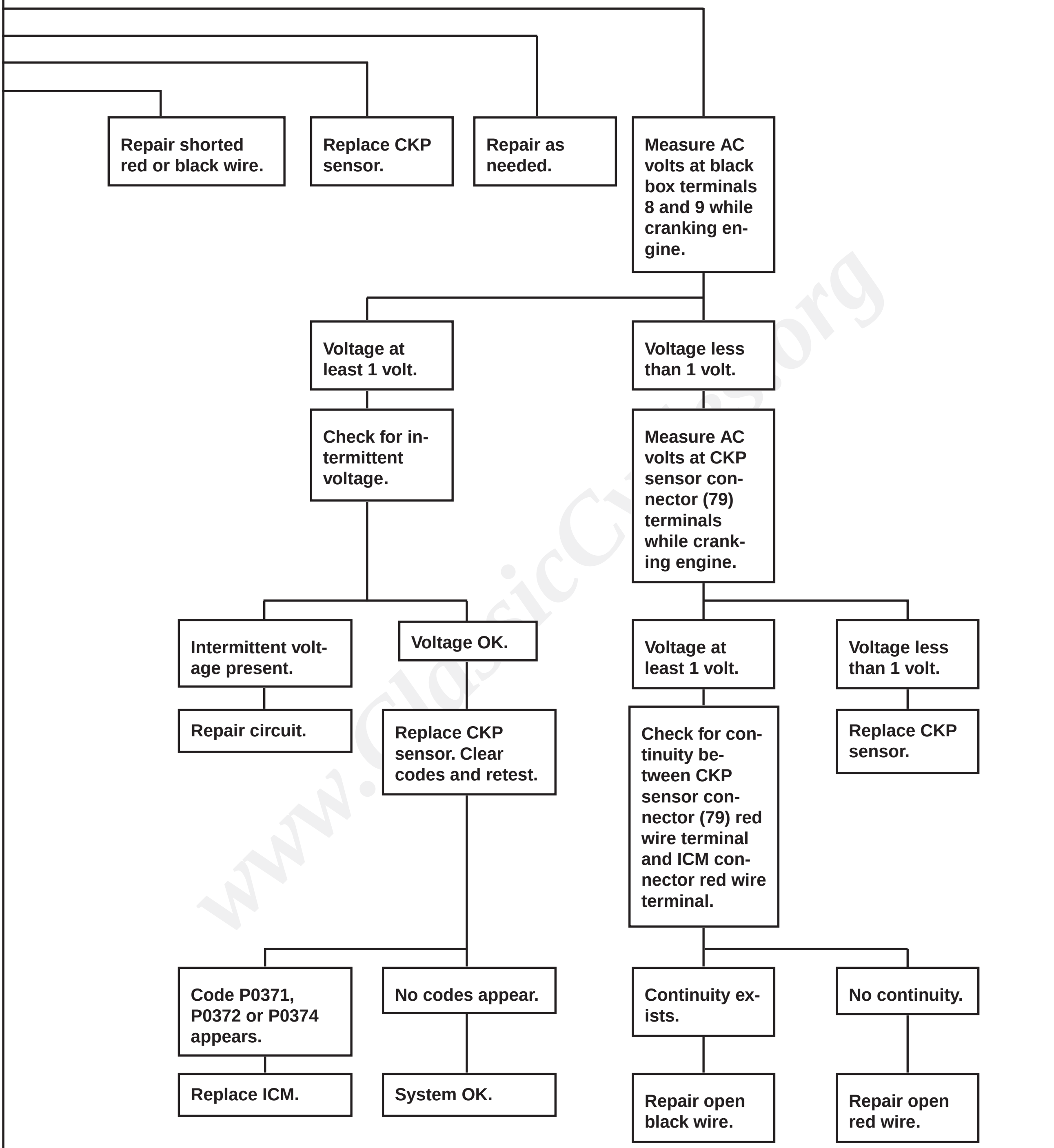
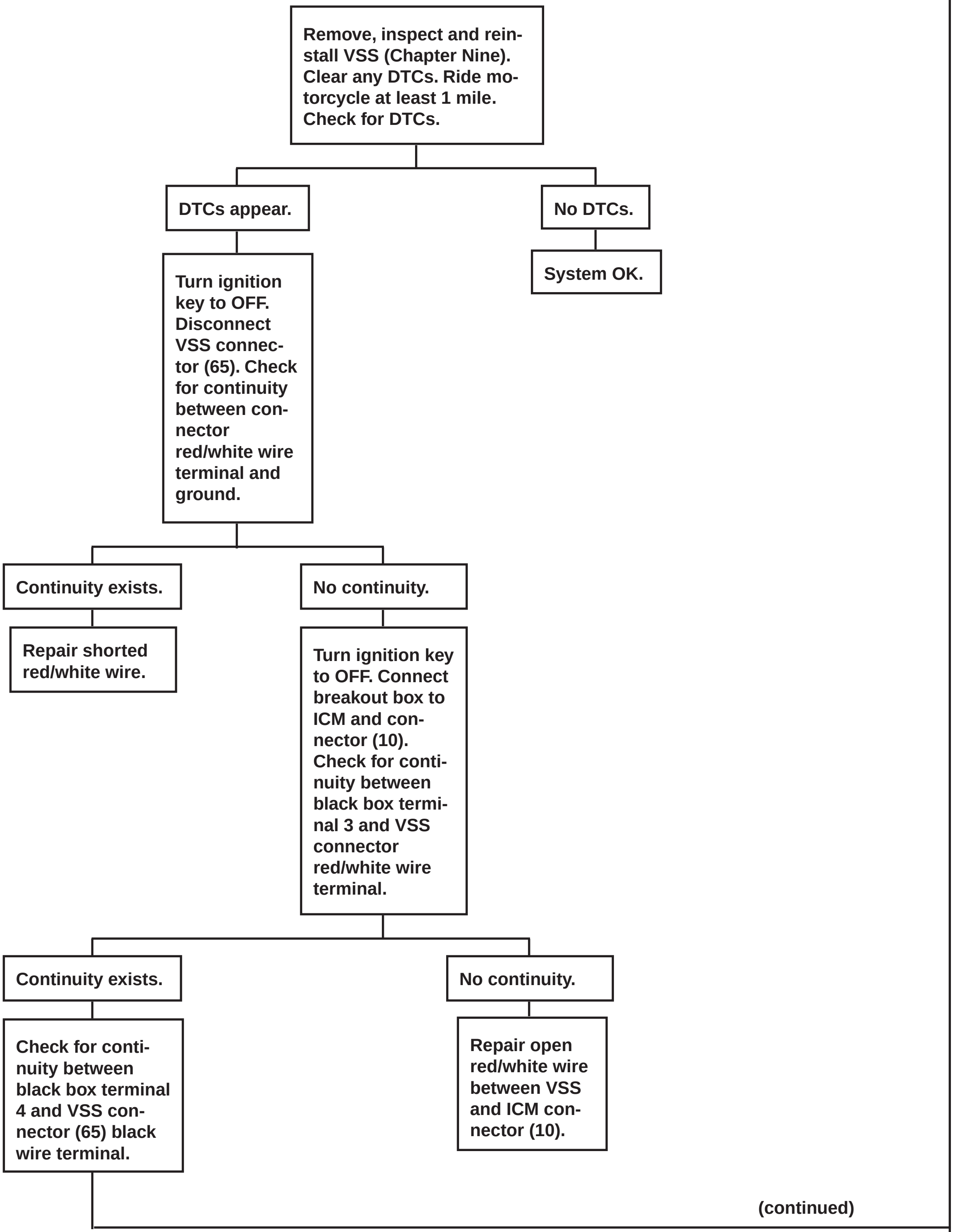


50

DTC P0501, P0502: VEHICLE SPEED SENSOR (VSS)



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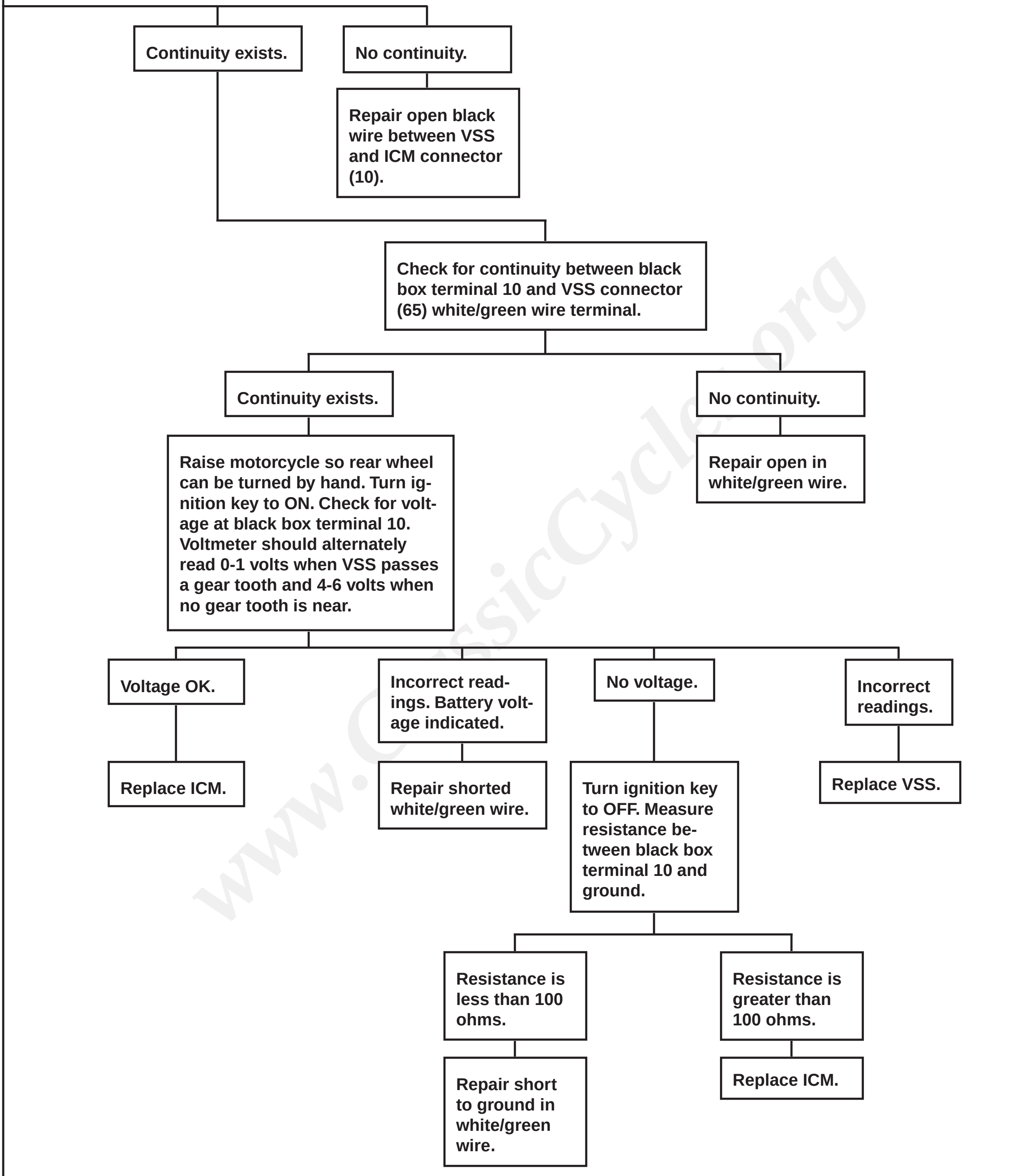
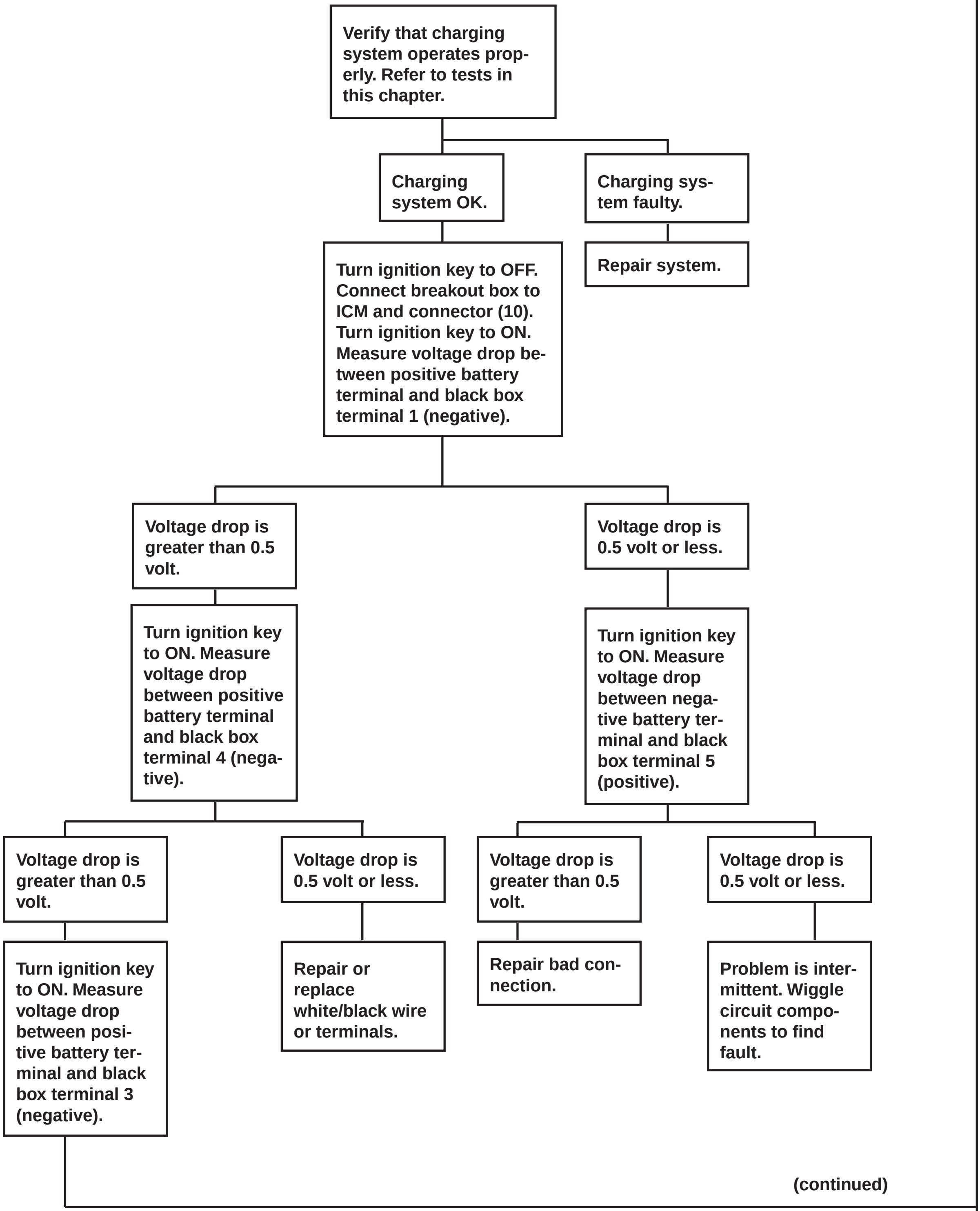


51

DTC P0562, P0563: SYSTEM VOLTAGE



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51 (continued)

Voltage drop is greater than 0.5 volt.

Voltage drop is 0.5 volt or less.

Check for loose wires or corrosion at engine stop switch connector. If OK, replace switch.

Turn ignition key to ON. Measure voltage drop between positive battery terminal and gray wire terminal of ignition fuse.

Voltage drop is greater than 0.5 volt.

Voltage drop is 0.5 volt or less.

Turn ignition key to ON. Measure voltage drop between positive battery terminal and red/black wire terminal of ignition fuse.

Repair or replace gray wire or terminal.

Voltage drop is greater than 0.5 volt.

Voltage drop is 0.5 volt or less.

Turn ignition key to ON. Measure voltage drop between positive battery terminal and terminal A of Maxi-fuse.

Replace fuse or terminals.

(continued)

51 (continued)

- Voltage drop is greater than 0.5 volt.
  - Turn ignition key to ON. Measure voltage drop between positive battery terminal and terminal B of Maxi-fuse.
    - Voltage drop is greater than 0.5 volt.
      - Replace wire of terminals causing high resistance.
    - Voltage drop is 0.5 volt or less.
      - Replace Maxi-fuse.
- Voltage drop is 0.5 volt or less.
  - Replace ignition switch or terminals.

52

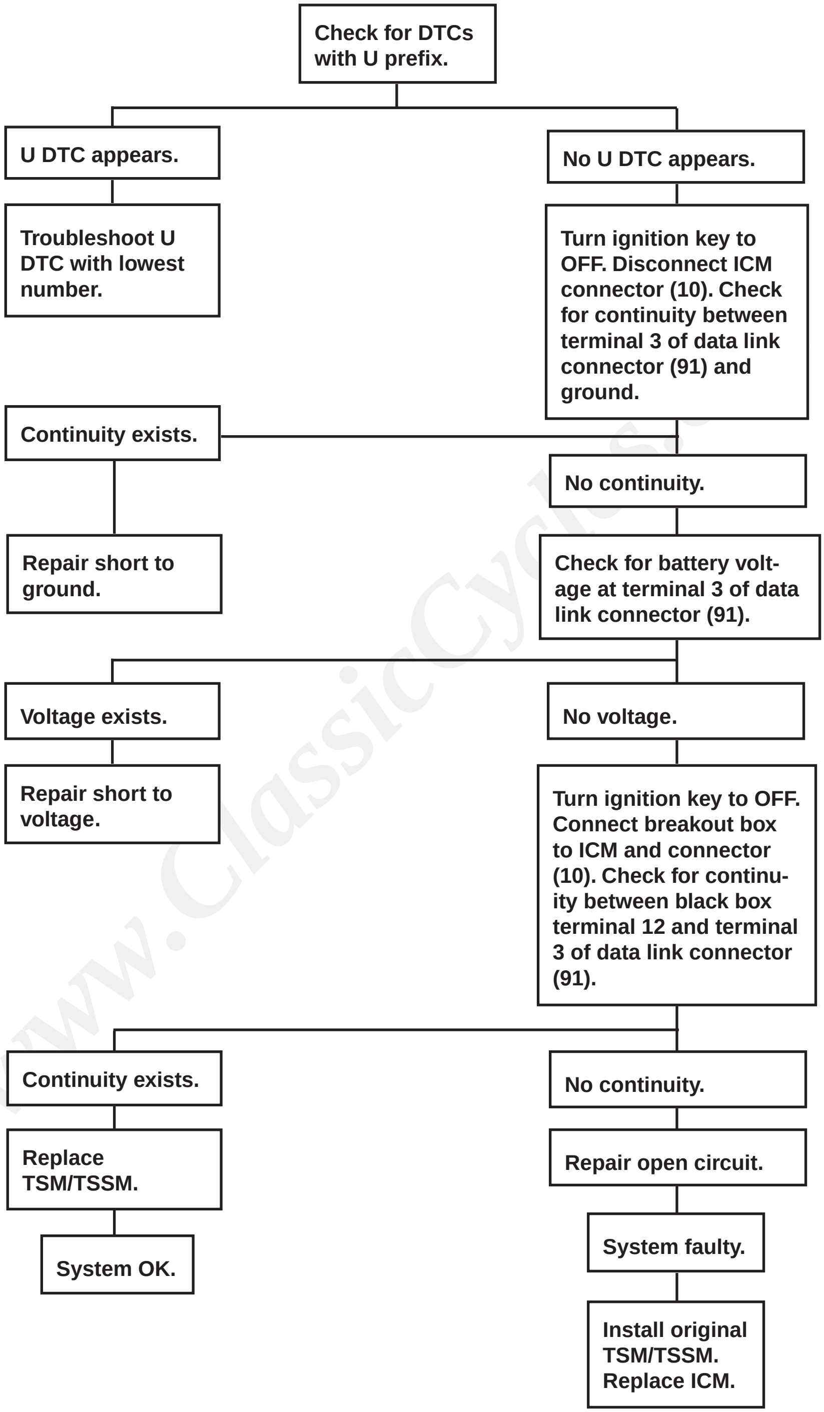
DTC P1009: INCORRECT PASSWORD

Perform password learning procedure in Chapter Nine.

- DTC P1009 appears.
  - Replace TSM/TSSM.
    - No DTC P1009.
      - System OK.
    - DTC P1009 appears.
      - Install original TSM/TSSM. Replace ICM.
- No DTC P1009.
  - System OK.

53

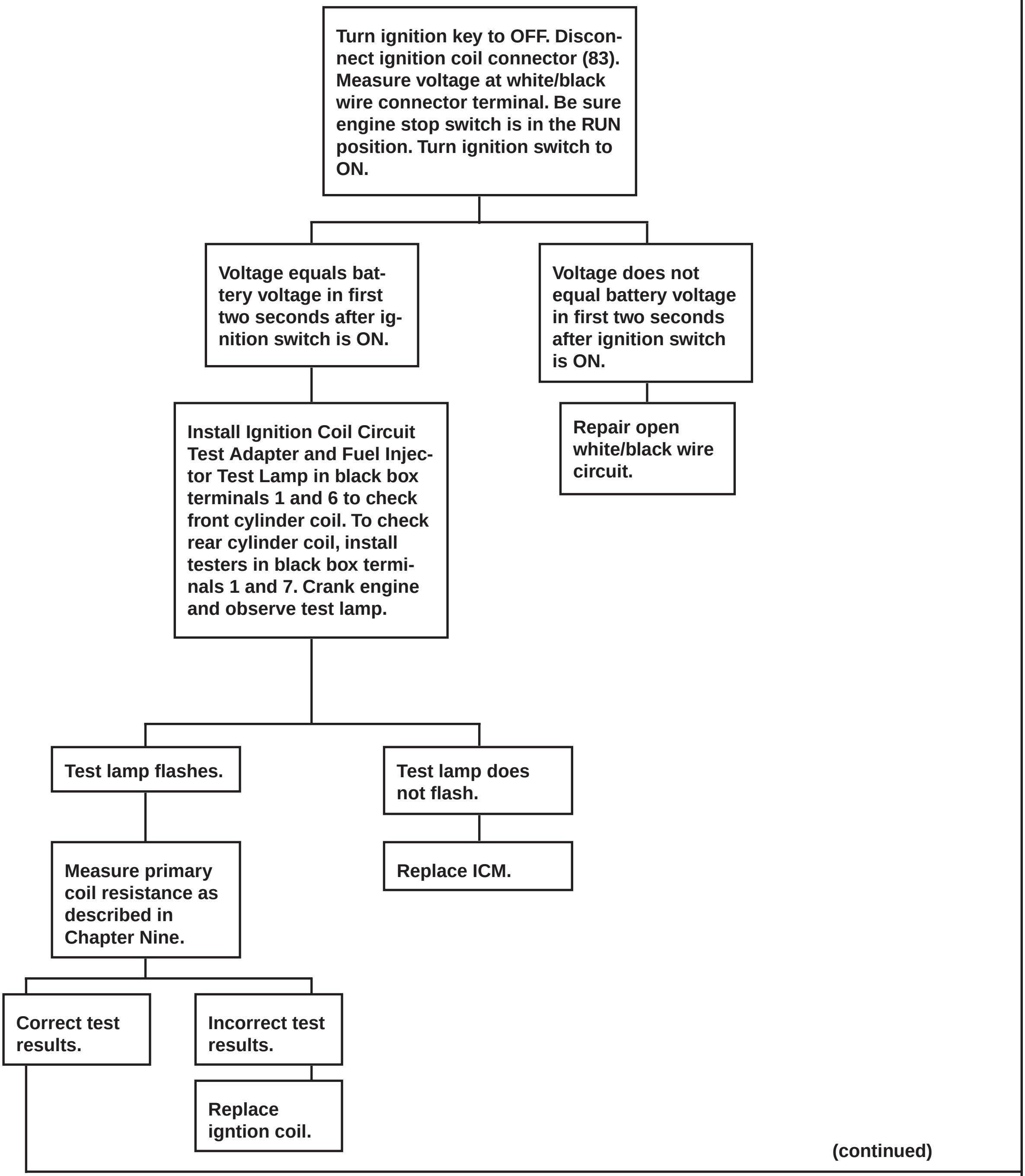
DTC P1010: MISSING PASSWORD



54

DTC P1351, P1352, P1354, P1355: IGNITION COIL

NOTE: This procedure uses H-D tools Ignition Coil Circuit Test Adapter (part No. HD-44687) and Fuel Injector Test Lamp (part No. HD-34730-2C).



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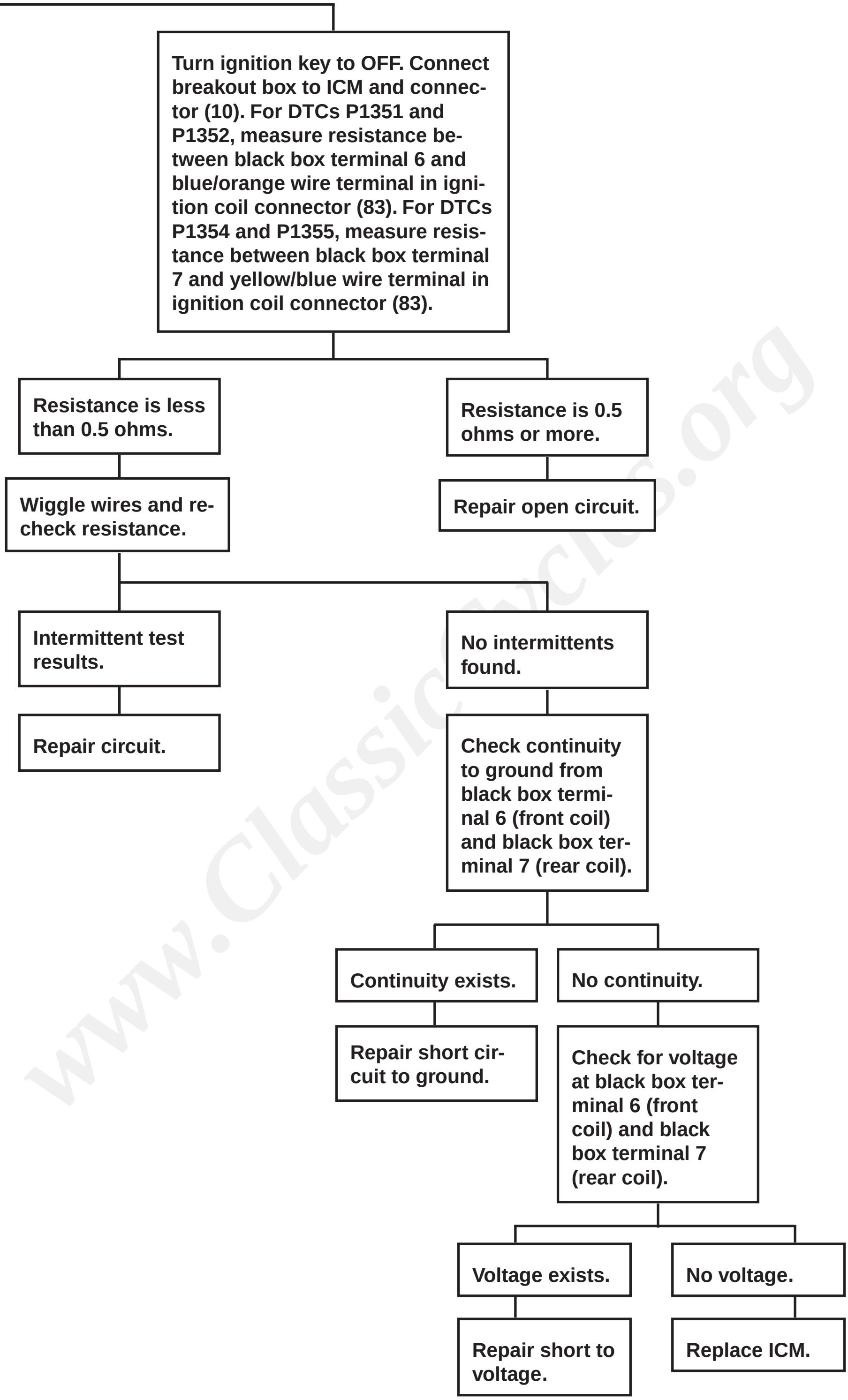
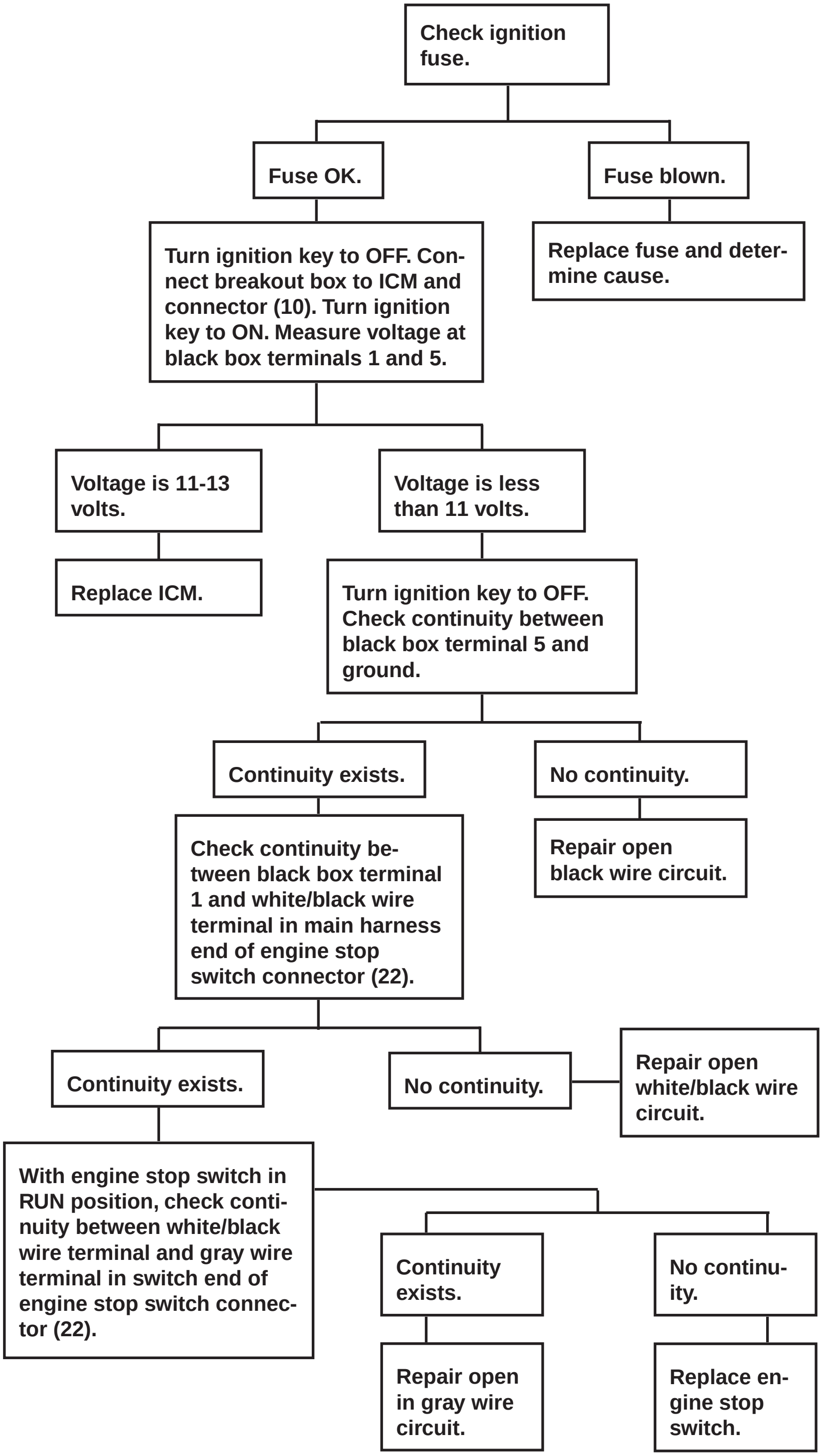
54 (continued)



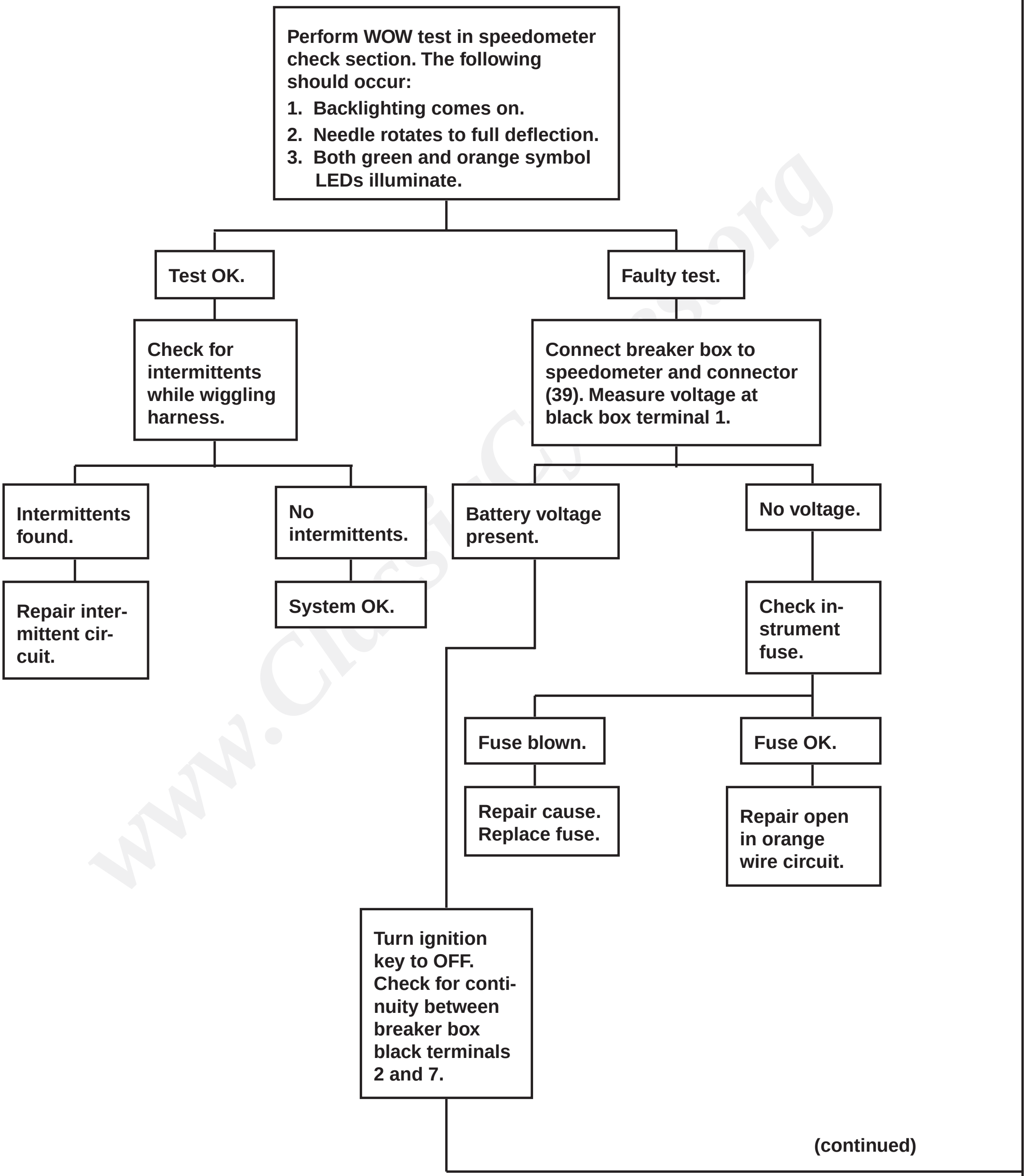
55

NO SPARK OR ICM POWER



TACHOMETER FAULTY

NOTE: The green and orange symbols in the initial test represent cruise (green) and pursuit (orange) functions on models other than Sportsters.



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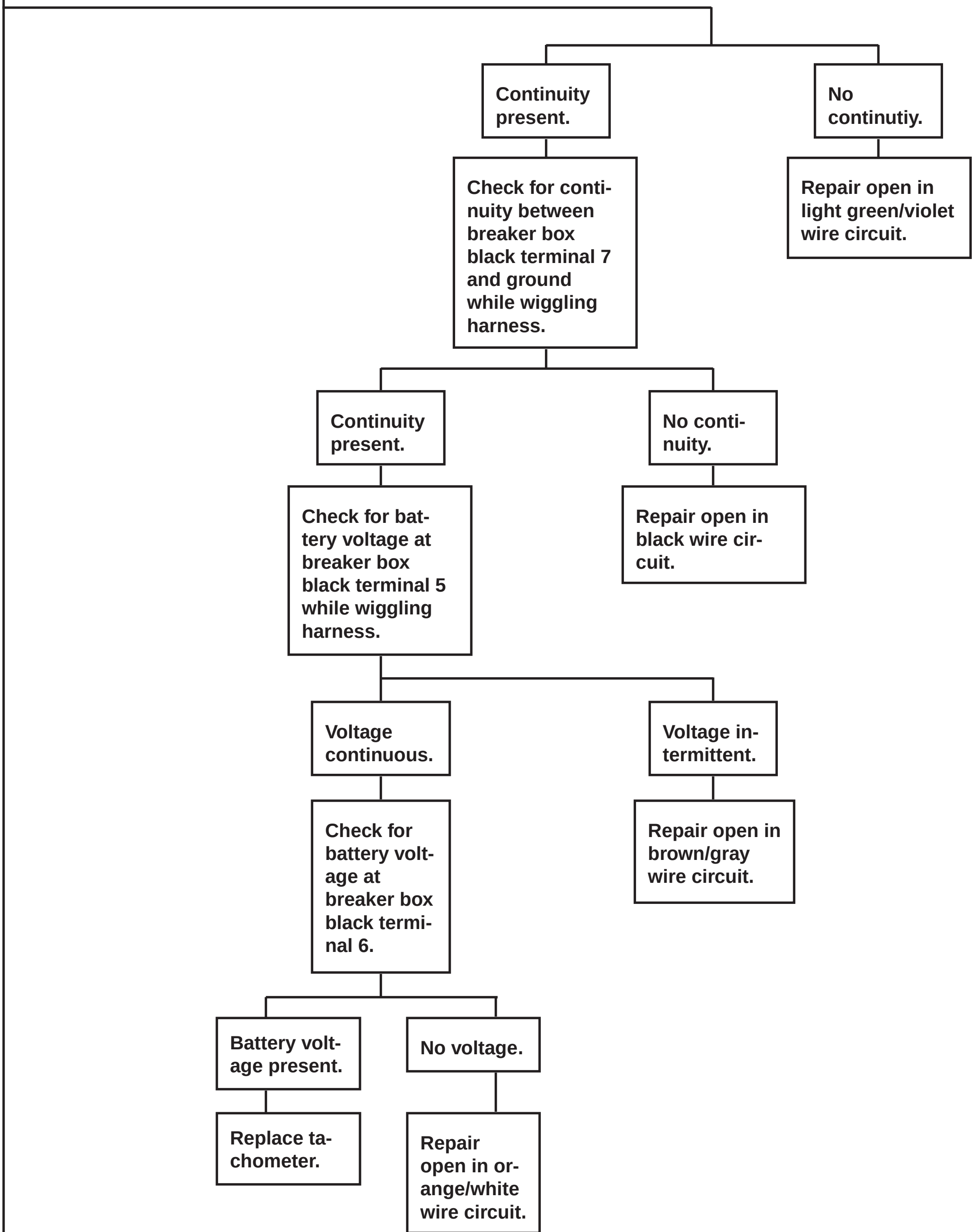

57

SECURITY SYMBOL DOES NOT LIGHT WITH IGNITION KEY TURNED TO ON

NOTE: This chart applies to motorcycles equipped with the security system.

Make sure engine stop switch is in RUN. Attempt to start engine.

- **Engine cranks.**
  - **Turn ignition key to OFF. Connect breakout box to speedometer and connector (39). Remove TSM/TSSM (Chapter Nine) and connect breakout box to TSM/TSSM and connector. Check for continuity between breakout box black terminal 4 and gray terminal 4.**
    - **Continuity present.**
      - **Check for continuity between breaker box black terminal 4 and ground.**
        - **Continuity present.**
          - **Repair short to ground in brown/violet wire circuit.**
        - **No continuity.**
          - **Disconnect breakout box and reconnect speedometer connector (39). Connect a jumper wire between gray box terminal 4 and positive battery terminal.**
    - **No continuity.**
      - **Repair open in brown/violet wire circuit.**
- **Engine does not crank.**
  - **Go to Step A.**

(continued)

57 (continued)

Security symbol illuminates.

Replace TSM/TSSM.

Security symbol does not light.

Replace speedometer.

STEP A

Be sure TSM/TSSM connector (30) is fully engaged and attempt to start engine.

Engine does not crank.

Turn ignition key to OFF. Remove TSM/TSSM (Chapter Nine) and connect breakout box to TSM/TSSM and connector (30). Check for battery voltage between breakout box gray terminal 1 (positive) and gray terminal 12 (negative).

Battery voltage present.

Check for battery voltage between breakout box gray terminal 2 (postive) and gray terminal 12 (negative).

No voltage.

Go to Step B.

Engine cranks.

System OK.

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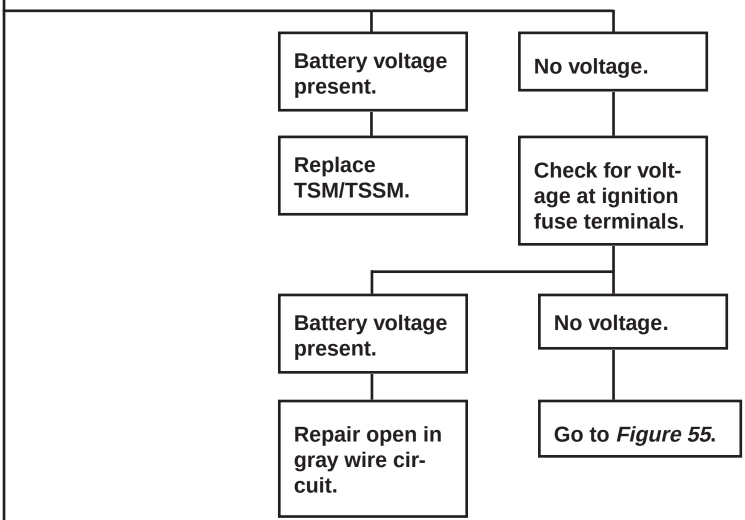
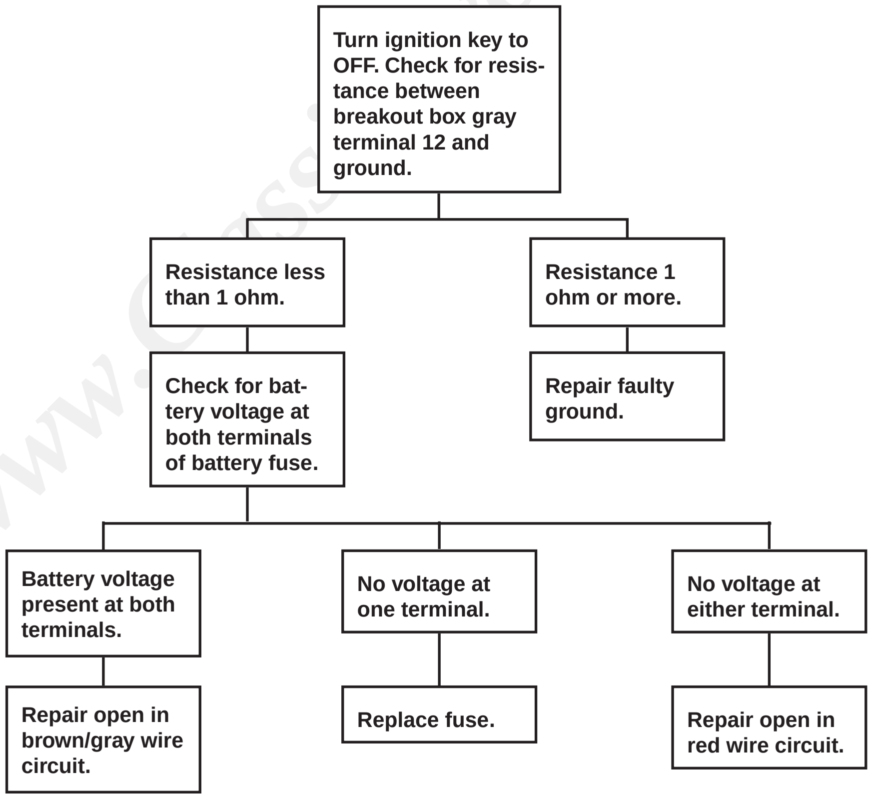
(57) (continued)



STEP B



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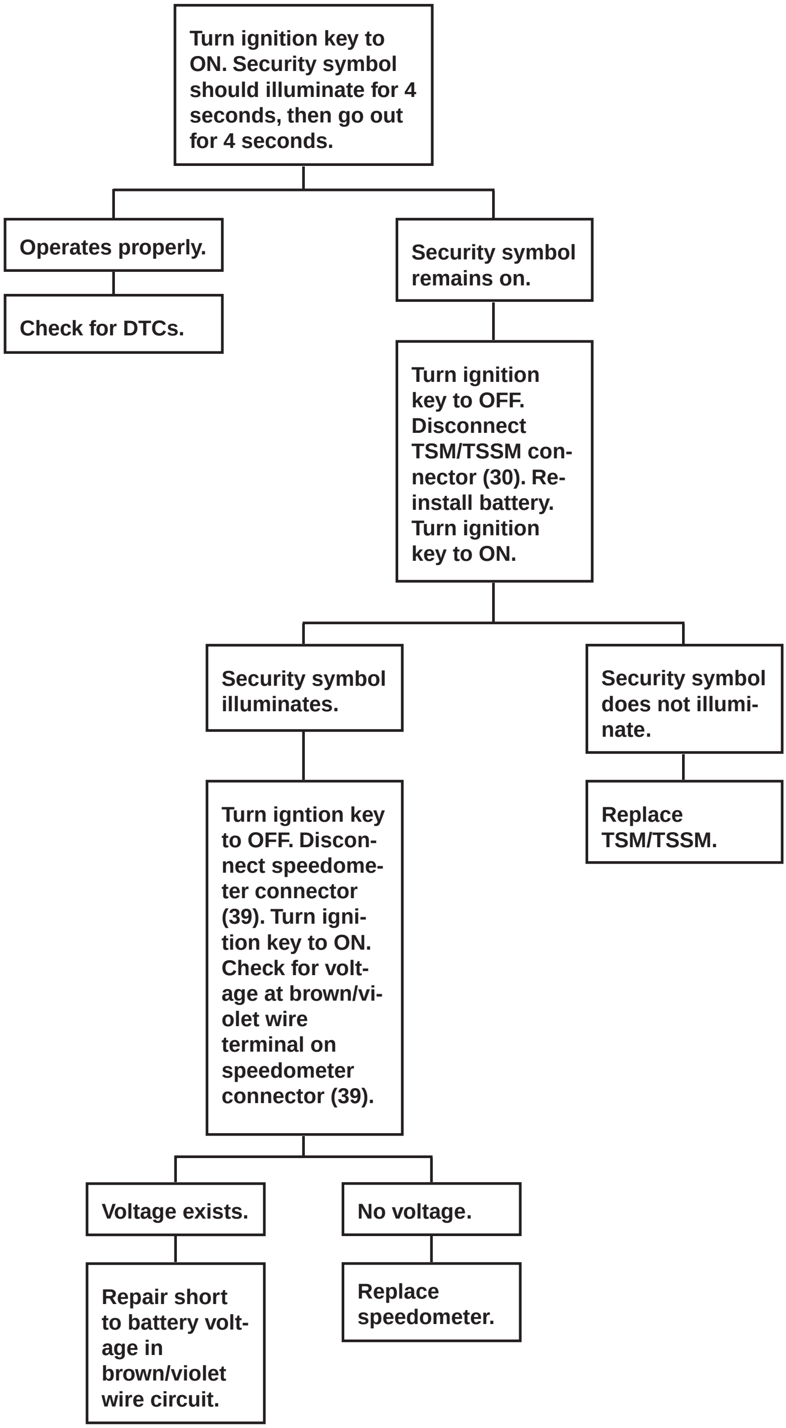
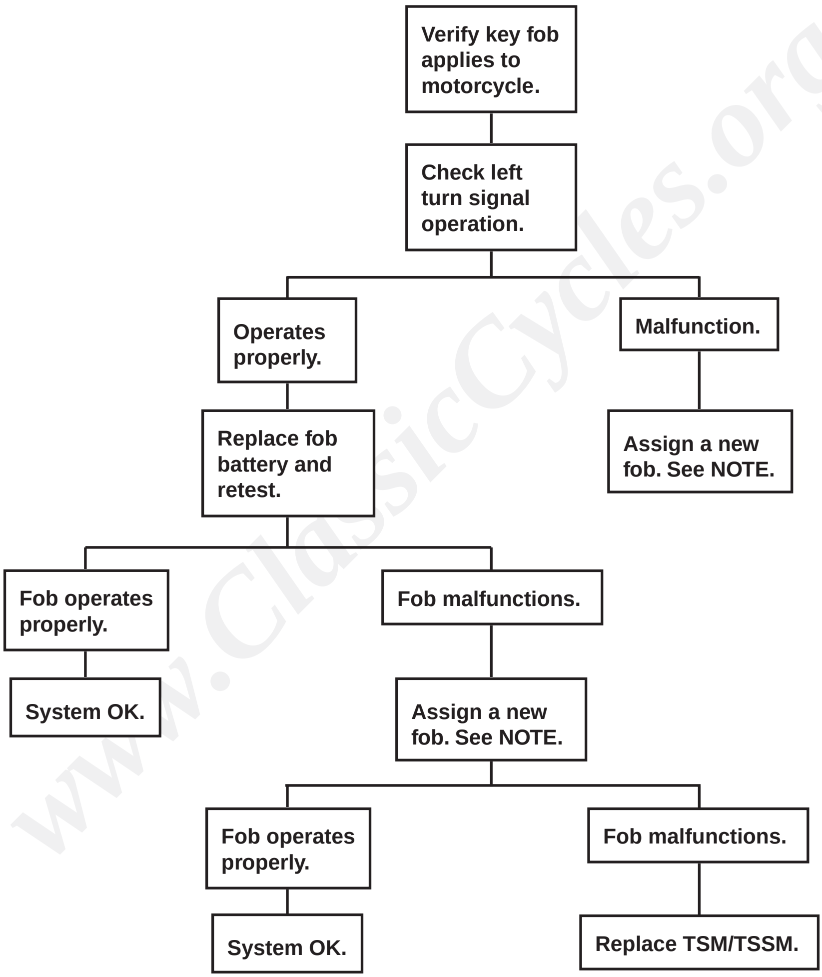
SECURITY SYMBOL ON CONTINUOUSLY



59

WEAK OR NO KEY FOB SIGNAL TO TSSM

NOTE: At least two attempts are required for the TSSM to recognize the new fob.



TURN SIGNAL CANCELS IMPROPERLY

NOTE: The following troubleshooting requires H-D Speedometer tester (part No. HD-41354).

Make sure TSM/TSSM is installed properly.

Make sure TSM/TSSM is configured for solo (not sidecar) operation.

Remove TSM/TSSM and reconnect connector (30). Reinstall battery. Activate 4-way flashers. Verify that 4-way flashers cancel when TSM/TSSM is tllted at least 45 degrees in both directions (as if mounted in bike).

- Operates properly.
  - Disconnect VSS connector (65). Connect speedometer tester to VSS and connector (65). Connect jumper wire between terminal B of tester and white/green wire terminal of VSS connector (65). Connect jumper wire between terminal C of tester and black wire terminal of VSS connector (65). Operate turn signals. Turn ignition key to ON (engine stop switch must be in the RUN position). Set tester so speedometer indicates greater than 20 mph. Key number 528 into tester. Turn signals should cancel after 20 flashes.
- Operates improperly.
  - Replace TSM/TSSM.

(continued)

60 (continued)

- Turn signals cancel after 20 flashes.
  - Turn igntion key to OFF. Remove TSM/TSSM and connect breakout box to TSM/TSSM and connector (30). Reinstall battery. Turn ignition key to ON. Check for voltage as follows:

    1. While depressing right turn signal switch, check for voltage at gray box terminals 7 and 12. Wiggle harness and note fluctuations.

    2. While depressing left turn signal switch, check for voltage at gray box terminals 8 and 12. Wiggle harness and note fluctuations.
- Operates improperly.
  - Check speedometer operation.
    - Speedometer indicates road speed.
      - Replace TSM/TSSM.
    - Speedometer does not indicate road speed.
      - Troubleshoot speedometer.

(continued)

60 (continued)

- **Voltage fluctuates.**
  - Repair open in circuit.
- **No voltage fluctuations.**
  - Turn igntion key to ON. Check for voltage as follows:
    1. With right turn signal switch released, check for voltage at gray box terminals 7 and 12. Wiggle harness and note fluctuations.
    2. With left turn signal switch released, check for voltage at gray box terminals 8 and 12. Wiggle harness and note fluctuations.
    - **Voltage fluctuates.**
      - Repair short in circuit.
    - **No voltage fluctuations.**
      - Turn ignition key to OFF. Check for continuity as follows:
        1. While depressing right turn signal switch, check for continuity between gray box terminals 7 and 12. Wiggle harness and note fluctuations.
        2. While depressing left turn signal switch, check for continuity between gray box terminals 8 and 12. Wiggle harness and note fluctuations.
        - **Continuity exists.**
          - Repair short in circuit.
        - **No continuity.**
          - System OK.

61

CARBURETOR TROUBLESHOOTING

Hard starting

- Fuel overflow from float assembly
- Enrichment system inoperative
- Plugged pilot jet and/or passage
- Fuel overflow

Fuel overflows

- Incorrect fuel level
- Damaged float assembly
- Worn float needle valve or dirty seat
- Incorrect float alignment
- Damaged float bowl O-ring or loose float bowl mounting screws
- Plugged vent in fuel tank cap
- Incorrect fuel tank cap installed

Poor idling

- Incorrect idle speed
- Plugged pilot jet system
- Loose pilot jet
- Air leak at carburetor mounting
- Enrichment valve nut loose or damaged

Poor acceleration

- Fuel level too low
- Clogged fuel passages
- Clogged jets
- Plugged vent in fuel tank cap
- Incorrect fuel tank cap installed (non-vent type)
- Enrichment valve nut loose or damaged
- Worn or damaged needle jet or needle
- Throttle cable misadjusted
- Air leak at carburetor mounting
- Damaged vacuum piston

Poor power at low engine speeds

- Incorrect idle speed adjustment
- Contaminated air filter element
- Damaged vacuum piston
- Worn or damaged needle jet or needle
- Clogged pilot jet system
- Plugged vent in fuel tank cap
- Enrichment valve nut loose or damaged
- Clogged fuel supply
- Air leak at carburetor mounting

(continued)

61 (continued)

Poor power at high engine speeds

- Incorrect fuel level
- Loose or plugged main jet
- Contaminated air filter element
- Damaged vacuum piston
- Worn or damaged needle jet or needle
- Plugged float bowl vent or overflow
- Enrichment valve nut loose or damaged
- Plugged vent in fuel tank cap
- Clogged fuel supply
- Air leak at carburetor mounting

Poor fuel economy

- Incorrect enrichment use
- Damaged vacuum piston
- Contaminated air filter element
- Loose jets
- Fuel level too high
- Worn or damaged needle jet or needle
- Plugged float bowl vent
- Enrichment valve nut loose or damaged
- Incorrect carburetor adjustment

Vacuum piston does not rise in bore correctly

- Vacuum piston binds in bore
- Diaphragm torn or damaged
- Vacuum piston spring binding
- Diaphragm cap loose or damaged
- Piston vent clogged
- Diaphragm incorrectly installed (pinched at lip)

Vacuum piston does not close

- Broken spring
- Diaphragm torn or damaged
- Vacuum piston binds in bore

Troubleshooting

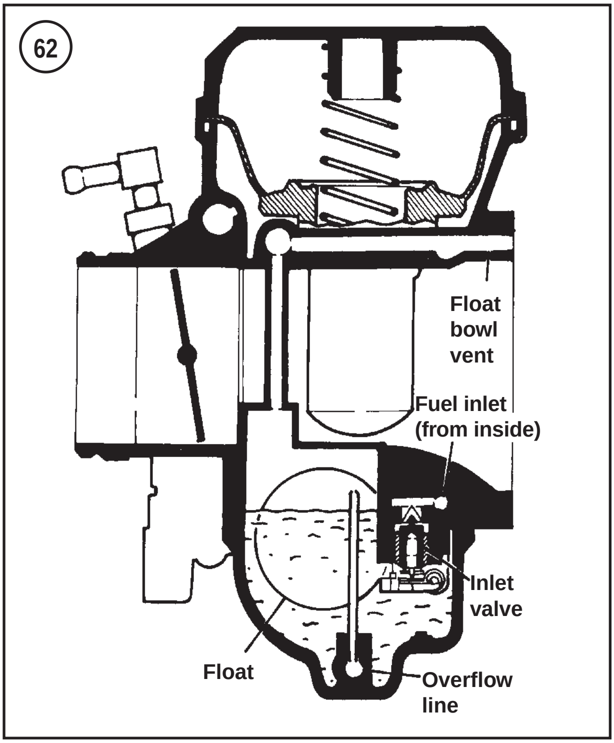
Isolate fuel system problems to the fuel tank, fuel shutoff valve and filter, fuel hoses, external fuel filter (if used) or carburetor. In the following procedures, it is assumed that the ignition system is working properly.

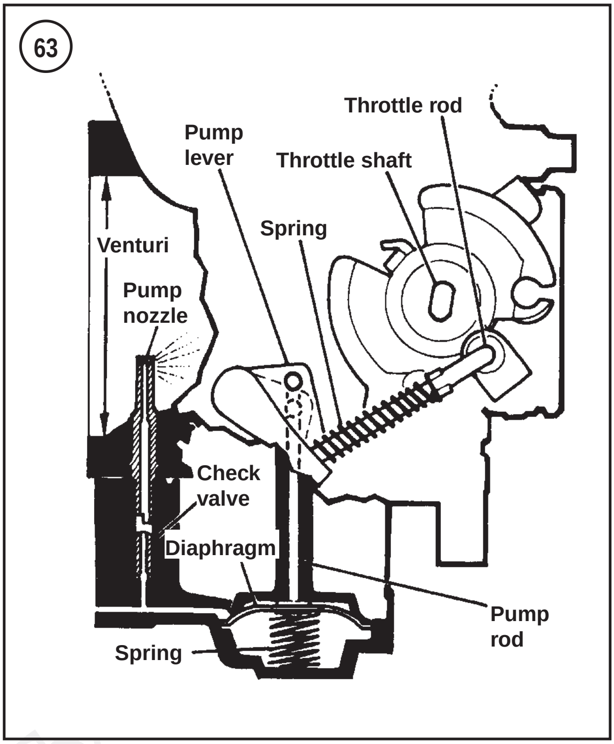
Refer to **Figure 61** for possible causes of fuel system problems.

Fuel level system

The fuel level system is shown in **Figure 62**. Proper carburetor operation depends on a constant and correct carburetor fuel level. As fuel is drawn from the float bowl during engine operation, the float level in the bowl drops. As the float drops, the fuel valve moves from its seat and allows fuel to flow through the seat into the float bowl. Fuel entering the float bowl causes the float to rise and push against the fuel valve. When the fuel level reaches a predetermined level, the fuel valve is pushed against the seat to prevent the float bowl from overfilling.

If the fuel valve fails to close, the engine will run too rich or flood with fuel. Symptoms of this problem are rough running, excessive black smoke and poor acceleration. This condition sometimes clears up when the engine is run at wide-open throttle and the fuel is being drawn





into the engine before the float bowl can overfill. However, as the engine speed is reduced, the rich running condition returns.

Several things can cause fuel overflow. In most instances, a small piece of dirt is trapped between the fuel valve and seat, or the float level is incorrect. If fuel is flowing out of the overflow tube connected to the bottom of the float bowl, the fuel valve inside the carburetor is being held open. First check the position of the fuel shutoff valve lever. Turn the fuel shutoff valve lever off. Then lightly tap on the carburetor float bowl and turn the fuel shutoff valve lever on. If fuel stops running out of the overflow tube, whatever was holding the fuel valve off of its seat has been dislodged. If fuel continues to flow from the overflow tube, remove and service the carburetor. See Chapter Eight.

NOTE
Fuel will not flow from the vacuum-operated fuel shutoff valve until the engine is running.

Starting enrichment (choke) system

A cold engine requires a rich mixture to start and run properly. On all models, a cable-actuated starter enrichment valve is used for cold starting.

If the engine is difficult to start when cold, check the starting enrichment (choke) cable adjustment as described in Chapter Three.

Accelerator pump system

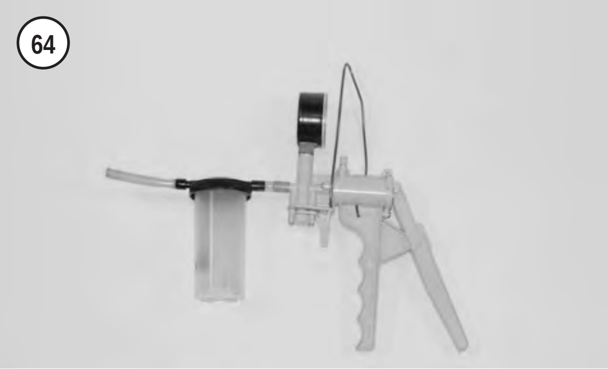
During sudden acceleration, the diaphragm type accelerator pump system (**Figure 63**) provides additional fuel to the engine. Without this system, the carburetor would not be able to provide a sufficient amount of fuel.

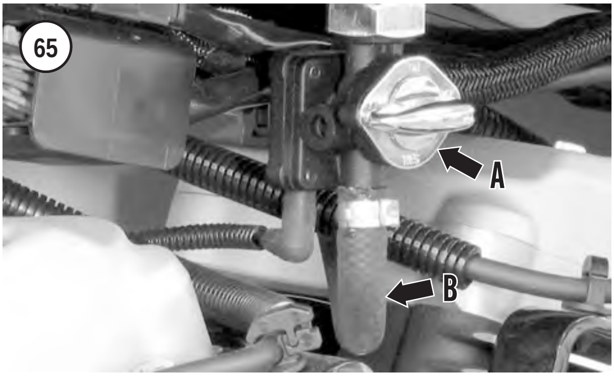
The system consists of a spring-loaded neoprene diaphragm that is compressed by the pump lever during sudden acceleration. This causes the diaphragm to force fuel from the pump chamber, through a check valve and into the carburetor venturi. The diaphragm spring returns the diaphragm to the uncompressed position, which allows the chamber to refill with fuel.

If the engine hesitates during sudden acceleration, check the operation of the accelerator pump system. Carburetor service is covered in Chapter Eight.

Vacuum-operated fuel shutoff valve testing

All models are equipped with a vacuum-operated fuel shutoff valve. A vacuum hose is connected between the fuel shutoff valve diaphragm and the carburetor. When





the engine is running, vacuum is applied to the fuel shutoff valve through this hose. For fuel to flow through the fuel valve, a vacuum must be present with the fuel shutoff valve handle in the on or reserve position. A Miti-Vac hand-operated vacuum pump (**Figure 64**), gas can, drain hose that is long enough to reach from the fuel valve to the gas can, and hose clamp are required for this test.

1. Disconnect the negative battery cable as described in Chapter Nine.

2. Visually check the amount of fuel in the tank. Add fuel if necessary.

3. Turn the fuel shutoff valve (A, **Figure 65**) off and disconnect the fuel hose (B) from the fuel shutoff valve. Plug the open end of the hose.

4. Connect the drain hose to the fuel shutoff valve and secure it with a hose clamp. Insert the end of the drain hose into a gas can.

5. Disconnect the vacuum hose from the fuel shutoff valve.

6. Connect a hand-operated vacuum pump to the fuel shutoff valve vacuum hose nozzle.

7. Turn the fuel shutoff valve on.

CAUTION

In Step 8, do not apply more than 25 in. (635 mm) Hg vacuum or the fuel shutoff valve diaphragm will be damaged.

8. Apply 25 in. (635 mm) Hg of vacuum to the valve. Fuel should flow through the fuel shutoff valve when the vacuum is applied.
9. With the vacuum still applied, turn the fuel shutoff valve lever to the reserve position. Fuel should continue to flow through the valve.
10. Release the vacuum and make sure the fuel flow stops.
11. Repeat Steps 8-10 five times. Fuel should flow with vacuum applied and stop flowing when the vacuum is released.
12. Turn the fuel shutoff valve off. Disconnect the vacuum pump and drain hoses.
13. Reconnect the fuel hose (B, **Figure 65**) to the fuel shutoff valve.
14. If the fuel valve failed this test, replace the fuel shutoff valve as described in Chapter Eight.

ENGINE NOISES

1. Knocking or pinging during acceleration can be caused by using a lower octane fuel than recommended or a poor grade of fuel. Incorrect carburetor jetting and an incorrect spark plug heat range (too hot) can cause pinging. Refer to *Spark Plugs* in Chapter Three. Also check for excessive carbon buildup in the combustion chamber or a defective ignition module.
2. Slapping or rattling noise at low speed or during acceleration can be caused by excessive piston-to-cylinder wall clearance. Also check for a bent connecting rod(s) or worn piston pin and/or piston pin hole in the piston(s).
3. Knocking or rapping during deceleration is usually caused by excessive rod bearing clearance.
4. Persistent knocking and vibration or other noises are usually caused by worn main bearings. If the main bearings are in good condition, consider the following:
   a. Loose engine mounts.
   b. Cracked frame.
   c. Leaking cylinder head gasket(s).
   d. Exhaust pipe leak at cylinder head(s).
   e. Stuck piston ring(s).
   f. Broken piston ring(s).
   g. Partial engine seizure.
   h. Excessive connecting rod bearing clearance.
   i. Excessive connecting rod side clearance.
   j. Excessive crankshaft runout.

5. Rapid on-off squeal indicates a compression leak around the cylinder head gasket or spark plug.
6. For valve train noise, check for the following:
   a. Bent pushrod(s).
   b. Defective lifter(s).
   c. Valve sticking in guide.
   d. Worn cam gears and/or cam.
   e. Damaged rocker arm or shaft. Rocker arm may be binding on shaft.

ENGINE LUBRICATION

An improperly operating engine lubrication system quickly leads to engine damage. The engine oil tank should be checked weekly and the tank refilled as described in Chapter Three.

Oil pump service is covered in Chapter Five.

Oil Light

The oil light, mounted on the indicator light panel (**Figure 66**), will come on when the ignition switch is turned on before starting the engine. After starting the engine, the oil light should go off when the engine speed is above idle.

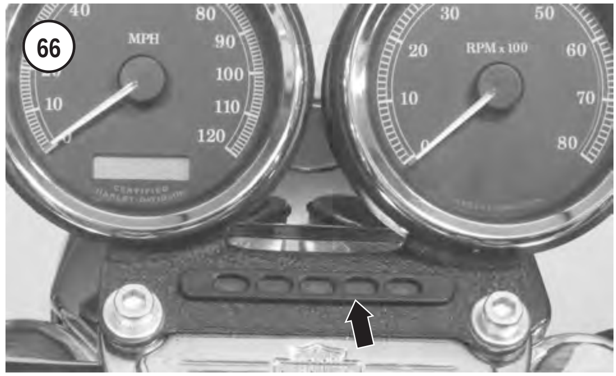
If the oil light does not come on when the ignition switch is turned on and the engine is not running, check for a burned out oil light bulb. If the bulb is good, check the oil pressure switch (**Figure 67**) as described in Chapter Nine.

If the oil light remains on when the engine speed is above idle, turn the engine off and check the oil level in the oil tank as described in Chapter Three. If the oil level is satisfactory, check the following:

1. Oil may not be returning to the tank from the return line. Check for a clogged or damaged return line or a damaged oil pump.
2. If operating the motorcycle in conditions where the ambient temperature is below freezing, ice and sludge may be blocking the oil feed pipe. This condition will prevent the oil from circulating properly.

Oil Consumption High or Engine Smokes Excessively

1. Worn valve guides.
2. Worn valve guide seals.
3. Worn or damaged piston rings.
4. Restricted oil tank return line.
5. Oil tank overfilled.
6. Oil filter restricted.
7. Leaking cylinder head surfaces.



Oil Fails to Return to Oil Tank

1. Oil lines or fittings restricted or damaged.
2. Oil pump damaged or operating incorrectly.
3. Oil tank empty.
4. Oil filter restricted.

Excessive Engine Oil Leaks

1. Clogged air filter breather hose.
2. Restricted or damaged oil return line to oil tank.
3. Loose engine parts.
4. Damaged gasket sealing surfaces.
5. Oil tank overfilled.

CLUTCH

All clutch troubles, except adjustments, require partial clutch disassembly to identify and repair the problem. Refer to Chapter Six for clutch service procedures.

Clutch Chatter or Noise

This problem is generally caused by worn or warped friction and steel plates. Also check for worn or damaged bearings.

Clutch Slip

1. Incorrect clutch adjustment.
2. Worn friction plates.
3. Weak or damaged diaphragm spring.
4. Damaged pressure plate.

Clutch Drag

1. Incorrect clutch adjustment.
2. Warped clutch plates.
3. Worn or damaged clutch shell or clutch hub.

TRANSMISSION

Transmission symptoms are sometimes hard to distinguish from clutch symptoms. Refer to Chapter Seven for transmission service procedures. Make sure the clutch is not causing the trouble before working on the transmission.

Jumping Out of Gear

1. Incorrect shifter pawl adjuster.
2. Worn or damaged shifter parts.
3. Bent shift forks.
4. Excessively worn or damaged gears.

Difficult Shifting

1. Worn or damaged shift forks.
2. Loose or damaged detent plate.
3. Worn or damaged shifter shaft assembly.
4. Worn or damaged detent arm.
5. Worn shift fork drum groove(s).
6. Loose, worn or damaged shifter fork pin(s).
7. Damaged shifter shaft splines.

Excessive Gear Noise

1. Worn or damaged bearings.
2. Worn or damaged gears.
3. Excessive gear backlash.

EXCESSIVE VIBRATION

Excessive vibration is usually caused by loose engine mounting hardware. High speed vibration may be due to a bent axle shaft or loose or faulty suspension components. Vibration can also be caused by the following conditions:

1. Broken frame.
2. Excessively worn primary chain.
3. Tight primary chain links.
4. Loose or damaged engine mounting bracket.
5. Improperly balanced wheel(s).
6. Defective or damaged wheel(s).
7. Defective or damaged tire(s).
8. Internal engine wear or damage.

SUSPENSION AND STEERING

Poor handling may be caused by improper pressure, a damaged or bent frame or front steering components, worn wheel bearings or dragging brakes. Possible causes for suspension and steering malfunctions are listed below.

Irregular or Wobbly Steering

1. Loose wheel axle nut(s).
2. Loose or worn steering head bearings.
3. Excessive wheel hub bearing play.
4. Damaged cast wheel.
5. Spoke wheel out of alignment.
6. Unbalanced wheel assembly.
7. Worn hub bearings.
8. Incorrect wheel alignment.
9. Bent or damaged steering stem or frame (at steering neck).
10. Tire incorrectly seated on rim.
11. Heavy front end loading from non-standard equipment.

Stiff Steering

1. Low front tire air pressure.
2. Bent or damaged steering stem or frame (at steering neck).
3. Loose or worn steering head bearings.

Stiff or Heavy Fork Operation

1. Incorrect fork springs.
2. Incorrect fork oil viscosity.
3. Excessive amount of fork oil.
4. Bent fork tubes.

Poor Fork Operation

1. Worn or damaged fork tubes.
2. Fork oil capacity low due to leaking fork seals.
3. Bent or damaged fork tubes.
4. Contaminated fork oil.
5. Incorrect fork springs.
6. Heavy front end loading from non-standard equipment.

Poor Rear Shock Absorber Operation

1. Weak or worn springs.
2. Damper unit leaking.
3. Shock shaft worn or bent.
4. Incorrect rear shock springs.
5. Rear shocks adjusted incorrectly.
6. Heavy rear end loading from non-standard equipment.
7. Incorrect loading.

BRAKES

All models are equipped with front and rear disc brakes. Brakes operation is vital to the safe operation of any vehicle. Perform the maintenance specified in Chapter Three to minimize brake system problems. Brake system service is covered in Chapter Thirteen. When refilling the front and rear master cylinders, use only DOT 5 silicone-based brake fluid.

Insufficient Braking Power

Worn brake pads or disc, air in the hydraulic system, glazed or contaminated pads, low brake fluid level, or a leaking brake line or hose can cause this problem. Visually check for leaks. Check for worn brake pads. Check also for a leaking or damaged primary cup seal in the master cylinder. Bleed and adjust the brakes. Rebuild a leaking master cylinder or brake caliper. Brake drag will cause excessive heat and brake fade. See *Brake Drag* in this section.

Spongy Brake Feel

This problem is generally caused by air in the hydraulic system. Bleed and adjust the brakes as described in Chapter Thirteen.

Brake Drag

Check brake adjustment, looking for insufficient brake pedal and/or hand lever free play. Also check for worn, loose or missing parts in the brake calipers. Check the brake disc for warpage or excessive runout.

Brakes Squeal or Chatter

Check brake pad thickness and disc condition. Make sure the pads are not loose; check that the anti-rattle springs are properly installed and in good condition. Clean off any dirt on the pads. Loose components can also cause this. Check for:

1. Warped brake disc.
2. Loose brake disc.
3. Loose caliper mounting bolts.
4. Loose front axle nut.
5. Worn wheel bearings.
6. Damaged hub.

Table 1 STARTER SPECIFICATIONS

Brush length (minimum)	0.443 in. (11.0 mm)
Commutator diameter (minimum)	1.141 in. (28.98 mm)
Commutator runout (maximum)	0.016 (0.41 mm)
Current draw	
Normal	160-200 amps
Maximum	250 amps
Maximum no-load speed at 11.5 volts	90 amps
Minimum no-load current at 11.5 volts	3000 rpm

Table 2 ELECTRICAL SPECIFICATIONS

Battery capacity	12 volt, 12 amp hr.
Ignition coil	
Primary resistance	0.5-0.7 ohms
Secondary resistance	5500-7500 ohms
Alternator	
Stator coil resistance	0.2-0.4 ohms
AC voltage output	19-26 Vac per 1000 rpm
Voltage regulator	
Voltage output	14.3-14.7 VDC at 75° F
Amps at 3600 rpm	22 amps

Table 3 DIAGNOSTIC TROUBLE CODES

DTC	Problem	Priority[1]	Troubleshooting chart
BusEr	Serial data bus fault	1	Figure 42 or 43
B0563[2]	Battery voltage high	12	
B1006	Accessory line overvoltage	7	Figure 37
B1007	Ignition line overvoltage	6	Figure 37
B1008	Reset switch closed	8	Figure 38
B1121	Left turn output fault	10	Figure 44
B1122	Right turn output fault	11	Figure 44
B1131	Alarm output low	13	Figure 45
B1132	Alarm output high	14	Figure 45
B1134	Starter output high	9	Figure 46
B1135[3]	Accelerometer fault	7	
B1141	Ignition switch open/low	15	Figure 44
B1151[4]			
B1152[4]			
B1153[4]			
P0106	MAP sensor rate-of-change error	16	Figure 48
P0107	MAP sensor failed open/low	17	Figure 48
P0108	MAP sensor failed high	18	Figure 48
P0371	CKP shorted low	13	Figure 49
P0372	CKP shorted high	14	Figure 49
P0374	CKP not detected/cannot synchronize	15	Figure 49
P0501	VSS failed low	23	Figure 50
P0502	VSS failed high/open	24	Figure 50
P0562	System voltage low	21	Figure 51
P0563	System voltage high	22	Figure 51
P0602[5]	Calibration memory error	1	
P0603[5]	EEProm memory error	2	
P0604[5]	RAM memory error	3	
P0605[5]	Program memory error	4	
P0607[5]	A to D error	5	
P1009	Incorrect password	11	Figure 52
P1010	Missing password	12	Figure 53
P1351	Ignition coil driver front low/open	19	Figure 54
P1352	Ignition coil driver front high/shorted	20	Figure 54
P1354	Ignition coil driver rear low/open	19	Figure 54
P1355	Ignition coil driver rear high/shorted	20	Figure 54
U1016	Loss of ICM serial data	4	Figure 39 or 40
U1064	Loss of TSM/TSSM serial data	9	Figure 41
U1097	Loss of speedometer serial data	10	Figure 47
U1255	Loss of ICM or TSM/TSSM serial data	6	Figure 39, 40, 41 or 47
U1300	Serial data low	7	Figure 42 or 43
U1301	Serial data open/high	8	Figure 42 or 43

1. Priority numbers are relative. There may be more than one DTC for a specific priority number due to differing systems, such as engine management and TSM/TSSM.
2. Follow the troubleshooting procedures for the charging system in this chapter.
3. Replace the TSM/TSSM due to an internal malfunction.
4. Not applicable to Sportster models. If DTC appears, reconfigure TSM/TSSM.
5. Replace the ICM due to an internal malfunction.

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