

GENERAL

See [Figure 4-62](#). The Electronic Control Module (ECM) is located under the seat.

REMOVAL

1. Remove seat. See [2.41 SEAT](#).

⚠ WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury. (49)

2. Disconnect and remove battery. See [1.5 BATTERY MAINTENANCE](#).
3. Disconnect ECM black connector [10] and gray connector [11].
4. Remove the two fasteners to detach electronic control module from bracket.

INSTALLATION

1. Align holes in ECM with those in electrical bracket. Install two fasteners and tighten to 48-72 **in-lbs** (5.4-8 Nm).
2. Attach ECM connectors [10] and [11].

⚠ WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury. (68)

3. Install battery by threading positive cable (red) into threaded hole first tightening to 72-96 **in-lbs** (8-11 Nm). See [1.5 BATTERY MAINTENANCE](#).
4. Connect negative battery cable.
5. Zero TPS. See [4.37 THROTTLE POSITION SENSOR](#).

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury. (70)

6. Install seat. See [2.41 SEAT](#).

NOTE

If the ECM was replaced with a new component, it will be necessary to recalibrate Throttle Position Sensor. Throttle position sensor can only be calibrated using DIGITAL TECHNICIAN (Part No. HD-44750).

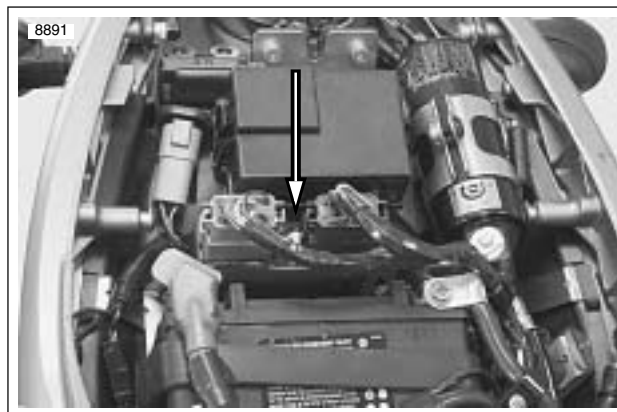


Figure 4-62. ECM

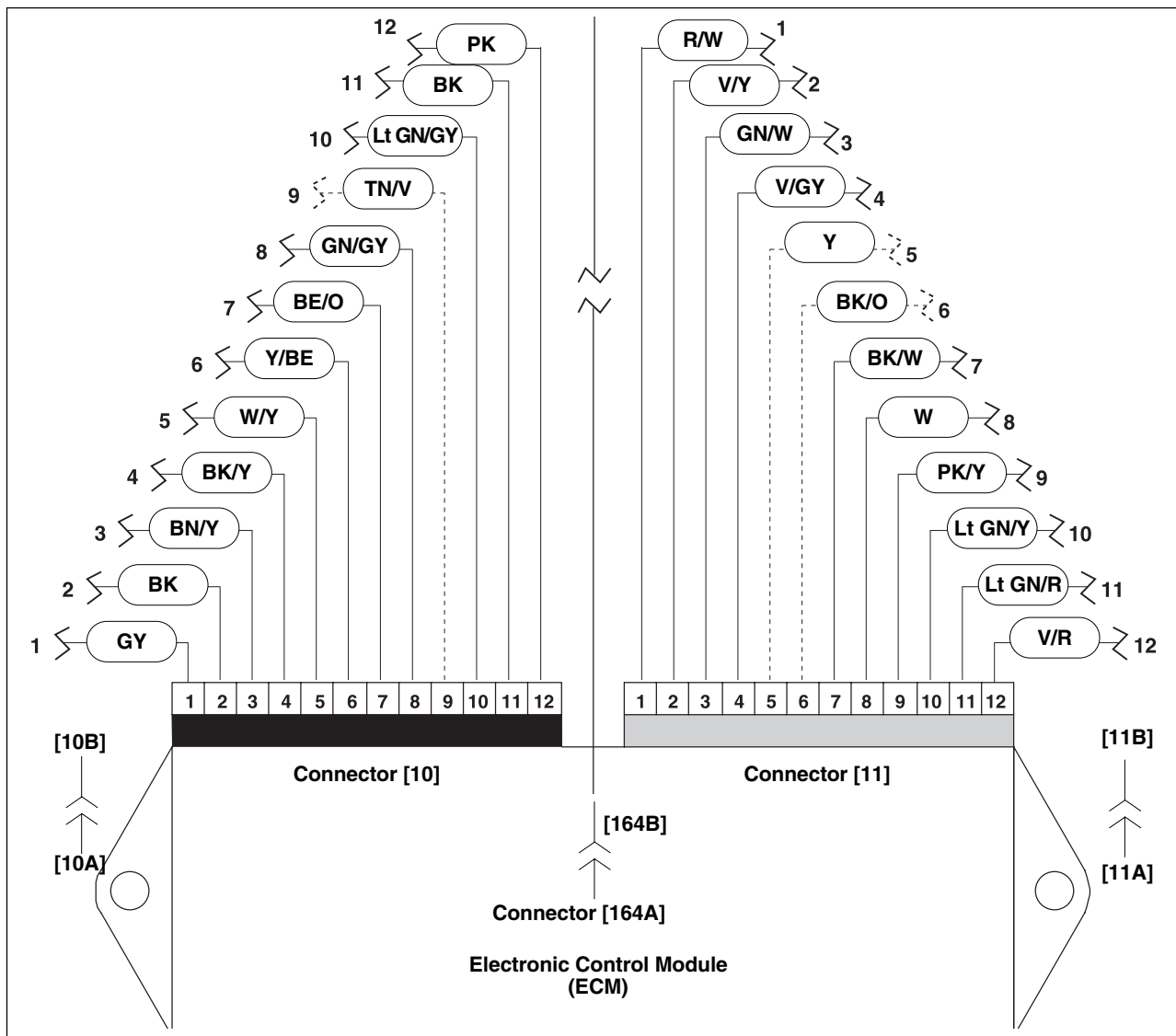


Figure 4-63. ECM Wiring (Interactive Muffler Connector [164] XB12S Only)

Table 4-35. Pin Table for
ECM Connector [10] (Black)

PIN	FUNCTION
1	Switched ignition
2	System ground A (module)
3	Fuel pump
4	Check engine lamp
5	Injector front
6	Front coil primary
7	Rear coil primary
8	Injector rear
9	Interactive muffler control feedback
10	Bank angle sensor input
11	System ground B (coil)
12	Tachometer

Table 4-36. Pin Table for
ECM Connector [11] (Gray)

PIN	FUNCTION
1	5 volt sensor power
2	Throttle position sensor
3	Camshaft position sensor
4	Oxygen sensor
5	Memory
6	Fan control
7	Sensor ground 1
8	Vehicle speed sensor
9	Engine temperature
10	Intake air temperature
11	Serial data receive
12	Serial data transmit

REMOVAL

⚠ WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

1. Disconnect negative battery cable.
2. Remove sprocket cover. See [2.31 SPROCKET COVER](#).

NOTES

- Make note of cable strap positions and wire routing during disassembly.
- For more information about the wiring located underneath the sprocket cover see [7.26 SPROCKET COVER WIRING](#).

3. Cut cable straps holding cam position sensor wiring.
4. See [Figure 4-64](#). Disconnect cam position sensor wiring at connector [14].
5. Note position of each cam position sensor wiring terminal in plug end of connector.
6. See [Figure 7-66](#). Remove connector terminal pins (7). See [B.2 DEUTSCH ELECTRICAL CONNECTORS](#) under [B.1 AMP MULTILOCK ELECTRICAL CONNECTORS](#).
7. Remove timer cover.
 - a. Drill off heads of outer timer cover pop rivets (1) using a 3/8 in. drill bit.
 - b. Tap remaining rivet shafts inboard through holes in timer cover (2) and inner cover (20).
 - c. Remove timer cover. Remove inner cover screws (3) and inner cover (20).
 - d. Carefully remove any remaining pieces of rivets from gearcase cover timer bore.
8. See [Figure 4-65](#). To obtain approximate ignition timing during installation, scribe alignment marks (4) across cam position sensor (3) in two places.
9. See [Figure 7-66](#). Remove timer plate studs (4). Carefully remove cam position sensor. Remove bolt (18) and trigger rotor (17).
10. Carefully remove camshaft oil seal (16) if damaged or if there is any evidence of oil leakage past the seal.



Figure 4-64. Cam Position Sensor Connector [14] (stator connector disconnected)

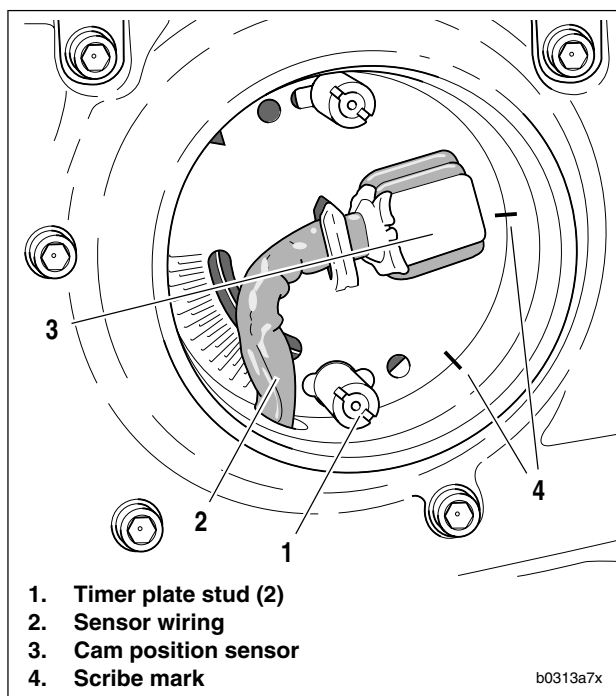


Figure 4-65. Marking Ignition Timing

-

Figure 7-66. Ignition Components

bs0017xx

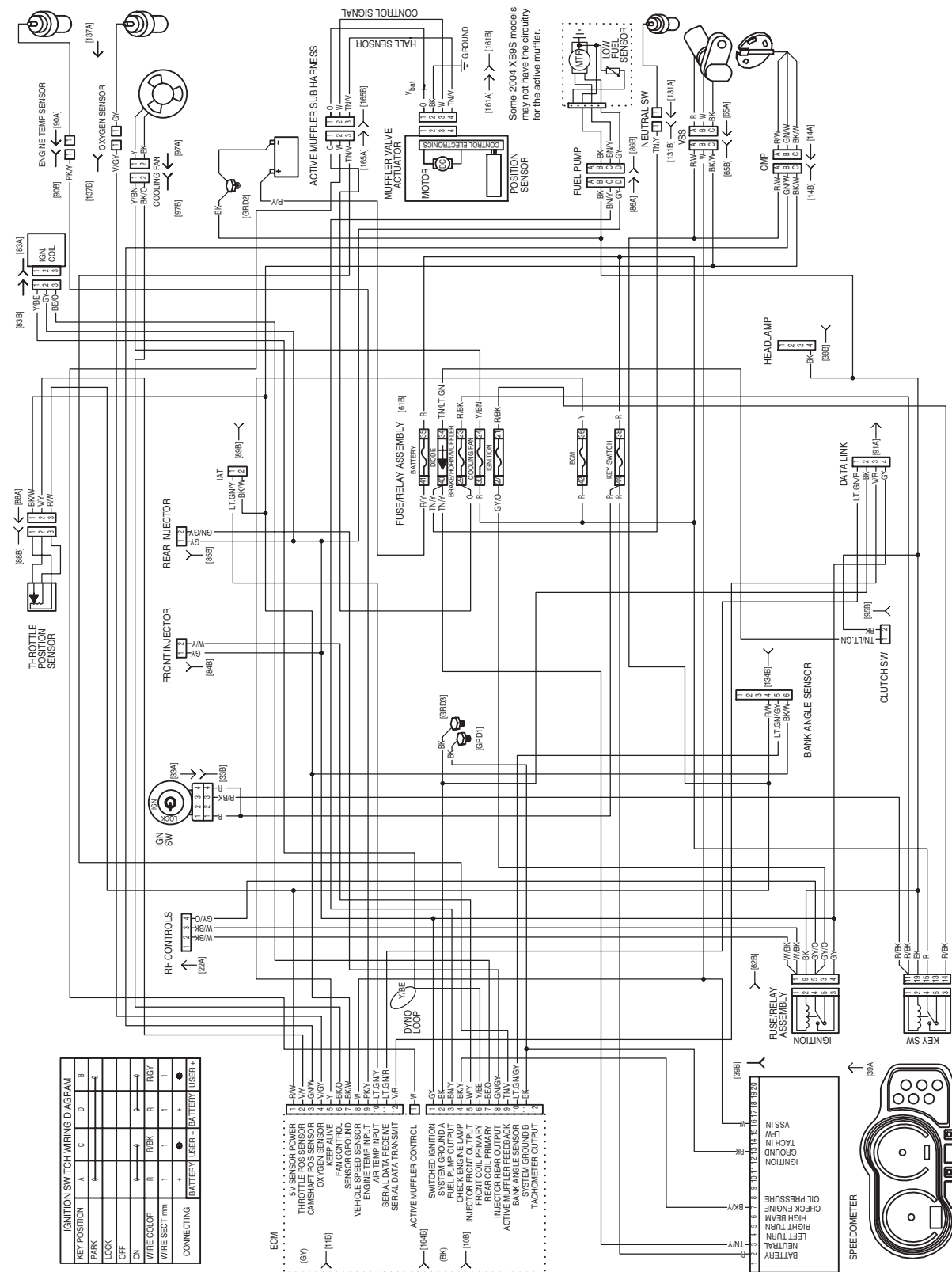


Figure 4-67. Ignition System Circuit

INSTALLATION

1. See [Figure 7-66](#). Coat lip of seal with a thin film of **clean** engine oil. With the lipped side facing inboard, install **new** camshaft oil seal (16) into gearcase cover (15), if removed. Press seal into position until flush with surface of timer bore.
2. Install trigger rotor (17).
 - a. Apply LOCTITE 243 (blue) to threads of bolt (18).
 - b. Position trigger rotor (17) onto end of camshaft aligning notch with camshaft slot.
 - c. Install bolt to secure rotor. Tighten to 43-53 **in-lbs** (5-6 Nm).
3. Install cam position sensor (19) and timer plate studs (4). Rotate cam position sensor to its previously marked position to obtain approximate ignition timing.
4. Route sensor wiring leads and install cable straps. See [7.26 SPROCKET COVER WIRING](#).
5. See [Figure 4-68](#). Install sensor wiring terminals into correct positions in plug end of connector [14]. R/W, GN/W and BK/W wires of plug end (from cam position sensor) must match same color wires in receptacle end of connector (from ignition module wiring harness). Install pin terminals. See [B.2 DEUTSCH ELECTRICAL CONNECTORS](#) under [B.1 AMP MULTILOCK ELECTRICAL CONNECTORS](#).
6. See [Figure 7-66](#). Attach connector [14] (6).
7. Check ignition timing. See [1.18 IGNITION TIMING](#).
8. Tighten timer plate studs (4) to 15-30 **in-lbs** (2-3 Nm).
9. Install inner cover (20) using screws (3). Tighten to 12-20 **in-lbs** (1-2 Nm).

CAUTION

Use only H-D Part No. 8699 rivets to secure outer timing cover. These rivets are specially designed so that no rivet end falls off into the timing compartment. Use of regular rivets can damage ignition system components and may allow water to enter the timing compartment.

10. Secure timer cover (2) to inner cover using **new** rivets (1).
11. Connect negative battery cable.

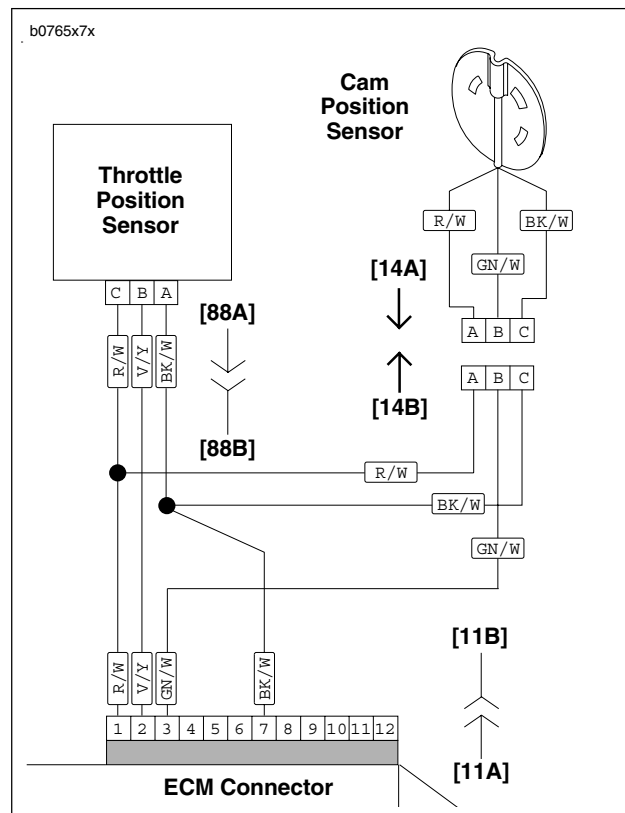


Figure 4-68. Connecting Sensor Wires

TROUBLESHOOTING

Follow the troubleshooting procedures listed under [4.8 INITIAL DIAGNOSTIC CHECK](#) if the engine will not start, is difficult to start or runs roughly. Also check condition of spark plug cables. Insulation on cables may be cracked or damaged allowing high tension current to short to metal parts. This problem is most noticeable when cables are wet.

If poor starting/running condition persists, check resistance of ignition coil primary and secondary windings using an ohmmeter.

Ignition Coil Primary Circuit Test

1. Remove ignition coil. See [REMOVAL](#) in this section.
2. Set ohmmeter scale to RX1.
3. See [Figure 4-69](#). Place multimeter wires on primary coil windings (1).
4. Check for primary coil winding resistance.
 - a. Normal resistance range is 0.5-0.7 ohms.
 - b. See [TEST RESULTS](#) if resistance is not within normal operating range.

Ignition Coil Secondary Circuit Test

1. Remove ignition coil. See [4.32 IGNITION COIL](#).
2. Set ohmmeter scale to RX1K.
3. See [Figure 4-69](#). Place multimeter wires on secondary coil windings (2).
4. Check for secondary coil winding resistance.
 - a. Normal resistance range is 5.5-7.5K ohms.
 - b. See [TEST RESULTS](#) if resistance is not within normal operating range.

Test Results

1. A low resistance value indicates a short in the coil winding. Replace coil.
2. A high resistance value might indicate that there is some corrosion/oxidation of the coil terminals. Clean the terminals and repeat resistance test. If resistance is still high after cleaning terminals, replace coil.
3. An infinite ohms (∞ or no continuity) resistance value indicates an open circuit (a break in the coil winding). Replace coil.

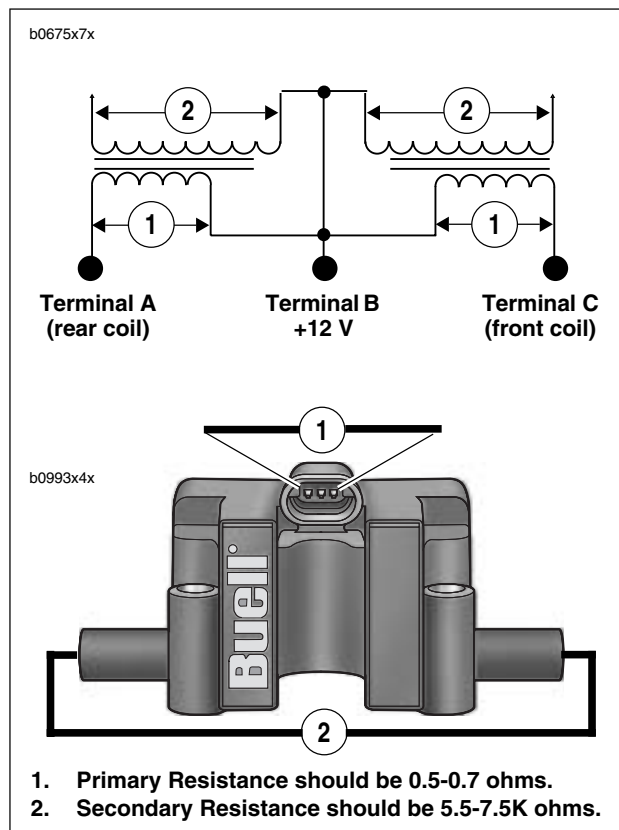


Figure 4-69. Ignition Coil Testing

Ignition Coil Substitution

If a coil tester is not available, use the following test.

NOTE

Coil will function without being attached to frame.

1. Substitute a **new** ignition coil by attaching it to any convenient point near the old coil. Transfer terminal wires to **new** coil.
2. Attach **new** spark plug cables to coil and plugs.
3. Test system. If ignition trouble is eliminated by the temporary installation of a **new** coil, carefully inspect old coil and cables for damage. The insulation on the cables may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or after the motorcycle has been washed.

REMOVAL

⚠ WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

1. Disconnect negative battery cable.
2. Remove intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
3. Remove airbox. See [4.44 AIRBOX](#).
4. See [Figure 4-70](#). Disconnect the spark plug cables from the coil plug posts (1, 5).
5. Detach connector (3) [83].
6. Remove coil fasteners (2).

INSTALLATION

NOTE

To ease installation, install spark plug cables to ignition coil first.

1. Connect spark plug cables to ignition coil.
2. See [Figure 4-70](#). Attach coil to frame with fasteners (2). Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
3. Attach front and rear spark plug cables to ignition coil posts.
4. Attach connector (3) [83].
5. Install ram air scoop assembly. See [2.36 AIR SCOOPS](#).
6. Install airbox. See [4.44 AIRBOX](#).
7. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
8. Connect negative battery cable.

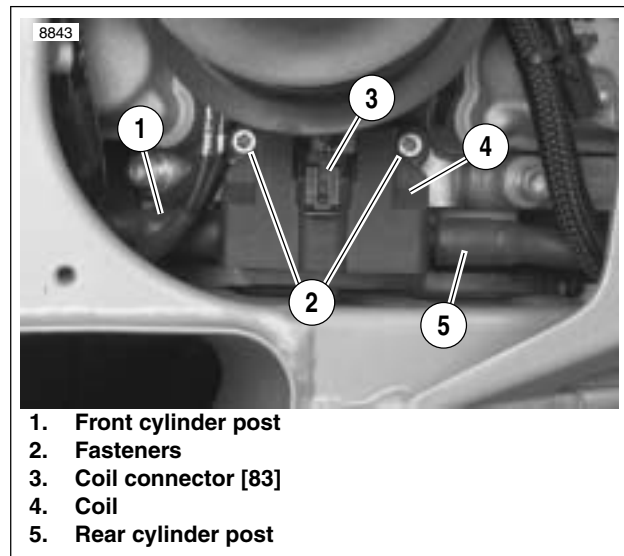


Figure 4-70. Ignition Coil Location

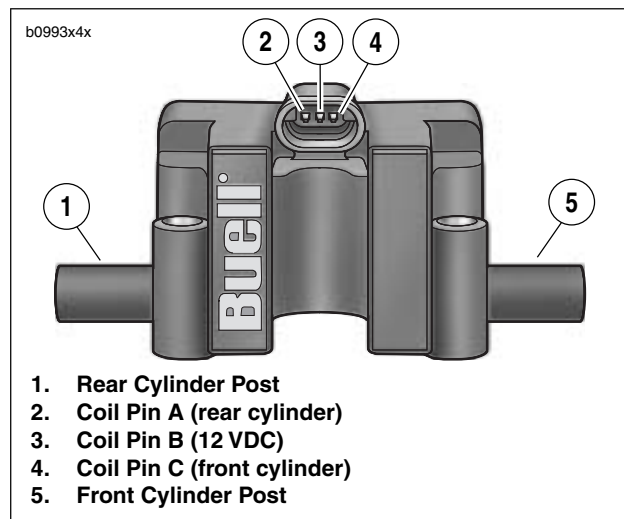


Figure 4-71. Ignition Coil

GENERAL

See [Figure 4-72](#). The oxygen sensor (O2 Sensor), located in the rear header pipe, monitors oxygen content in the exhaust gas and converts it to a voltage reading. This voltage reading is used by the ECM to maintain the proper air/fuel ratio during closed loop operation.

REMOVAL

⚠ WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

1. Disconnect negative battery cable.
2. Remove intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
3. Remove airbox assembly. See [4.44 AIRBOX](#).
4. Remove shock absorber. See [2.22 REAR SHOCK ABSORBER](#).
5. Remove cooling fan. See [4.38 COOLING FAN](#).
6. See [Figure 4-73](#). Remove cable straps (2). Unplug 1-place connector [137] (1).
7. Remove oxygen sensor from exhaust header using Snap-on Part No. YA8875.

INSTALLATION

1. Apply LOCTITE ANTI-SEIZE LUBRICANT to threads of sensor. Make sure anti-seize is marked as safe for use with O2 sensors.
2. See [Figure 4-72](#). Thread sensor into exhaust header. Tighten sensor to 40-45 ft-lbs (54-61 Nm).
3. Install cooling fan. See [4.38 COOLING FAN](#).
4. Install shock absorber. See [2.22 REAR SHOCK ABSORBER](#).
5. See [Figure 4-73](#). Connect 1-place connector [137] (1) to wiring harness.
6. Install cable straps (2).
7. Install airbox assembly. See [4.44 AIRBOX](#).
8. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
9. Connect negative battery cable.

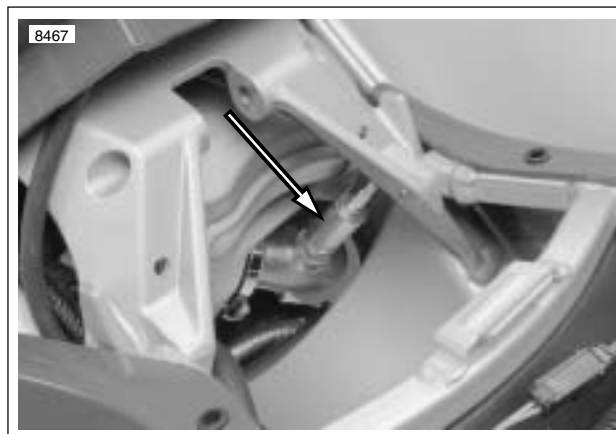


Figure 4-72. Installed Oxygen Sensor (shock absorber removed)

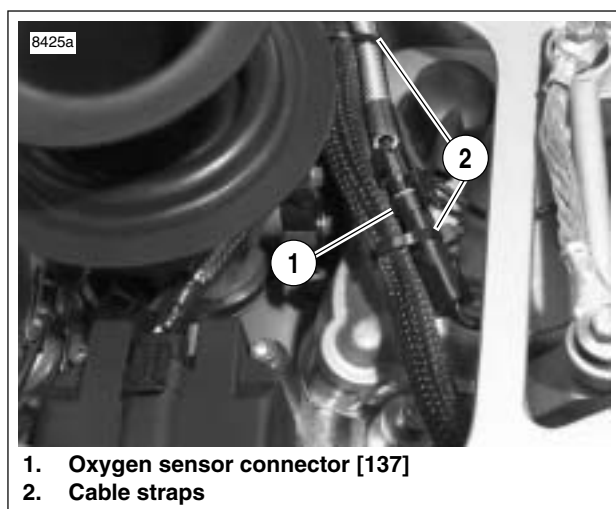


Figure 4-73. Oxygen Sensor Connector [137] (984 Models)

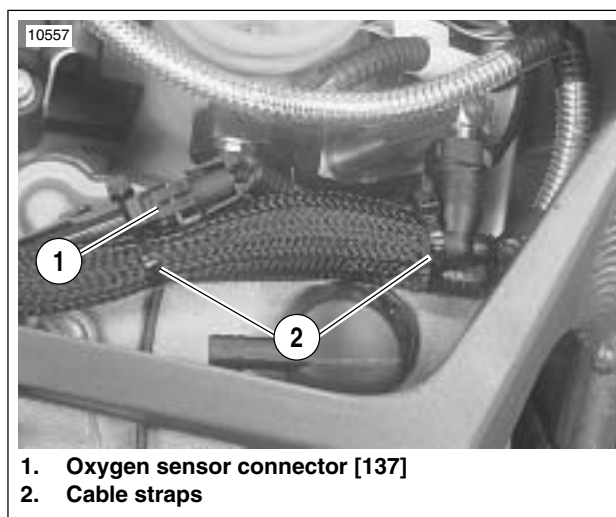


Figure 4-74. Oxygen Sensor Connector [137] (1200 Models)

GENERAL

See [Figure 4-75](#). The Engine Temperature Sensor (ET Sensor), located in the rear cylinder head, monitors the engine temperature close to the combustion chamber. In addition to aiding the ECM in monitoring the operation of the engine, it is also used to warn the operator of potentially damaging temperatures by causing the CHECK ENGINE lamp to blink during operation.

REMOVAL

⚠ WARNING

To protect against accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

1. Disconnect negative battery cable.
2. Remove intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
3. Remove airbox. See [4.44 AIRBOX](#).
4. See [Figure 4-76](#). Remove right upper tie bar fastener (2). Rotate tie bar to provide access to sensor.

CAUTION

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

5. Unplug 1-place ET Sensor connector (1) [90] above rear cylinder head.
6. Slide rubber boot up ET sensor wire.
7. Remove sensor from rear cylinder head using Snap-on socket M3503B.

b0801x4x

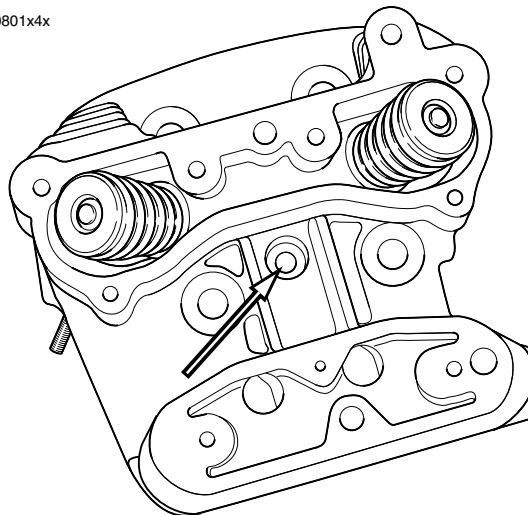


Figure 4-75. Engine Temperature Sensor Location (rear cylinder)

10557



1. Engine temperature sensor connector [90] (approximate location)

Figure 4-76. Engine Temperature Sensor Connector Approximate Location [90]

INSTALLATION

CAUTION

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

1. See [Figure 4-75](#). Screw sensor into rear cylinder head.

NOTE

In next step, make sure wire is in cutout portion (slot) of socket to prevent damage.

2. Secure sensor with Snap-on socket M3503B. Tighten ET sensor to 120-168 **in-lbs** (13.6-19 Nm).

NOTE

Orient the rubber boot so the flat on the boot is towards the left side of the motorcycle.

3. Push rubber boot down sensor wire towards cylinder head until it seats in hole on top of ET sensor.
4. See [Figure 4-76](#). Connect ET sensor 1-place connector [90] to wiring harness.
5. Install right upper tie bar fastener (2). Tighten fastener to 25-27 ft-lbs (33.9-36.6 Nm).
6. Install airbox. See [4.44 AIRBOX](#).
7. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
8. Connect negative battery cable.

GENERAL

The Bank Angle Sensor (BAS), located under the seat, provides input to the ECM on vehicle lean angle. If vehicle lean angle exceeds predetermined bank angle limit, the Bank Angle Sensor will shut off power to the ignition and fuel pump.

REMOVAL

1. Remove seat. See [2.41 SEAT](#).

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

2. Disconnect negative battery cable.
3. See [Figure 4-77](#). Remove screws and washers to detach sensor from seat latch bracket.
4. Unplug bank angle sensor connector [134] and remove.

INSTALLATION

1. See [Figure 4-77](#). Install bank angle sensor connector [134].
2. Position bank angle sensor on seat latch bracket. Make sure locating post on sensor engages hole in mounting tab.
3. Install bank angle sensor to mounting tab with fasteners and **new** locknuts. Tighten fastener to 12-36 **in-lbs** (1.4-4.1 Nm).

⚠ WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury. (68)

4. Connect negative battery cable.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury. (70)

5. Install seat. See [2.41 SEAT](#).

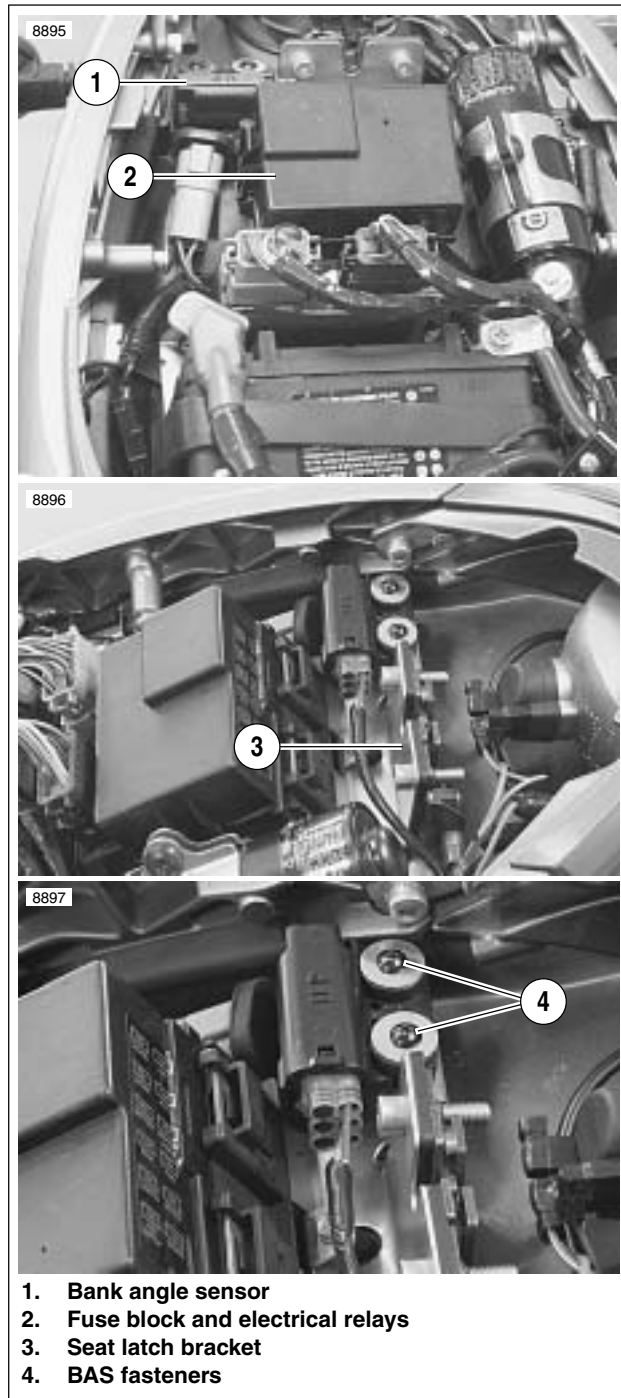


Figure 4-77. Bank Angle Sensor Location

GENERAL

See [Figure 4-78](#). The intake air temperature sensor (IAT Sensor), located on the airbox base plate, measures the air temperature allowing the ECM to calculate the density of the air entering the manifold. The IAT is a thermistor type sensor.

REMOVAL

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

1. Disconnect negative battery cable.
2. See [Figure 4-78](#). Remove airbox cover and filter. Remove fasteners securing base. See [4.44 AIRBOX](#).
3. Raise base and pull IAT sensor from sensor grommet.
4. Disconnect connector [89] from intake air temperature sensor.
5. Inspect sensor grommet for damage and replace as required.

INSTALLATION

1. Connect IAT sensor connector [89] to wiring harness.
2. Install IAT sensor into grommet on air cleaner base from underneath.
3. Install airbox. See [4.44 AIRBOX](#).
4. Install negative battery cable.

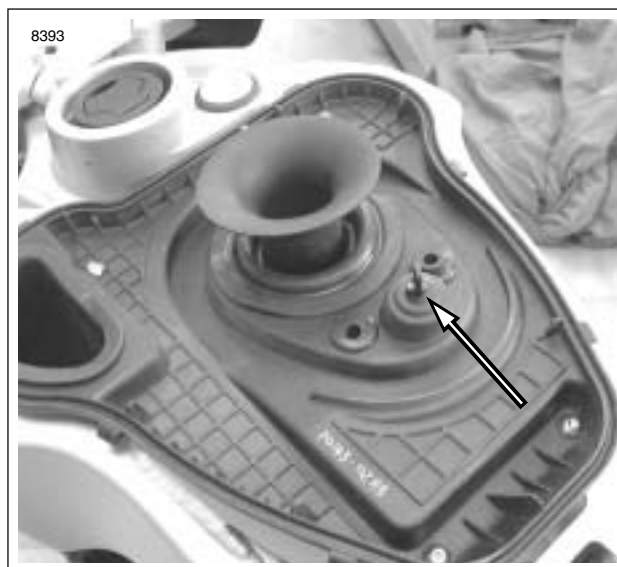


Figure 4-78. Intake Air Temperature Sensor Installed

REMOVAL

1. Remove airbox. See 4.44 AIRBOX.
2. See Figure 4-79. Disconnect throttle position sensor connector [88].
3. See Figure 4-80. Remove two screws and washers to detach TP sensor.

INSTALLATION

1. See Figure 4-80. Apply LOCTITE 222 (purple) to threads of fasteners.
2. Install fastener into lower mounting hole of sensor prior to installation.
3. Attach TP sensor with both fasteners and washers. Tighten to 16-20 **in-lbs** (1.8-2.3 Nm).
4. See Figure 4-81. Attach throttle position sensor connector [88]. Slots on female connector [88B] must fully engage tabs on male connector housing [88A].

NOTE

Throttle position sensor can only be calibrated using *DIGITAL TECHNICIAN* (Part No. HD-44750).

5. Calibrate throttle position sensor.

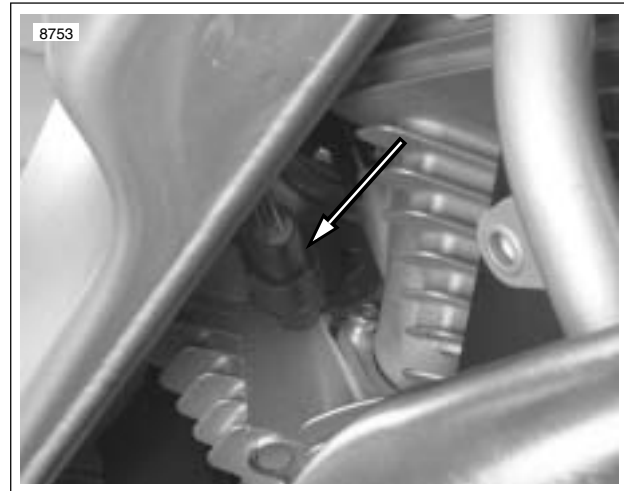


Figure 4-79. Throttle Position Sensor Location

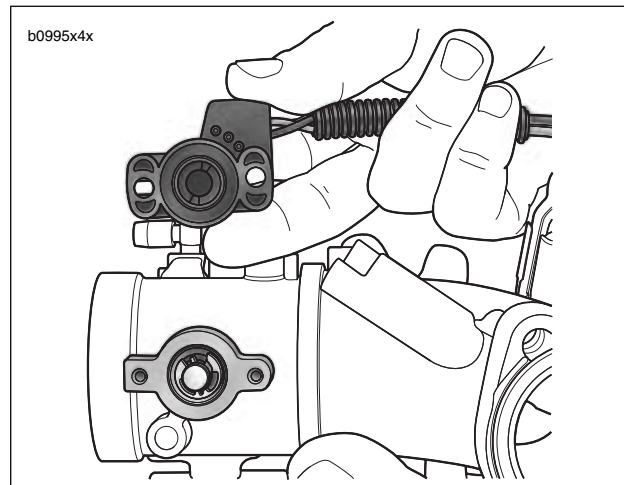


Figure 4-80. Throttle Position Sensor

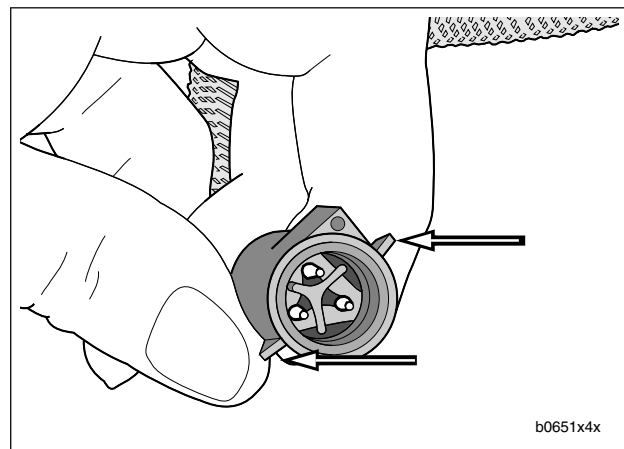


Figure 4-81. Tabs on TP Sensor Connector [88A]

GENERAL

A computer-controlled cooling fan assists engine cooling during operation in high temperatures. Fan actuation is controlled by the ECM. Refer to [Table 4-37](#).

Table 4-37. Cooling Fan Specifications

	FAN ON	FAN OFF
Key ON	220° C (428° F)	180° C (356° F)
Key OFF	170° C (338° F)	150° C (302° F)

REMOVAL

1. Remove seat. See [2.41 SEAT](#).

⚠ WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury. (48)

2. Disconnect negative battery cable.
3. Remove shock absorber. See [2.22 REAR SHOCK ABSORBER](#).
4. See [Figure 4-82](#). Remove cooling fan fasteners (1).
5. Rotate fan clockwise (looking towards front of vehicle) to remove.
6. See [Figure 4-83](#). Disconnect cooling fan connector [97].

INSTALLATION

1. See [Figure 4-83](#). Connect cooling fan connector [97].

NOTES

- When installing cooling fan (3), be sure wiring, transmission vent hose and fuel line are routed through notch (2) in fan body.
 - On California models, both fuel tank and canister vent hoses are routed through notch in fan body.
2. Install fan and rotate counterclockwise into position.
 3. Install cooling fan fasteners. Tighten to 12-36 in-lbs (1.4-4.1 Nm).
 4. Install shock absorber. See [2.22 REAR SHOCK ABSORBER](#).
 5. Connect negative battery cable.

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury. (70)

6. Install seat. See [2.41 SEAT](#).

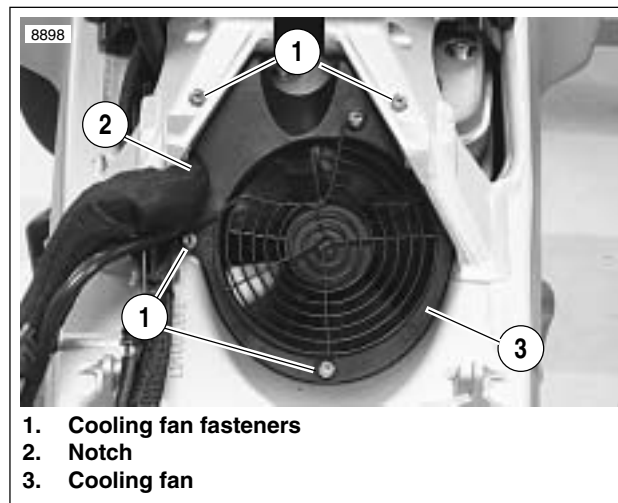


Figure 4-82. Cooling Fan



Figure 4-83. Cooling Fan Connector [97]

GENERAL

The fuel pump is located inside the left rear portion of the fuel tank/frame.

DRAINING FUEL TANK

WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before servicing fuel pump. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

1. Purge the fuel supply line of high pressure gasoline.
 - a. See [Figure 4-84](#). Disconnect the 4-place fuel pump connector (1) [86]. 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

An open flame or spark may cause a fuel tank explosion if all traces of fuel are not purged from the tank. Use extreme caution when servicing fuel tanks. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Remove drain plug (4) and drain fuel into appropriate container. Discard plug.
3. When fuel tank is empty, replace with **new** drain plug. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).

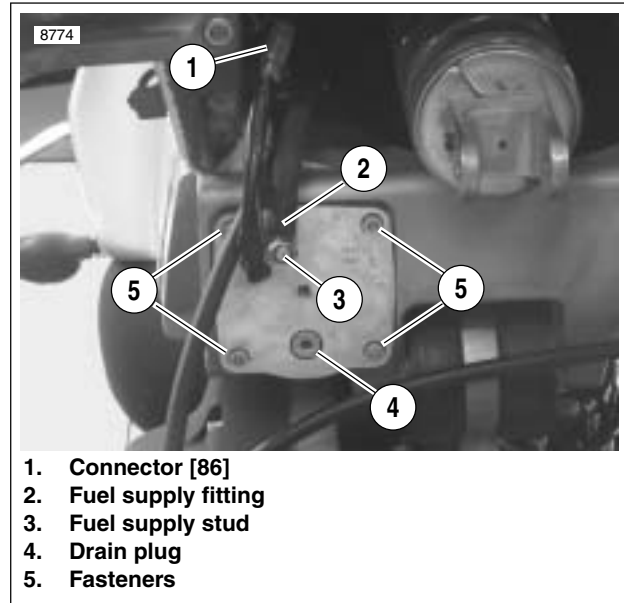


Figure 4-84. Fuel Pump Location

REMOVAL

PART NO.	SPECIALTY TOOL
B-45657	Fuel pump puller

1. Remove rider footpeg mounts. See [2.30 FOOTPEG, HEEL GUARD AND MOUNT](#).
2. Remove swingarm. See [2.19 SWINGARM AND BRACE](#).
3. Drain fuel tank. See [DRAINING FUEL TANK](#) under [4.39 FUEL PUMP](#).

WARNING

A small amount of gasoline will drain from the fuel supply fitting, fuel line and fuel pump when removed. Thoroughly wipe up any spilt fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

4. See [Figure 4-84](#). Remove fuel line from fuel supply fitting (2).
5. Remove four fuel pump fasteners (5).
6. See [Figure 4-85](#). Assemble fuel pump puller.
 - a. Thread nut (3) onto bolt (4).
 - b. Slide washer (2) onto bolt.
 - c. Insert bolt assembly into hole in main body (1).
7. See [Figure 4-86](#). Place the main body of the fuel pump puller over the fuel pump assembly.
8. Thread bolt into the threaded hole in the center of the fuel pump assembly until snug.
9. Thread the nut down the shaft of the bolt until it makes contact with the main body of the fuel pump puller.
10. Place wrench onto nut and another wrench onto the bolt. Hold the bolt stationary and turn nut clockwise until fuel pump is pulled free from frame.

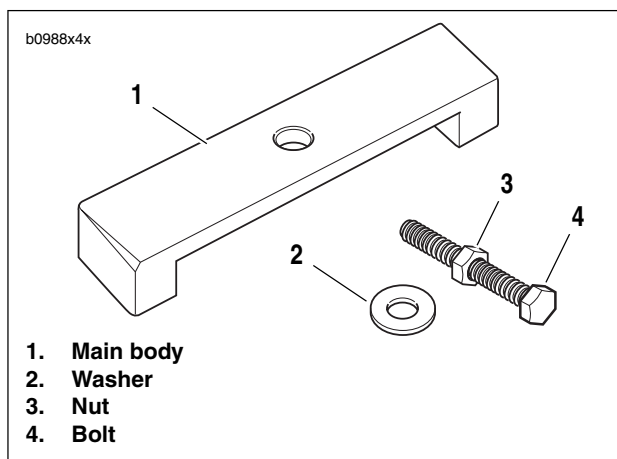


Figure 4-85. Fuel Pump Puller

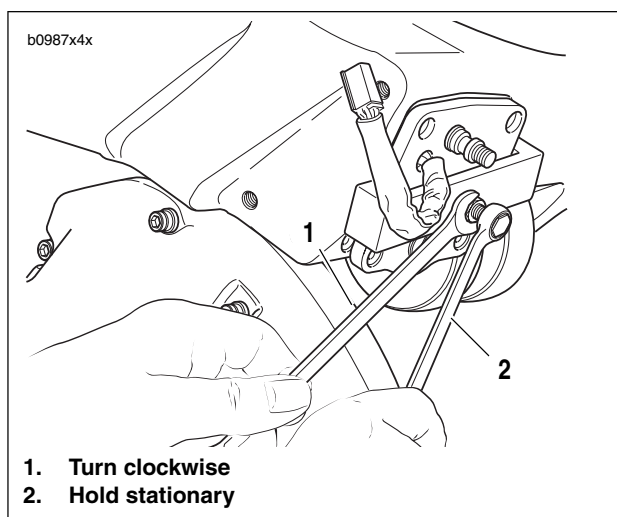


Figure 4-86. Fuel Pump Removal

REPAIR

Fuel Pressure Regulator Replacement

1. Remove fuel pump assembly from tank. See [REMOVAL](#) in this section.
2. See [Figure 4-87](#). Pry four tabs of clip holding fuel pressure regulator (8) in place. Detach regulator from regulator housing.
3. Remove and discard O-rings from regulator.
4. Install **new** O-rings on regulator. Press **new** regulator into place.
5. Install **new** regulator clip.
6. Install fuel pump assembly. See [INSTALLATION](#) in this section.

Low Fuel Level Sensor Replacement

1. Remove fuel pump assembly from tank. See [REMOVAL](#) in this section.
2. See [Figure 4-88](#). Disconnect low fuel level sensor connector (4).
3. Remove clamp (5) securing low fuel level sensor (6) in place.
4. Install **new** sensor.
5. Install new clamp over sensor.
6. Attach wire connector.
7. Install fuel pump assembly. See [INSTALLATION](#) in this section.

Fuel Filter Replacement

1. Remove fuel pump assembly from tank. See [REMOVAL](#) in this section.
2. See [Figure 4-88](#). Remove fuel pump clamps (3, 7).
3. See [Figure 4-89](#). Remove fuel pump clips (1).
4. Pull regulator housing (2) from fuel pump assembly.
5. See [Figure 4-90](#). Discard regulator housing o-rings (2).
6. See [Figure 4-88](#). Remove fuel filter hose from fitting (2) and remove fuel filter (1).
7. Install **new** clamps on fuel filter hose.
8. Install **new** fuel filter hose with 90° bend towards fitting (2).
9. See [Figure 4-90](#). Install **new** regulator housing o-rings.
10. Install regulator housing onto fuel pump assembly.
11. See [Figure 4-88](#). Tighten fuel filter clamps (3, 7).
12. See [Figure 4-89](#). Install clips (1) into center grooves.
13. Install fuel pump assembly. See [INSTALLATION](#) in this section.

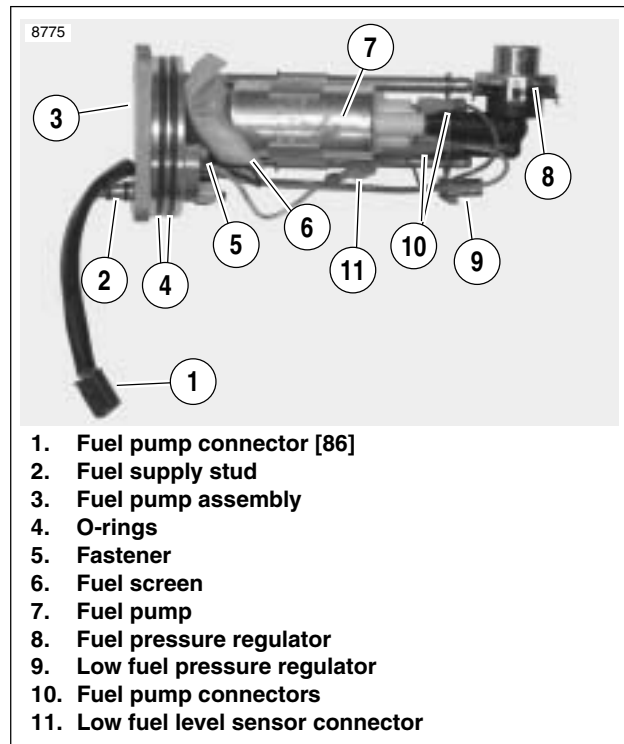


Figure 4-87. Fuel Pump Assembly (left side)

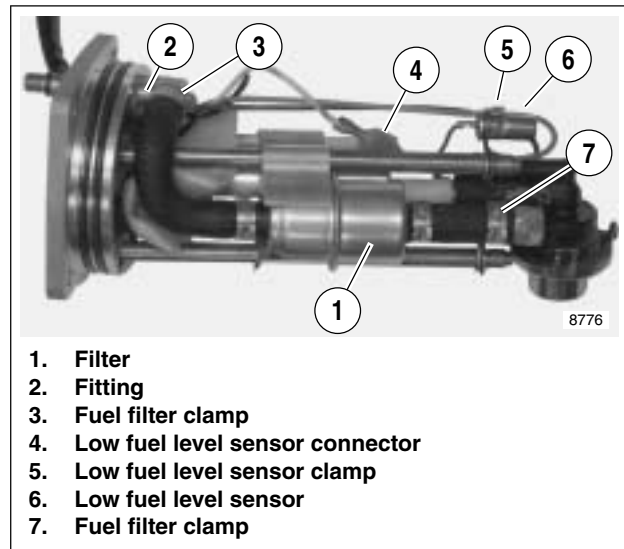


Figure 4-88. Fuel Pump Assembly (right side)

Fuel Screen Replacement

1. Remove fuel pump assembly from tank. See [REMOVAL](#) in this section.
2. See [Figure 4-88](#). Remove fuel filter clamp (3). Disconnect hose from fitting (2).
3. See [Figure 4-89](#). Remove clips (1).
4. See [Figure 4-87](#). Disconnect fuel pump connectors (10) and low fuel level sensor connector (11).
5. Slide fuel pump and fuel filter off of fuel pump assembly.
6. Pry fuel screen (6) from fuel pump (7).

NOTE

In next step, make sure that section of screen with most material faces towards inside of fuel pump assembly.

7. Install **new** fuel screen on fuel pump.
8. Without damaging fuel screen, slide fuel pump onto fuel pump assembly.
9. See [Figure 4-88](#). Attach fuel filter hose to fitting (2) with clamp (3).
10. See [Figure 4-89](#). Install clips (1) into middle grooves.
11. See [Figure 4-87](#). Connect low fuel level sensor wiring (11).
12. Connect fuel pump connectors (10). Connectors are two different sizes.
13. Install fuel pump assembly. See [INSTALLATION](#) in this section.

Table 4-38. Fuel Pump Specifications

SPECIFICATION	DATA
Pressure Setting	49 PSI
Operating Voltage	13.2 volts
Fuel Delivery	60 LPH @ 45 PSI [310 kPa]
Current Draw	6.0 amps

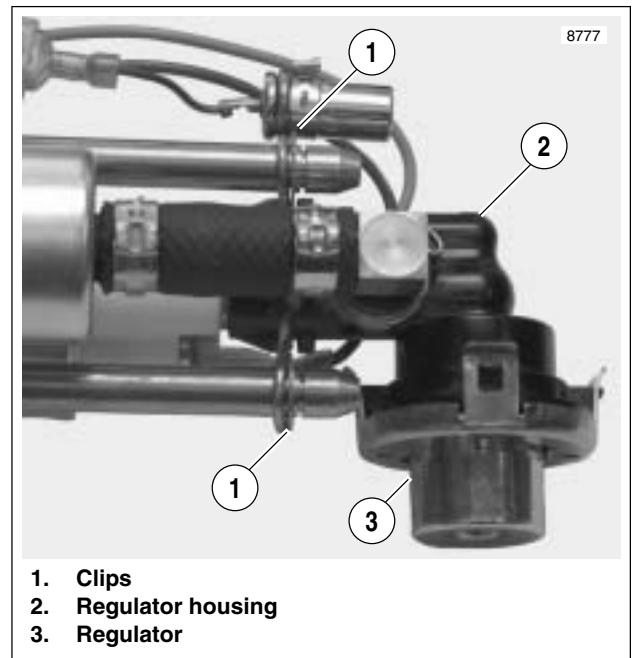


Figure 4-89. Fuel Pump Clips

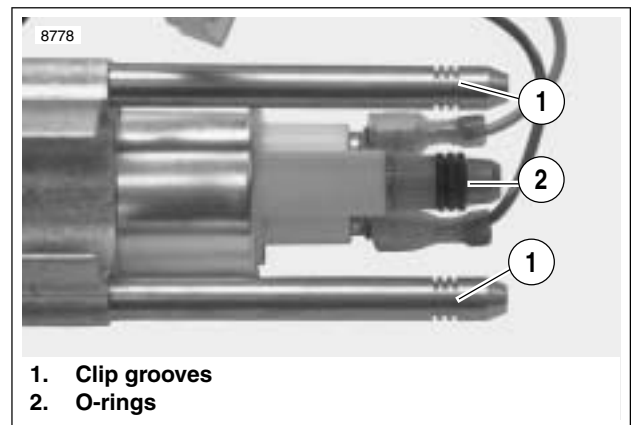


Figure 4-90. Regulator Housing O-rings

Fuel Pump Wire Harness Replacement

1. Remove fuel pump assembly from tank. See [REMOVAL](#) in this section.
2. See [Figure 4-88](#). Remove fuel filter clamp (3). Disconnect hose from fitting (2).
3. See [Figure 4-89](#). Remove fuel pump clips (1).
4. See [Figure 4-87](#). Disconnect fuel pump connector (10) and low fuel level sensor connector (11).
5. Slide fuel pump and fuel filter off of fuel pump assembly.
6. Remove terminals from fuel pump connector [86].

NOTE

Note positions of wires in connector for correct assembly.

7. Disassemble fuel pump connector [86].
 - a. See [Figure 4-91](#). Remove connector clips (3).
 - b. Insert push pin/safety pin (1), into connector as shown.
 - c. Bend terminal tab towards connector pin and pull wire from opposite side of connector.
 - d. Repeat for all wires.
8. See [Figure 4-87](#). Remove screw (5).
9. See [Figure 4-92](#). From outer side of fuel pump assembly, push wire harness through assembly.
10. Lubricate **new** o-rings with **clean** engine oil. From inner side of fuel pump assembly, push new wire harness into assembly.
11. See [Figure 4-87](#). Insert **new** fastener (5), through ground wire terminal and secure to fuel pump assembly. Tighten to 18-22 **in-lbs** (2.0-2.5 Nm).

NOTE

After installing terminals, pull slightly on wire to make sure it is seated. If necessary, bend tab on terminal to aid in seating wire.

12. Install terminals into proper locations of fuel pump connector [86]. Install connector clips.
13. Without pinching fuel screen, slide fuel pump onto fuel pump assembly.
14. See [Figure 4-88](#). Attach fuel filter hose to fitting (2) with clamp (3).
15. See [Figure 4-89](#). Install clips (1) into middle grooves.
16. See [Figure 4-87](#). Connect low fuel level sensor connector (11).
17. Connect fuel pump connectors (10). Connectors are two different sizes.
18. Install fuel pump assembly. See [INSTALLATION](#) in this section.

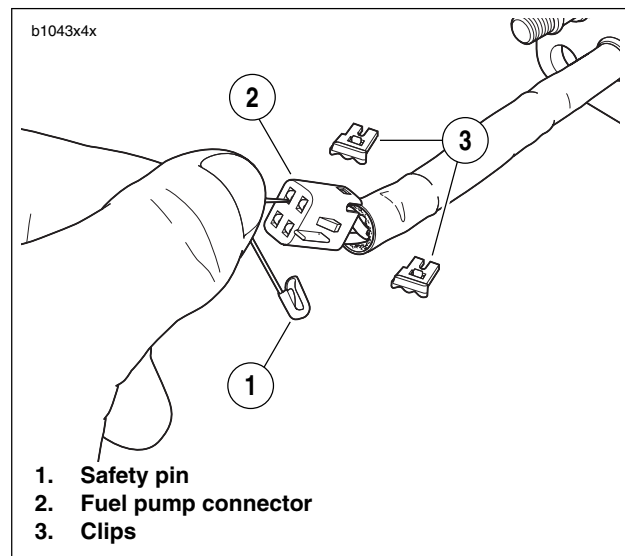


Figure 4-91. Fuel Pump Connector Disassembly

INSTALLATION

1. See [Figure 4-87](#). Replace o-rings (4). Lubricate **new** o-rings with **clean** engine oil.
2. Install **new** o-rings on fuel supply stud (2). Larger o-ring is located in groove closer to fuel pump.
3. See [Figure 4-93](#). Insert fuel pump into frame until resistance is felt.
4. Insert four screws (5) through fuel pump and into frame.

CAUTION

Use all four screws to draw fuel pump into frame. Using less than four screws will damage fuel pump o-rings.

5. Using crosswise pattern, draw fuel pump into frame by tightening screws. Final tighten screws to 48-51 **in-lbs** (5.4-5.8 Nm).

WARNING

Do NOT overtighten fuel fitting nuts. Overtightening fasteners may result in excessive compression of sealing components and fuel leakage which could result in death or serious injury.

6. Install fuel supply line banjo fitting (2) over fuel supply stud (3). Install **new** fastener. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).
7. Fill tank with a small amount of fuel. Check for leaks.
8. Connect fuel pump connector [86] (1) and push cable strap tab into hole in frame.

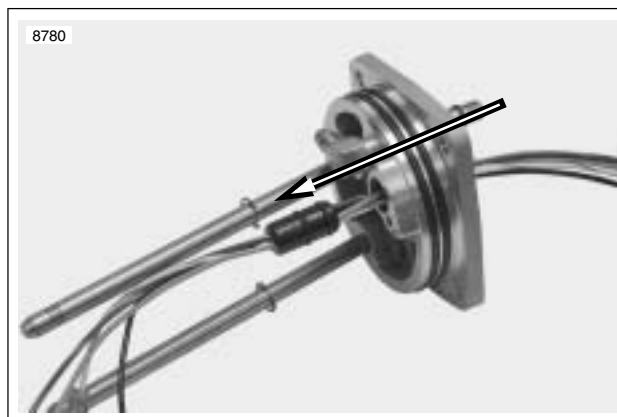


Figure 4-92. Wire Harness Removal Direction

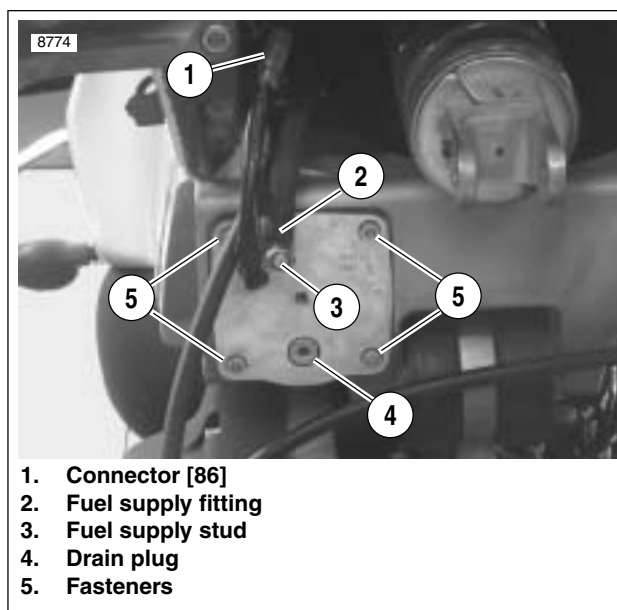


Figure 4-93. Fuel Pump Installation

GENERAL

The vent valve opens to allow gas vapor to escape the fuel tank and either vent to the atmosphere or to the charcoal canister on California Models (EVAP-equipped) and closes to prevent gasoline from leaking out of the fuel tank if the vehicle is tipped at an extreme angle.

NOTE

The fuel tank must be drained to perform this service.

REMOVAL

1. Drain fuel tank. See [DRAINING FUEL TANK](#) under [4.39 FUEL PUMP](#).
2. Remove fuel tank vent line from vent valve.
3. See [Figure 4-95](#). Remove vent valve fasteners (5).
4. Remove bracket (4), vent valve (3) and o-ring (2) from fuel tank/frame (1).

INSTALLATION

1. See [Figure 4-95](#). Install **new** vent valve o-ring (2).
2. Install vent valve (3) into fuel tank/frame. Vent valve nozzle should be at approximately the 7:00 position.
3. Install bracket over vent valve. Slot in bracket should line up with notch in valve.
4. Loosely install vent valve fasteners (5).
5. Tighten fasteners to 39-41 **in-lbs** (4.4-4.6 Nm).
6. Connect fuel tank vent line to vent valve.
7. Install airbox. See [4.44 AIRBOX](#).
8. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
9. Connect negative battery cable. Tighten battery terminal hardware to 60-96 **in-lbs** (7-11 Nm).

⚠ WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury. (70)

10. Install seat. See [2.41 SEAT](#).

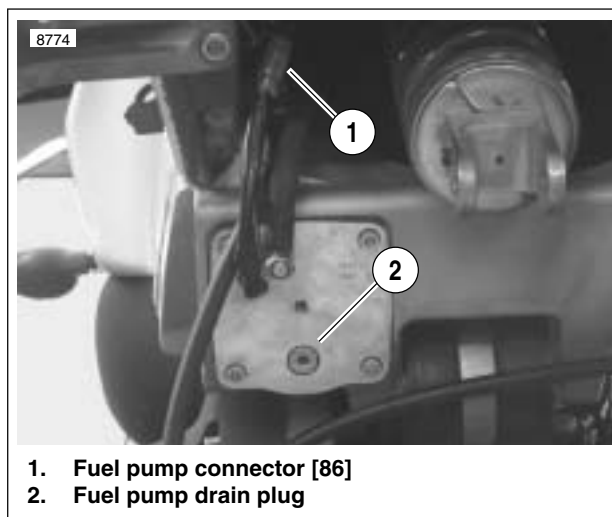


Figure 4-94. Fuel Pump Drain Screw (swingarm removed for illustration)

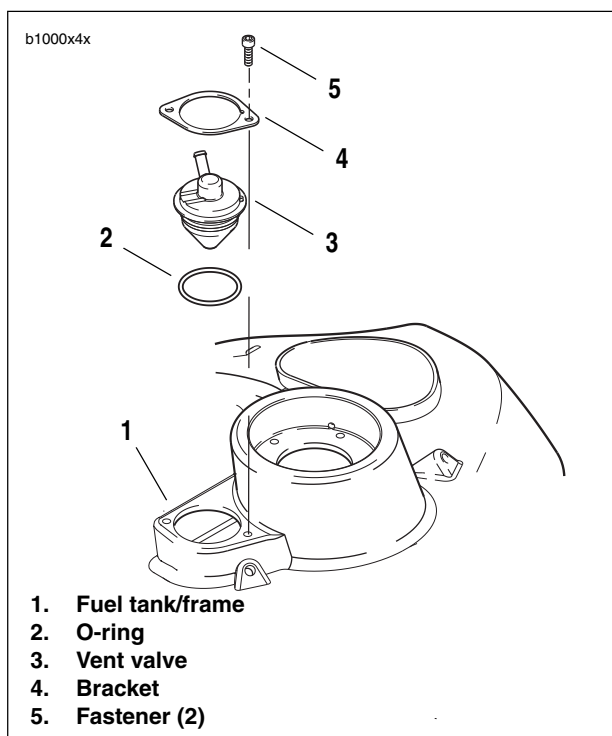


Figure 4-95. Fuel Tank Vent Valve

REMOVAL

NOTE

The fuel tank must be drained to perform this service.

1. Drain fuel tank. See [DRAINING FUEL TANK](#) under 4.39 [FUEL PUMP](#).
2. Remove fuel filler cap.
3. See [Figure 4-97](#). Remove fasteners (4) securing fuel cap retaining ring (3) to fuel filler neck (1).
4. Remove fuel cap retaining ring and o-ring (2). Discard o-ring.

INSTALLATION

1. Coat **new** o-ring (2) with thin film of clean engine oil.
2. Place o-ring into groove in underside of fuel cap retaining ring (3).

NOTE

Be sure o-ring remains in groove of fuel cap retaining ring during installation.

3. Insert fuel cap retaining ring into fuel filler neck.
4. Install fasteners (4). Tighten to 17-70 **in-lbs** (1.9-7.9 Nm).
5. Install fuel filler cap.

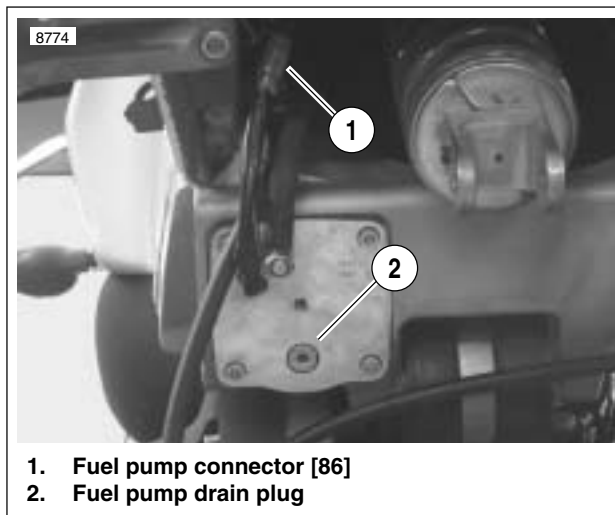


Figure 4-96. Fuel Pump Drain Screw (swingarm removed for illustration)

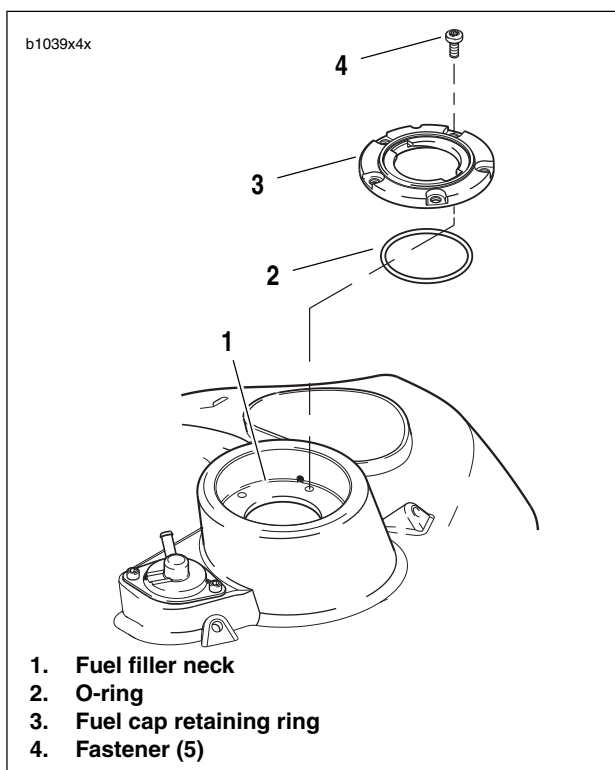


Figure 4-97. Fuel Cap Retaining Ring

GENERAL

See [Figure 4-99](#). The throttle body consists of the following components:

- Fuel supply fitting.
- Idle speed adjustment screw.
- Cable bracket.
- Throttle position sensor.
- Throttle lever.

REMOVAL

WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (49 psi [338 kPa]). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before servicing throttle body. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

1. Purge the fuel supply line of high pressure gasoline.
 - a. See [Figure 4-98](#). Disconnect the 4-place fuel pump connector [86]. Connector is located on the left side, above the fuel pump.
 - 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.
 - d. Reconnect fuel pump connector.
2. Label and detach throttle cables. See [2.23 THROTTLE CONTROL](#).
3. See [Figure 4-101](#). On California models, pull EVAP hose from fitting (1).
4. Rotate engine for service. See [3.3 ENGINE ROTATION FOR SERVICE](#).

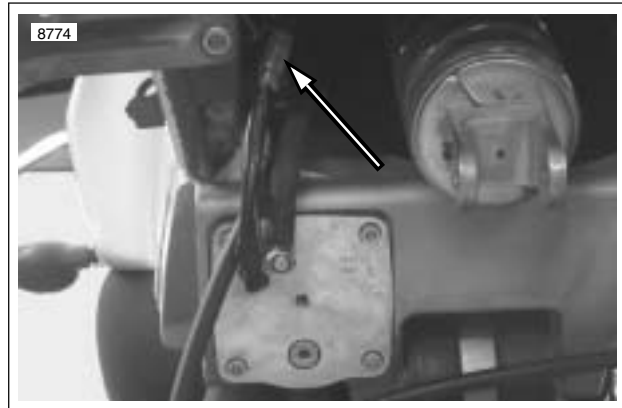


Figure 4-98. Fuel Pump connector [86] (swingarm removed for illustration)

1. Front fuel injector
2. Rear fuel injector
3. Fuel rail fastener (2)
4. Fuel rail
5. Throttle position sensor
6. Throttle position sensor fastener (2)
7. Washer
8. Velocity stack
9. Throttle body
10. Velocity stack fastener (2)
11. Ring seal
12. Intake manifold
13. Intake flange fastener (2)
14. Intake flange (2)
15. Intake seal (2)
16. Intake flange fastener (2)

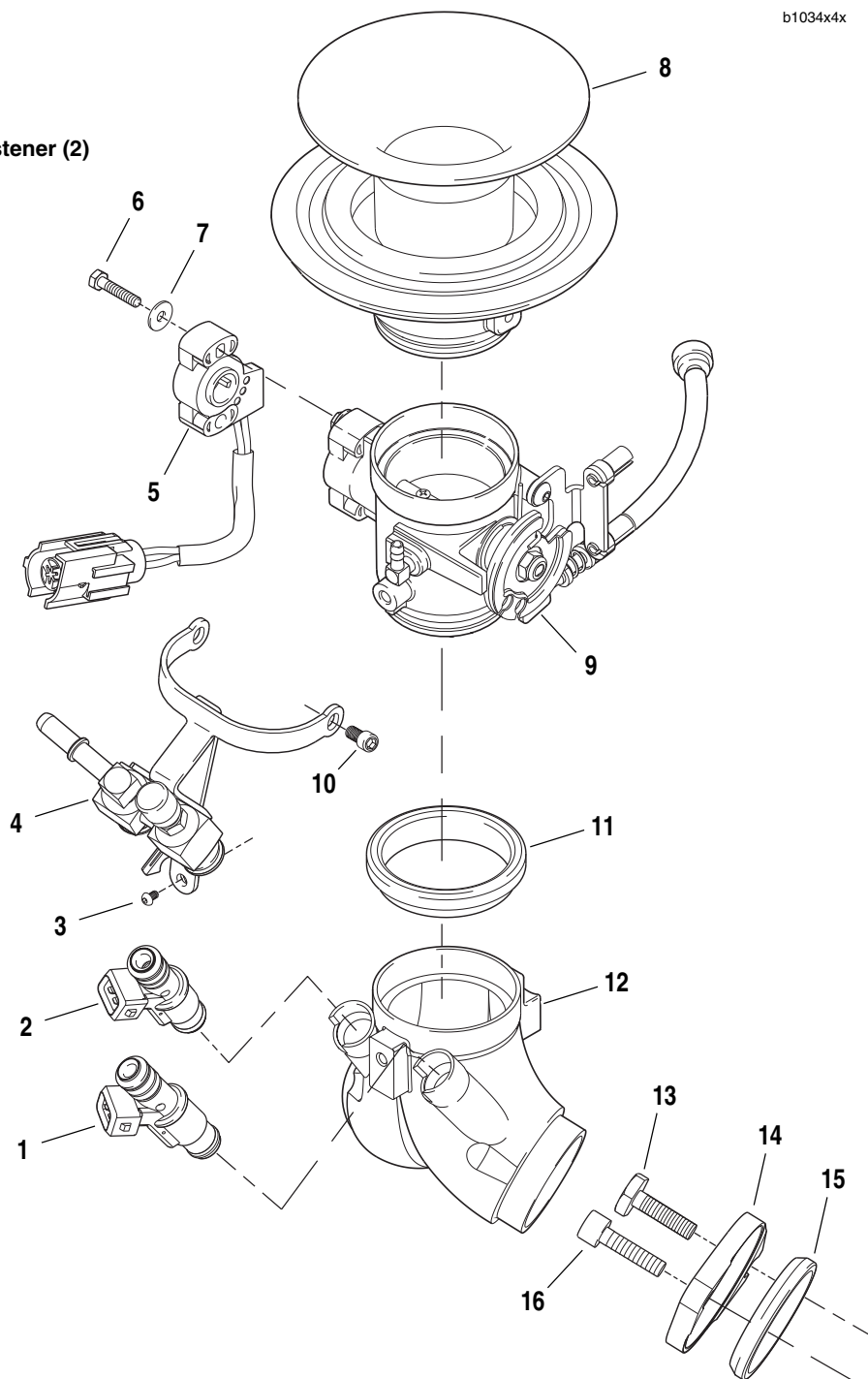
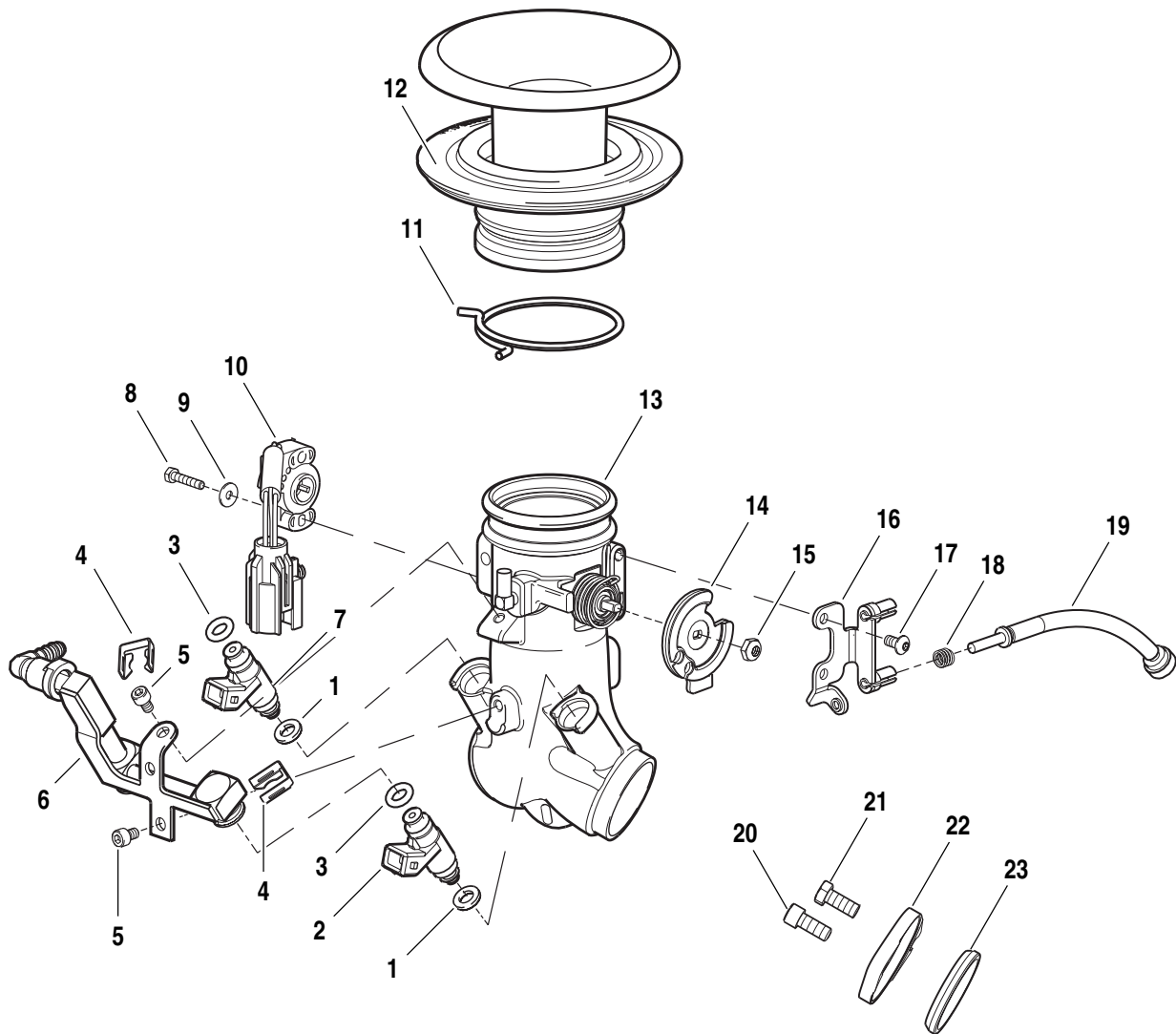


Figure 4-99. Two Piece Throttle Body/Intake Manifold Assembly (XB9S Model)

b0063



- | | |
|----------------------------------|---|
| 1. O-ring, fuel injector, outlet | 13. Throttle body manifold assembly |
| 2. Fuel Injector, front | 14. Throttle lever assembly |
| 3. O-ring, fuel injector, inlet | 15. Nylock |
| 4. Clip, injector (2) | 16. Cable Bracket |
| 5. Screw (2) | 17. Screw (2) |
| 6. Fuel Rail | 18. Spring, idle adjuster |
| 7. Fuel injector, rear | 19. Idle adjuster |
| 8. Screw (2) | 20. Bolt (2) |
| 9. Washer, flat (2) | 21. Bolt (2) |
| 10. Throttle position sensor | 22. Mounting flange, intake (1 front, 1 rear) |
| 11. Clamp, wire spring, 49mm | 23. Seal, intake manifold (2) |
| 12. Velocity stack, 49mm | |

Figure 4-100. One Piece Throttle Body/Intake Manifold Assembly (XB12 Model)

5. Remove assembly from motorcycle.
 - a. See [Figure 4-102](#). On primary cover side, loosen but do not remove the two front and rear intake flange fasteners (2).
 - b. Remove fastener (1) holding manifold to engine mount.
 - c. See [Figure 4-103](#). On gearcase cover side, remove both intake flange fasteners from cylinder heads.
 - d. Slide the throttle body and manifold assembly through top of bike frame.
6. See [Figure 4-99](#). Remove intake flanges (14) from manifold. Remove and discard seals (15).

REPAIR

Throttle Position Sensor

See [4.37 THROTTLE POSITION SENSOR](#) for removal, installation and calibration information.

Intake Manifold

1. See [Figure 4-104](#). Remove upper fuel rail fastener (1).
2. See [Figure 4-99](#). Separate intake manifold (12) from throttle body (9). Discard ring seal (11).
3. Install **new** ring seal on intake manifold.
4. Install intake manifold on throttle body.
5. See [Figure 4-104](#). Apply a drop of LOCTITE 222 (purple) to threads of fuel rail fastener (1).
6. Install fastener. Tighten to 24-28 **in-lbs** (2.7-3.2 Nm).

Fuel Injectors

1. Remove throttle body. See [REMOVAL](#) in this section.
2. Separate fuel rail assembly from intake manifold.
 - a. See [Figure 4-104](#). Remove both injector clips (4).
 - b. Remove fuel rail fasteners (1, 6) that hold the fuel rail to the throttle body and manifold.
 - c. Separate fuel rail from injectors (2, 5) by gently rocking the fuel rail and pulling it away from the injectors.
3. Remove fuel injectors (2, 5) from manifold by gently rocking and pulling it away from the manifold.

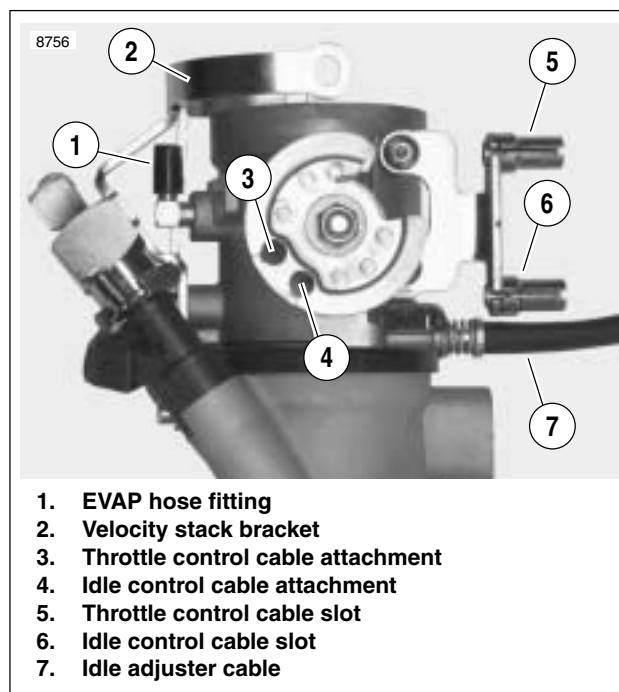


Figure 4-101. Throttle Cable Bracket (Typical)

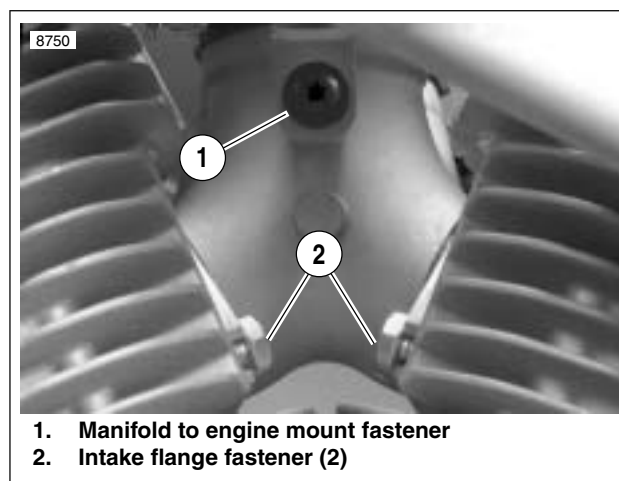


Figure 4-102. Intake Manifold (primary side)

⚠ WARNING

Do not use any injector that has damaged or deformed O-rings. Damaged O-rings may leak gasoline. Gasoline is extremely flammable and highly explosive. Use of damaged O-rings could result in death or serious injury.

4. Inspect all injector O-rings for cuts, tears or general deterioration. Replace injector if O-rings have been damaged or have taken a definite set.
5. Apply a thin coat of clean engine oil to top and bottom injector O-rings.
6. See [Figure 4-104](#). Install fuel injectors.
 - a. Install both injectors (2, 5) into intake manifold.
 - b. Press the fuel rail assembly (3) onto the top of the injectors.
 - c. Apply a drop of LOCTITE 222 (purple) to threads of fuel rail fasteners (1, 6).
 - d. Secure the fuel rail to the throttle body and manifold with fasteners. Tighten to 24-28 **in-lbs** (2.7-3.2 Nm).
7. Snap the injector clips (4) over the flange on the fuel rail outlet and into the top groove in the injector.

Testing

1. Remove intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).
2. Remove airbox cover. See [4.44 AIRBOX](#).
3. Conduct test.
 - a. Turn key ON for two seconds.
 - b. Turn key OFF for two seconds.
 - c. Repeat Steps A and B five consecutive times.
 - d. Open throttle, replace fuel injectors if there is any evidence of raw fuel in throttle body manifold.
4. Install airbox cover. See [4.44 AIRBOX](#).
5. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).

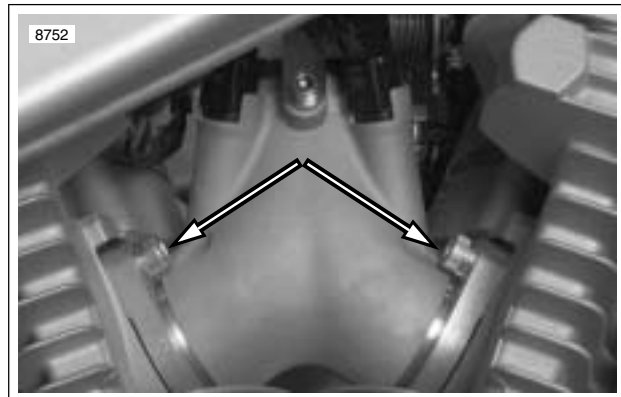


Figure 4-103. Intake Manifold Fasteners (gearcase cover side)

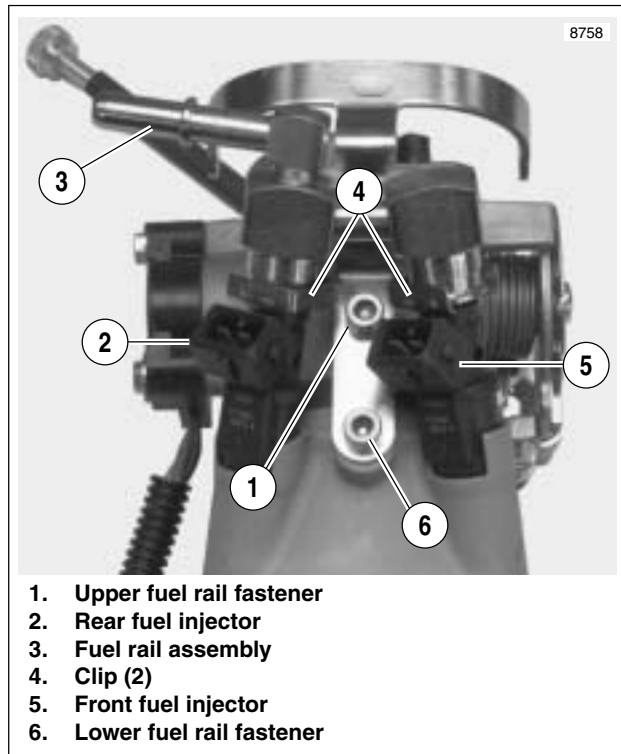


Figure 4-104. Fuel Injectors

INSTALLATION

1. See [Figure 4-105](#). Install front and rear intake flanges onto manifold with the counterbore facing out. Each intake flange is labeled and the pieces are not interchangeable.
2. Place a **new** seal in each intake flange with the beveled side against the counterbore.
3. Install throttle body/intake manifold assembly.
 - a. See [Figure 4-102](#). Slide the assembly toward installed position. Manifold should slide over fasteners (2) on primary cover side of engine.
 - b. Align holes in intake flanges with those in cylinder heads and start screws.
 - c. Make sure throttle body is centered between cylinders and tighten all intake flange screws to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Rotate engine into installed position. See [3.3 ENGINE ROTATION FOR SERVICE](#).
5. Attach throttle cables. See [2.23 THROTTLE CONTROL](#).
6. Attach wiring.
 - a. Injector cables are tagged F(ront) and R(ear) for ease of assembly. Push connector halves together until latches “click.” Grooves in female connector must align with the tabs in male housing.
 - b. Connect throttle position sensor by pushing the connector halves together. Slots on female connector must fully engage tabs on male connector housing.
7. Connect EVAP hose to port at bottom of throttle body (California models only).
8. Calibrate throttle position sensor if removed or replaced. See [4.37 THROTTLE POSITION SENSOR](#).
9. Install airbox. See [4.44 AIRBOX](#).
10. Check throttle cable adjustment. See [2.23 THROTTLE CONTROL](#).

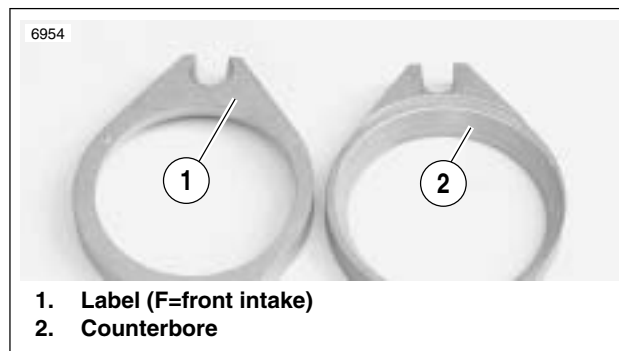


Figure 4-105. Intake Flanges

GENERAL

DANGER

Propane is an extremely flammable liquid and vapor. Vapor may cause flash fire. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation.

WARNING

Read all directions and warnings on propane bottle. Failure to follow all directions and warnings on bottle could result in death or serious injury.

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

LEAK TESTER

Parts List

- Standard 14 oz. propane cylinder.
- SNAP-ON YA7148 Propane Enrichment Kit.
- 12 in. (304 mm) long-1/4 in. (6 mm) diameter copper tubing.

Tester Assembly

1. Cut rubber hose from kit to 18 in. (457 mm) in length.
2. See [Figure 4-106](#). Flatten one end of copper tube to form a nozzle.
3. Insert round side of copper tube into end of tubing.

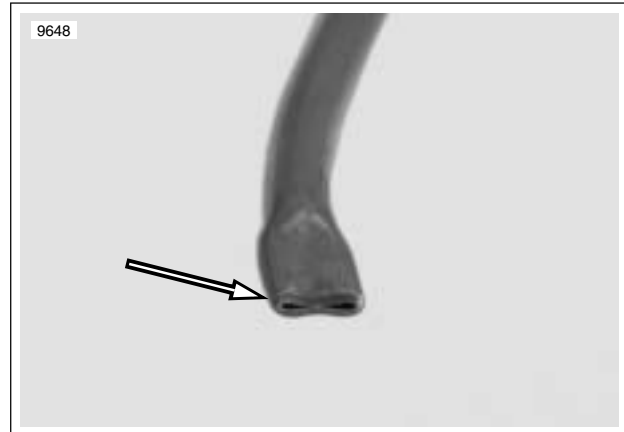
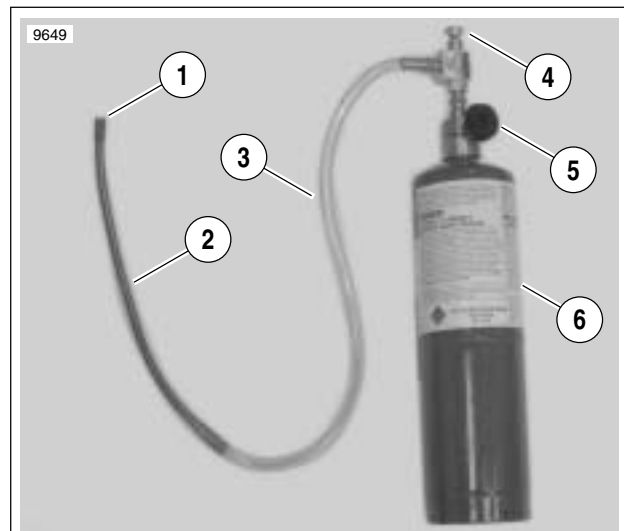


Figure 4-106. Nozzle



1. Nozzle
2. Copper Tube
3. Hose
4. Valve
5. Knob
6. Propane bottle

Figure 4-107. Leak Tester

INTAKE LEAK TEST

1. Start engine.
2. Warm engine to operating temperature.
3. See [Figure 4-107](#). Turn knob (5) counterclockwise to open propane bottle (6).

DANGER

Propane is an extremely flammable liquid and vapor. Vapor may cause flash fire. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation.

NOTE

Do not direct propane stream toward front of engine. If propane enters air scoop a false reading will be obtained.

4. See [Figure 4-108](#). Aim nozzle toward possible sources of leak such as fuel injectors and intake tract.
5. See [Figure 4-107](#). Push valve (4) to release propane. Tone of engine will change when propane enters source of leak.



Figure 4-108. Checking for Intake Leak

REMOVAL

1. Remove intake cover assembly. [2.35 INTAKE COVER ASSEMBLY](#).

NOTE

For 1200 motorcycles please see [7.6 INTERACTIVE EXHAUST SYSTEM \(XB12S\)](#).

2. See [Figure 4-109](#). Remove fuel vent tube (3) from fuel cell vent (4) and groove on top of airbox cover (2).
3. Unlatch six lock tabs (1) and remove airbox cover from baseplate.
4. Remove the filter element from baseplate. Inspect and replace if necessary.
5. See [Figure 4-111](#). Remove air cleaner base plate.
 - a. Remove four fasteners (1) and raise baseplate (4).
 - b. Disconnect longer breather hose from base plate (pull out from bottom).
 - c. Disconnect shorter breather hose from PVC valve located on top of rear cylinder.
 - d. Disconnect IAT sensor [89] from bottom of baseplate.
 - e. Lift baseplate off of frame, carefully disengaging baseplate from rubber sealing ring (8) on velocity stack (7).
 - f. Remove baseplate from motorcycle.

INSPECTION

1. Inspect air cleaner. Check for dirt, torn filter material and general condition. Replace if necessary.
2. Inspect inside of backing plate and cover. Remove any dirt or debris.
3. Inspect condition of velocity stack and velocity stack sealing ring. If torn or damaged, replace.
4. Inspect IAT sensor and replace if faulty. See [4.36 INTAKE AIR TEMPERATURE SENSOR](#)
5. Inspect breather hoses, intake air temperature sensor grommet and baseplate gasket (3). Replace as necessary.

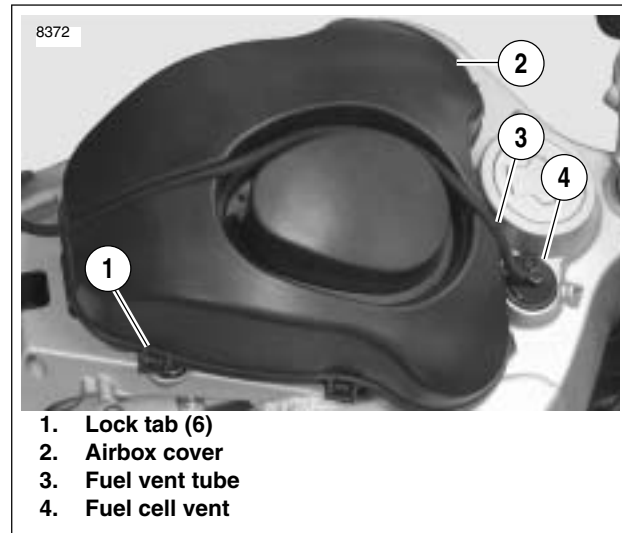


Figure 4-109. Airbox Cover (XB9S)

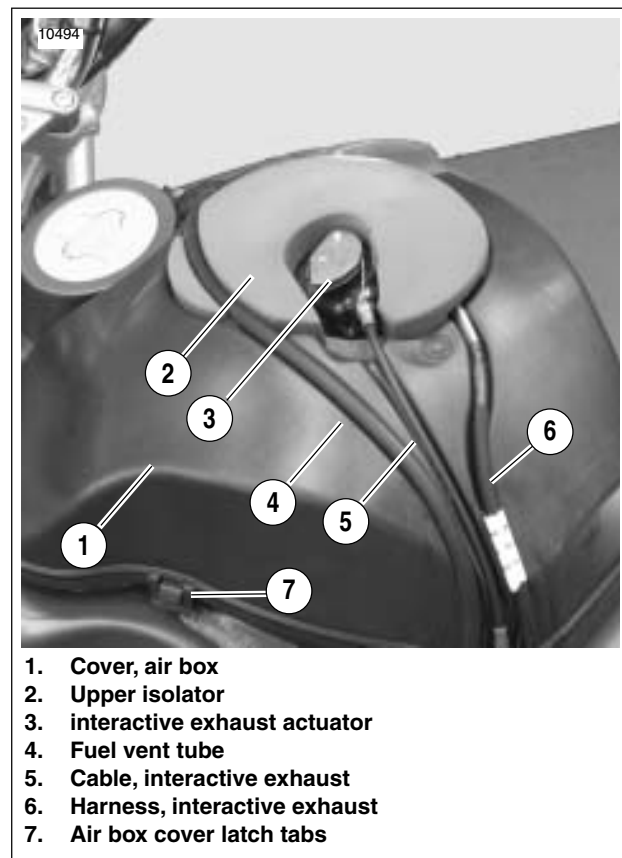


Figure 1-110. Air box cover, Fuel Vent Tube and Fuel Vapor Valve (XB12 Models)

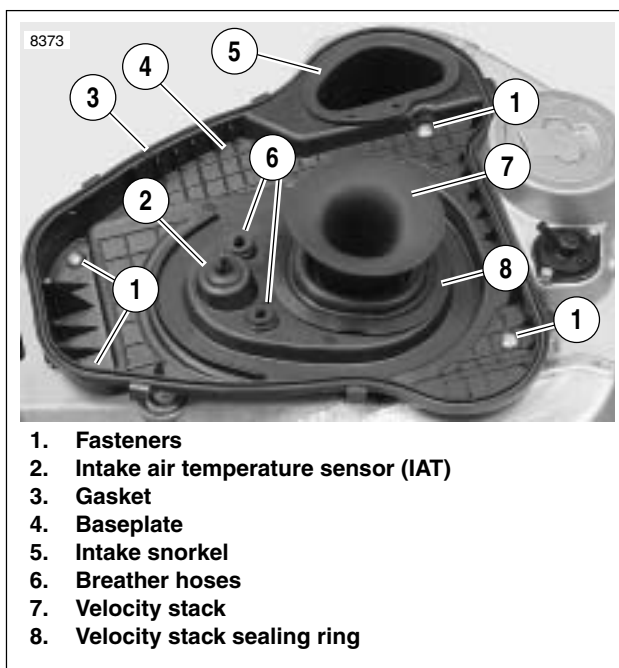


Figure 4-111. Base Plate (All Models)

INSTALLATION

1. See [Figure 4-112](#). Hold base plate above mounting position.
2. Insert IAT sensor into grommet on baseplate from underside.

NOTE

A small amount of soapy water applied to the inside diameter of grommet will make breather hose installation easier.

CAUTION

In next step, be sure breather hoses do not extend past Intake air temperature sensor tower. If hoses extend past tower, damage to sensor may occur.

3. Insert longer breather hose into right baseplate grommet from underside.
4. Attach shorter breather hose onto crankcase breather located on top of rear cylinder.
5. Carefully lower baseplate into mounting position. Ensure rubber sealing ring on velocity stack completely engages baseplate. Baseplate should be sandwiched between upper and lower rubber sealing rings.

6. Install baseplate to frame with four fasteners and washers (5). Tighten fasteners to 84-120 **in-lbs** (9.5-13.6 Nm).
7. Position air cleaner filter on baseplate.
8. Install airbox to base plate and latch six latches to secure.
9. Route vent hose through groove on airbox to vent valve.

NOTE

For XB12S model see [7.6 INTERACTIVE EXHAUST SYSTEM \(XB12S\)](#).

10. Install intake cover assembly. See [2.35 INTAKE COVER ASSEMBLY](#).

WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift during vehicle operation and startle the rider, causing loss of control which could result in death or serious injury. (70)

11. Install seat. See [2.41 SEAT](#).

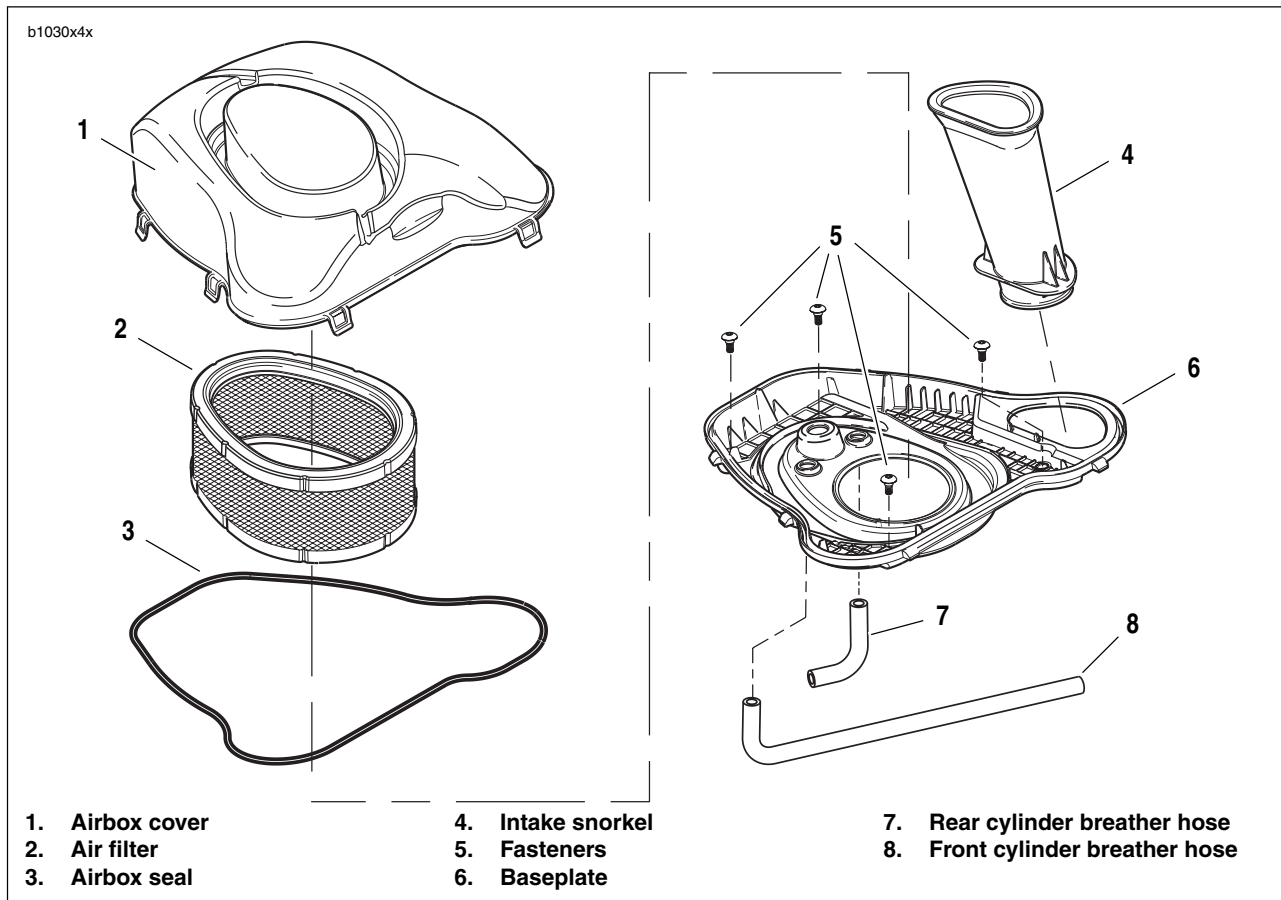


Figure 4-112. Airbox (Typical XB9S)

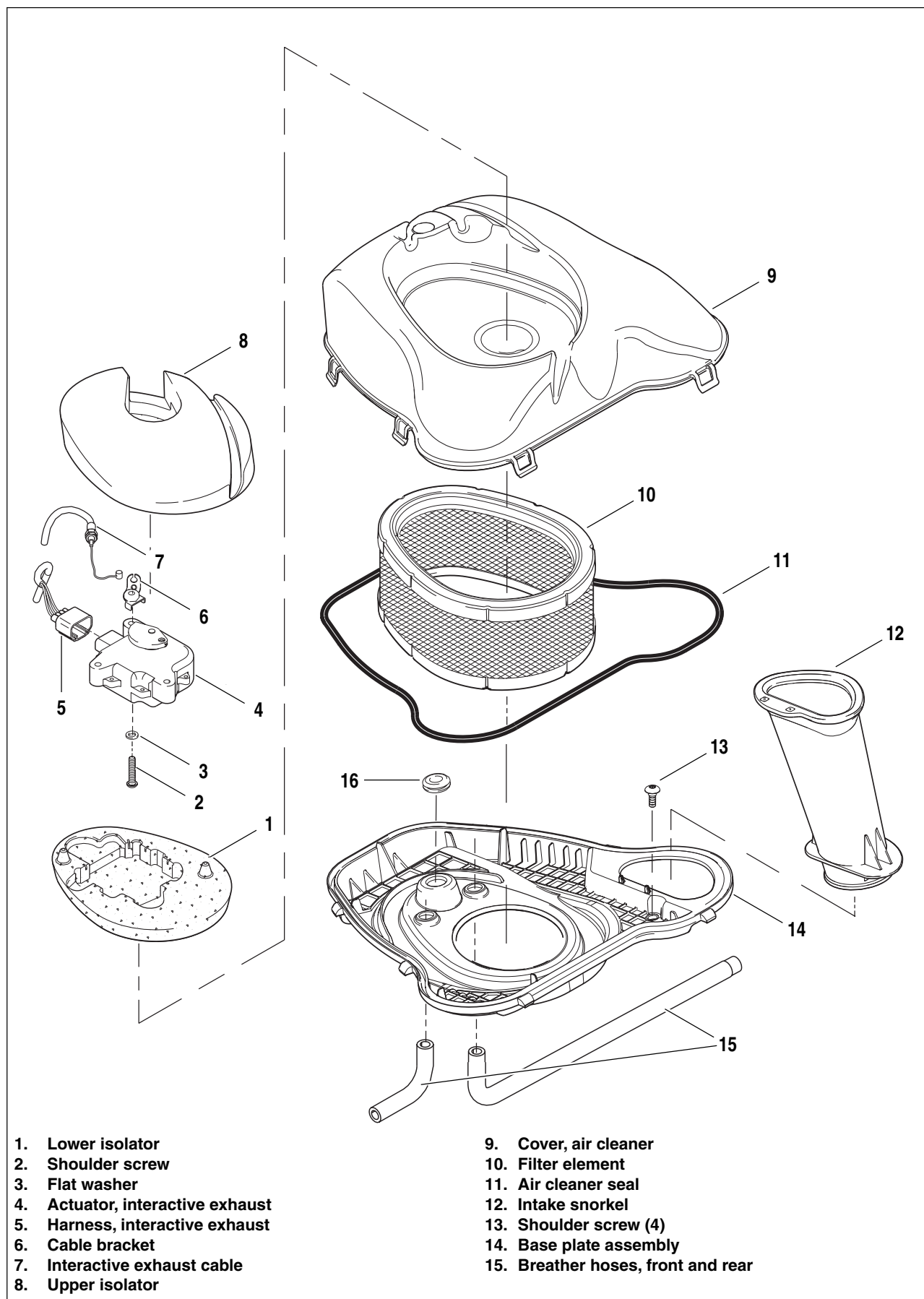


Figure 4-113. Air Cleaner Assembly (XB12) with Interactive Exhaust Components

GENERAL

Buell motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. The EVAP system prevents fuel hydrocarbon vapors from escaping into the atmosphere and is designed to meet the California Air Resource Board (CARB) regulations in effect at the time of manufacture.

The EVAP functions in the following manner:

- Hydrocarbon vapors in the fuel tank are directed through the vent valve and stored in the carbon canister. If the vehicle is tipped at an abnormal angle, the vent valve closes to prevent liquid gasoline from leaking out of the fuel tank through the fuel tank vent hose.
- When the engine is running, manifold venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the carbon canister through the canister vent hose. These vapors pass through the throttle body manifold and are burned as part of normal combustion in the engine.

TROUBLESHOOTING

WARNING

Verify that the evaporative emissions system hoses do not contact hot exhaust or engine parts. The hoses contain flammable vapors that can be ignited if damaged, which could result in death or serious injury.

The system has been designed to operate with a minimum of maintenance. Check that all hoses are properly routed and connected and are not pinched or kinked.

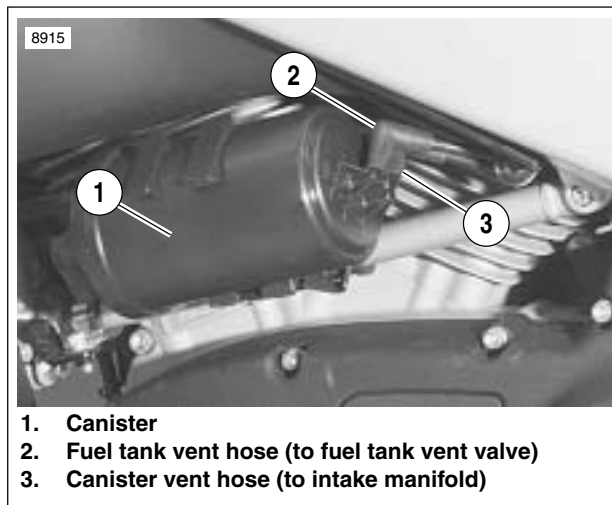


Figure 4-114. Carbon Canister Installation.

REMOVAL

Vent Valve

1. Remove vent valve. See [4.40 FUEL TANK VENT VALVE](#).
2. If necessary, label fuel tank vent hose at canister fitting and remove.

Canister

1. See [Figure 4-114](#). Label and disconnect the fuel tank vent hose (2) and canister vent hose (3) from the canister.
2. Slide canister towards rear of vehicle to disengage from mounting plate.

INSTALLATION

Vent Valve

⚠ WARNING

Verify that the fuel tank vent hose does not contact hot exhaust or engine parts. The hose contains flammable vapors that can be ignited if damaged, which could result in death or serious injury.

NOTE

For 1200 motorcycles please see [7.6 INTERACTIVE EXHAUST SYSTEM \(XB12S\)](#).

1. Install vent valve. See [4.40 FUEL TANK VENT VALVE](#).
2. See [Figure 4-114](#). Attach fuel tank vent hose (2) to canister if disconnected.

Canister

NOTE

In next step, be sure canister hose barbs are facing rear of vehicle at approximately the 1 o'clock position.

1. See [Figure 4-116](#). Slide canister into position on canister mounting plate and push towards front of vehicle.

⚠ WARNING

Always make sure fuel hoses are seated against the component they connect to and that hose clamps are properly tightened and positioned on straight section of fitting and not on the fitting barb. Failure to comply may result in fuel leakage which could result in death or serious injury.

NOTE

The barb is the larger outside diameter portion (bump) on the fuel fitting.

2. See [Figure 4-114](#). Connect two hoses to the canister. Make sure to push hoses all the way on to carbon canister fittings.

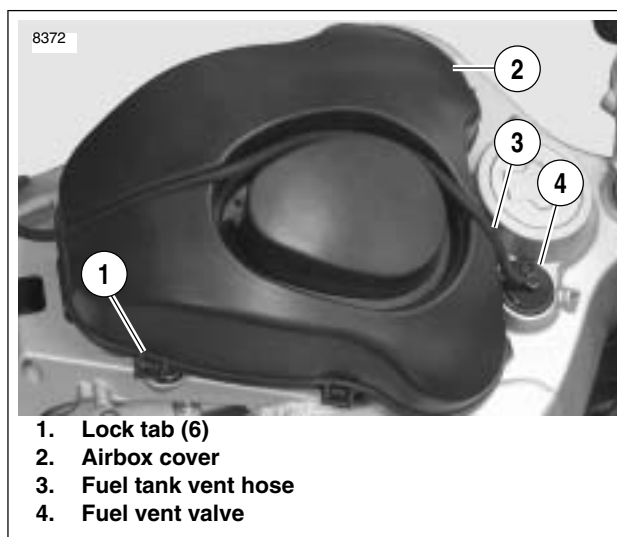


Figure 4-115. Airbox Cover (Typical XB9S)

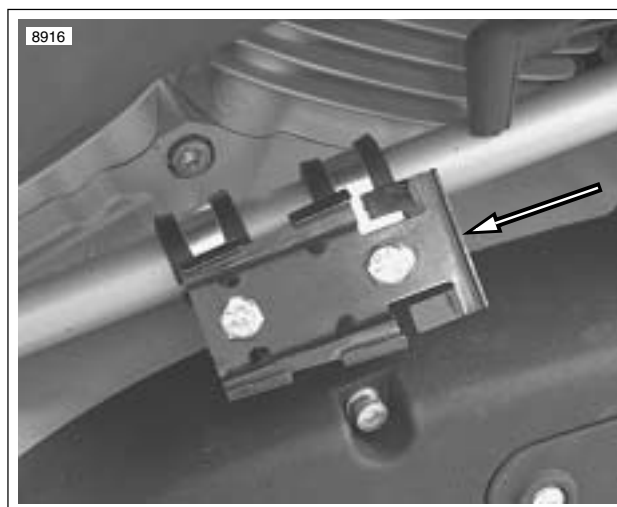


Figure 4-116. Canister Mounting Bracket

HOSE ROUTING

Both fuel tank and canister vent hoses are routed through notch in fan body.

NOTE

For information on vent hose routing, see [HOSE AND WIRE ROUTING](#).

⚠ WARNING

Always make sure fuel hoses are seated against the component they connect to and that hose clamps are properly tightened and positioned on straight section of fitting and not on the fitting barb. Failure to comply may result in fuel leakage which could result in death or serious injury.

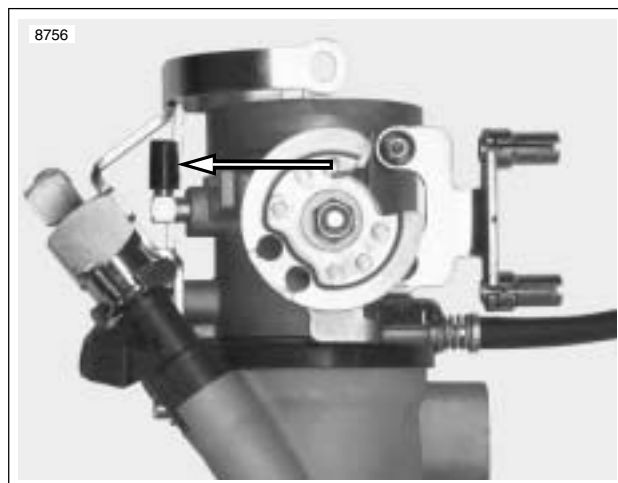


Figure 4-117. Emissions Hose Attachment, California Models Only