**FUEL SYSTEM** 

ETV mille USA \_\_\_\_\_



**FUEL SYSTEM** 



# **FUEL SYSTEM**

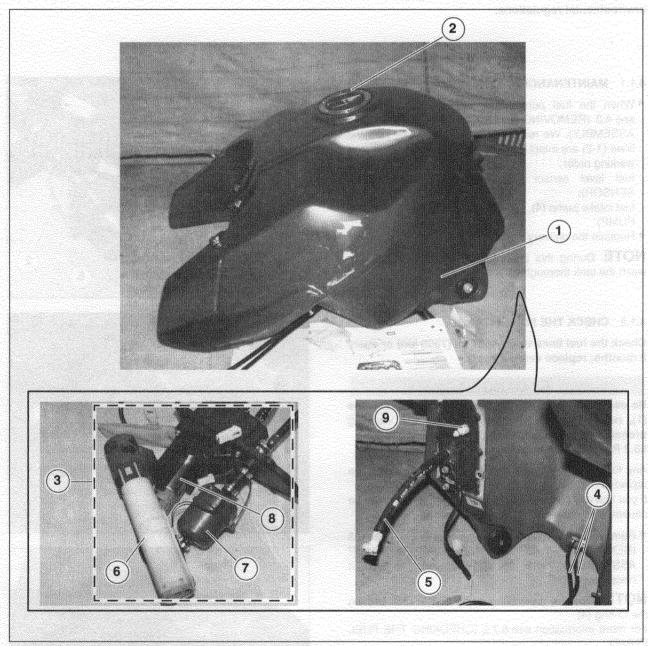
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#### 4.1 FUEL TANK

The refueling cap is at the top of the tank, while the following are installed at the bottom:

- The fuel pump unit;
- ◆ The water drain tube, which drains away any water accidentally introduced into the fuel line from rain or while washing;
- ◆ The overflow drain, which accommodates overflow gasoline in the event of overfilling.



### Legend

- 1) Fuel tank
- 2) Filling cap
- 3) Fuel intake pump unit
- 4) Drainage lines
- 5) Fuel return line

- 6) Fuel sensor
- 7) Fuel delivery filter
- 8) Fuel pump
- 9) Fuel delivery line



Carefully read 1.3.9 (PRECAUTIONS AND GENERAL INFORMATION), and 1.4.1 (FUEL).

#### **A** DANGER

Gasoline fumes are harmful to your health.

Before proceeding, make sure that the work area has adequate air circulation.

Do not inhale the fuel fumes.

Avoid skin contact with the gasoline.

Do not smoke or use open flames.

Always dispose of fuel in compliance with environmental regulations.

### 4.1.1 MAINTENANCE

- When the fuel pump assembly is to be removed, see 4.3 (REMOVING THE COMPLETE FUEL PUMP ASSEMBLY). We recommend that you make sure the lines (1-2) are intact, and that the following are in good working order:
- fuel level sensor (3) see 6.10.5 (FUEL LEVEL SENSOR);
- fuel intake pump (4), see 6.7.2 (CHECKING THE FUEL PUMP).
- Replace the delivery filter (5).

NOTE During this procedure, it is also advisable to wash the tank thoroughly.

### 4.1.2 CHECK THE FUEL INTAKE

Check the fuel lines every 4687 mi (7500 km) or every 8 months; replace every 4 years.

### **A** DANGER

Be especially thorough in checking the delivery line (1), return line (2), and their fittings; the working pressure of the delivery line (1) is approximately 65.2 PSI (450 kPa) (4.5 bar).

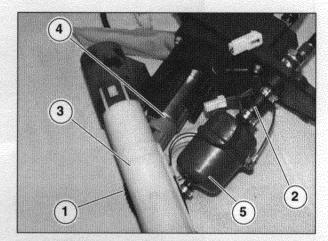
Any fuel lines that are cracked or split must always be replaced.

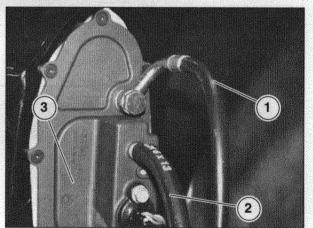
If you find any fuel leaks from the flange (3), they may be caused by a damaged O-ring (4), therefore:

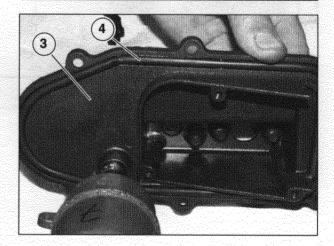
 Remove the complete pump assembly, see 4.3 (REMOVING THE COMPLETE FUEL PUMP ASSEMBLY); check its condition and replace if necessary.

NOTE When reassembling apply LOCTITE® 518 on the O-ring (4).

For more information see 6.7.2 (CHECKING THE FUEL PUMP).









#### 4.2 DRAINING FUEL FROM THE TANK

To drain the fuel tank, see 2.8 (DRAINING FUEL FROM THE TANK).

### 4.3 REMOVING THE COMPLETE FUEL PUMP **ASSEMBLY**

Read carefully 1.3.9 (PRECAUTIONS AND GENERAL INFORMATION), 1.4.1 (FUEL) and (MAINTENANCE).

- · Completely empty the fuel tank, see the first eleven steps described in the paragraph 2.8 (DRAINING FUEL FROM THE TANK).
- Unscrew and remove the six screws (1).
- Unscrew the screw (2).
- Turn the fitting (3) of the fuel delivery line.
- Unscrew and remove the screw (4).

NOTE When reassembling, screw all the screws by hand and cross-tighten.

Tightening torque for screws (1-4): 4.42 lbft (6 Nm).

Tightening torque for screw (2): 7.38 lbft (10 Nm).

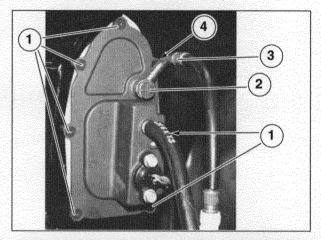
### **A WARNING**

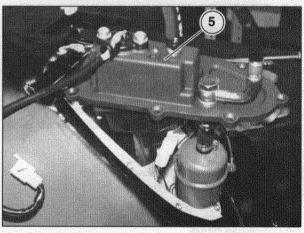
When reassembling apply LOCTITE® 518 on the thread of the screws (1-4).

When reassembling apply LOCTITE® 243 on the thread of the screw (2).

When removing the pump assembly (5), be careful not to damage the lines and the fuel level sensor.

Remove the complete pump assembly (5).







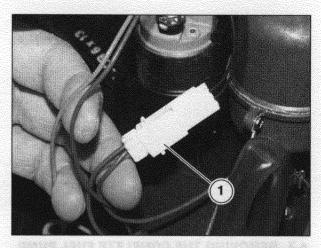
#### 4.4 REMOVING THE FUEL LEVEL SENSOR

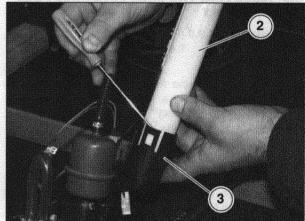
- Remove the complete fuel intake pump unit, see 4.3 (REMOVING THE COMPLETE FUEL PUMP ASSEMBLY).
- Disconnect the electrical connector (1).

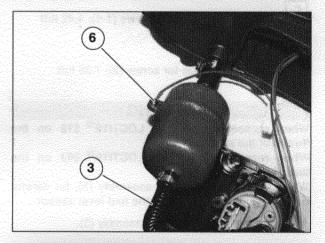
# **A WARNING**

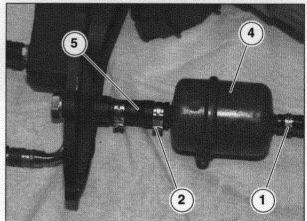
When reassembling, make sure the electrical connector (1) is fitted properly.

• Use a screwdriver to help you remove the fuel level sensor (2) from the support (3).









# 4.5 REMOVING THE FUEL DELIVERY FILTER

- Remove the complete fuel intake pump unit, see 4.3 (REMOVING THE COMPLETE FUEL PUMP ASSEMBLY).
- Unscrew and remove the screw (6) to free the grounding cable.

NOTE Use the special click clamp installation pliers (code 0277295); during reassembly, replace each clamp with a new one of the same kind.

- Release the click clamp (1-2).
- Slide the hose (3) off the filter (4).
- Slide the filter (4) off the hose (5).

# **A WARNING**

Do not re-use filters.

• Replace the filter (4) with another of the same kind.



#### 4.6 REMOVING THE FUEL INTAKE PUMP

- Remove the complete fuel intake pump unit, see 4.3 (REMOVING THE COMPLETE FUEL PUMP ASSEMBLY).
- Disconnect the electrical connector (1).

### **A WARNING**

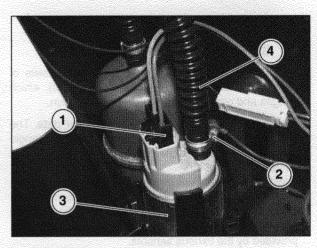
When reassembling, make sure the electrical connector (1) is fitted properly.

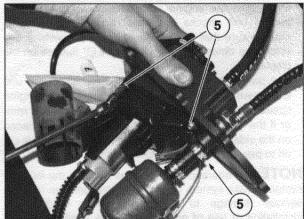
NOTE Use the special click clamp installation pliers (code 0277295); during reassembly, replace each clamp with a new one of the same kind.

- \* Release the click clamp (2).
- Slide the fuel hose (4) from the pump (3).
- Unscrew and remove the three screws (5).

# **WARNING**

When performing the operations listed below, take care not to stretch or twist the electrical wires.





• Remove the snap ring (6) from the filter element (7).

### A WARNING

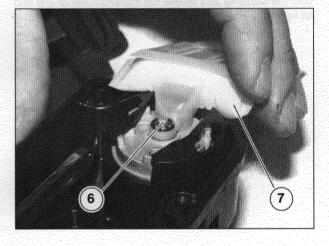
When reassembling, replace the snap ring (6) with a new one of the same kind.

• Remove the filtering mesh (7).

### **A** WARNING

If the filter element (7) shows traces of sediment, clean it with a blast of compressed air.

◆ Use a screwdriver to help you slide the fuel pump (3) out from the opposite side.





#### **4.7 ENGINE MANAGEMENT**

#### 4.7.1 GENERAL INFORMATION

The "heart" of engine management system consists of the electronic control unit (Engine Control Unit), which manages and optimizes ignition and fuel injection.

- ◆ Ignition is managed based on specific user data. The electronic control unit detects the exact ignition angle from the engine rpm signals and position of the throttle valves (volume of air).
- ◆ Injection time (amount of fuel) is controlled by engine speed, the throttle valve position (which in turn controls the volume of air used by the engine and the manifold pressure) and is corrected by various correction factors provided by the various sensors.
- Every time the engine is switched on, the electronic control unit checks the sensors and ignition coils, making sure that they are functioning properly. If any errors are detected, the message "EFI" flashes on the display.
- ◆ The safety devices inside the electronic control unit shut down both ignition and fuel injection if the engine speed exceeds the maximum allowable of 10,500 rpm, or if the vehicle falls over. When the vehicle is placed on the side stand and the gears engaged, ignition is cut off to prevent the vehicle from starting.

**NOTE** Any alterations or changes made to the exhaust system, intake system or engine control unit can result in serious damage to the engine. Any modification, installation or use of non-original parts shall completely void the warranty and relieve the manufacturer of any and all liability.



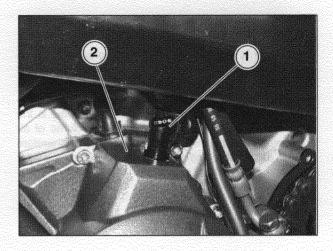
#### 4.7.2 SENSORS

Pick-up flywheel (1) Location: in the flywheel cover (2).

This is a sensor that detects the movement of the selected phonic wheel on the crankshaft. The selected wheel has a unique pulse length, triple the distance/ clearance, to act as a reference point on the wheel. Using this reference point it is possible to calculate the crankshaft position.

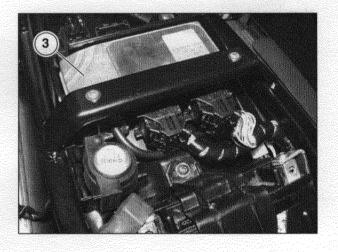
In a four-stroke engine, this alone is not enough information about the reference point to allow us to determine whether a cylinder near top dead center (TDC) is in the intake or exhaust stage. To obtain this information, it is necessary to obtain further details about the position by applying a strategy of varying the engine speed.

The information about the engine position is used to determine the engine speed, and for any activities that must be synchronized with the crankshaft rotation, such as fuel injection.



# Atmospheric pressure sensor Location: inside the electronic control unit (3).

This sensor is connected to the air gap via a via a small hose. It is a piezoelectric sensor that measures the absolute air pressure. The measurement point is located to greately limit changes in pressure caused by engine induction processes. The nominal pressure within the air gap corresponds to the atmospheric pressure. The air gap pressure is used to compensate for load density changes in the fuel system.



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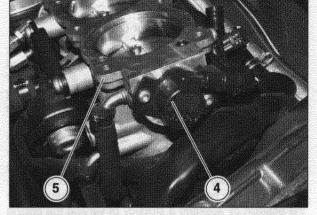
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### Throttle Location: sensor (4) Location: on the throttle body (5).

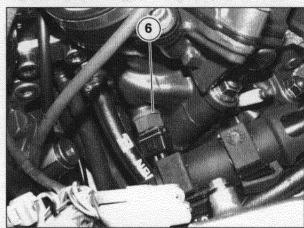
This sensor is a potentiometer, and for greater precision its location: is determined by comparing the output voltage with the input voltage (rated 5 V).

Once the throttle is open, the output voltage from the sensor increases in a linear fashion. The throttle is the main driving control, which regulates the volume of air admitted to the engine. The throttle angle is therefore used to assess the load and determine whether the rider wishes to accelerate or decelerate.



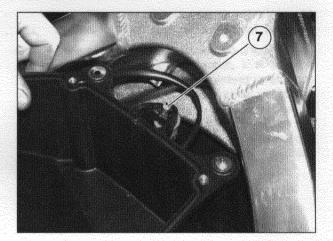
#### Engine temperature sensor (6)

The engine temperature sensor is a thermistor with a negative temperature coefficient. This means that its resistance decreases as the temperature increases. This sensor is positioned to provide a precise indication of the engine running temperature. The EMS compensates for the various engine operating properties within different engine temperature ranges. For example, a cold engine will need a different amount of fuel for start-up compared to a warm engine.



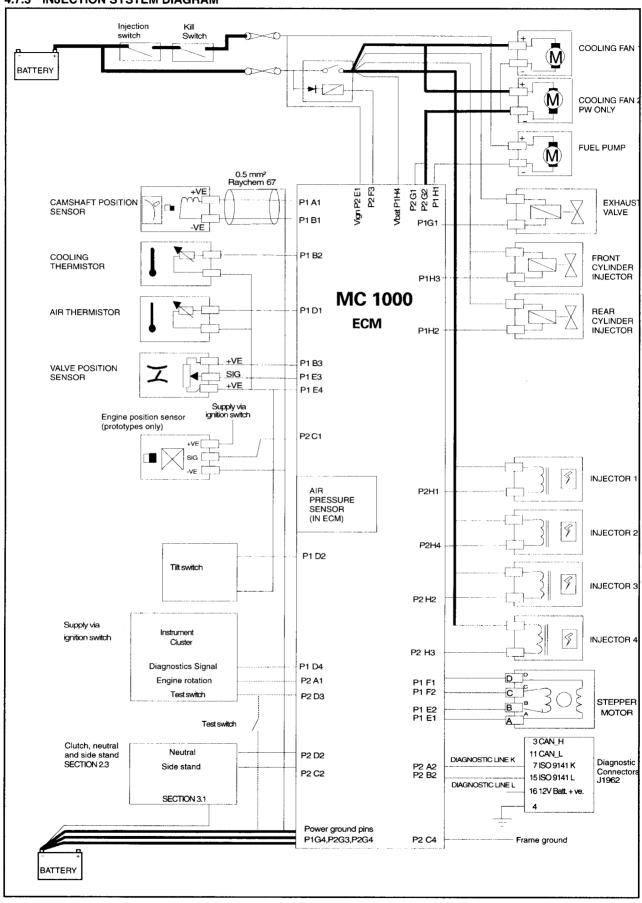
### Air temperature sensor Location: in the air filter box (7).

Air temperature affects the density of the incoming air, thereby altering the actual load on the engine and thus the amount of fuel needed. Compensation is necessary to limit the risk of explosion caused by air high temperatures.





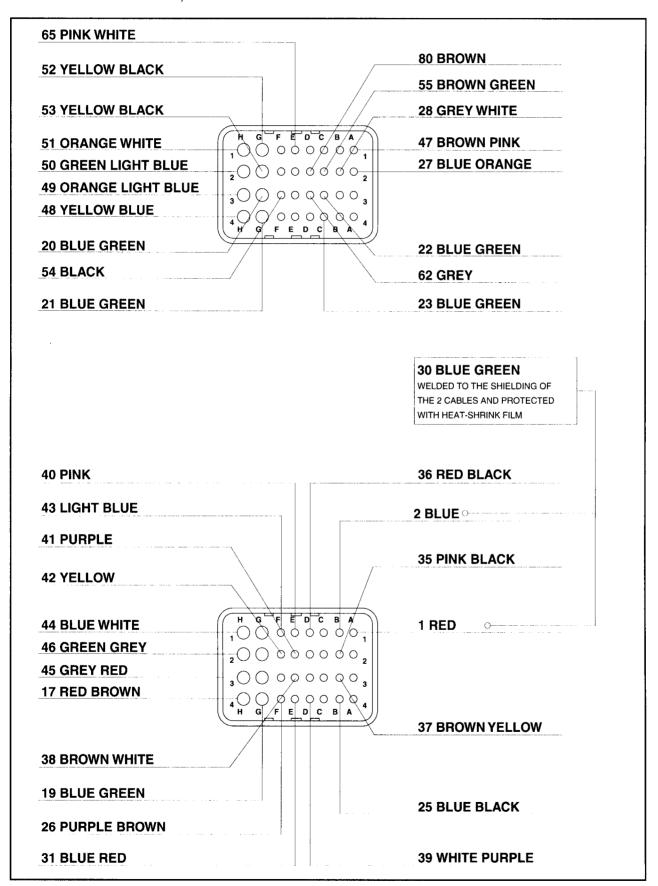
#### 4.7.3 INJECTION SYSTEM DIAGRAM





#### 4.7.4 ELECTRONIC CONTROL UNIT

For more information, see 6.6 (CONNECTIONS TO THE ELECTRONIC CONTROL UNIT).





#### 4.7.5 AUTOMATIC TESTING

See 6.5 (IGNITION/INJECTION SYSTEM).

### 4.7.6 TROUBLESHOOTING IN THE ELECTRONIC SYSTEM USING DISPLAYED INFORMATION

# A DANGER

Take care around the high voltage in the ignition system.

Never disconnect the connections with the engine running. Whenever working on the ignition system, unless otherwise indicated, always leave the ignition switch set to "S" and the battery disconnected (when disconnecting the battery, disconnect the negative pole "-" first).

# **▲** WARNING

All measurements should be taken with components at a temperature of 20°C (68°F).

General troubleshooting instructions: as soon as you have identified the fault, remove the defective component.

◆ If the "EFI" LED comes on while the vehicle is running, it means the control unit has detected a fault.

#### **FAULT CODE TABLE:**

Code	Description of fault
12	crankshaft location: sensor (pick-up) malfunction
15	throttle location: sensor (TPS) malfunction
18	CALIFORNIA ONLY
21	engine temperature sensor malfunction
22	air temperature sensor malfunction
23	barometric pressure sensor malfunction
33	coil 1 malfunction
34	coil 2 malfunction
35	coil 3 malfunction
36	coil 4 malfunction
41	fall sensor signal malfunction
42	injector 1 malfunction
43	injector 2 malfunction



#### 4.8 THROTTLE BODY

### **A WARNING**

The lever mechanism on the throttle body may not be adjusted nor replaced. In case of malfunction, replace the complete throttle body, see 4.8.1 (REMOVING THE THROTTLE BODY).

The two screws M4x12 (1) attaching the throttle valve potentiometer to the throttle body are painted, and may be removed only when replacing the sensor itself.



### 4.8.1 REMOVING THE THROTTLE BODY

Carefully read 1.3.9 (PRECAUTIONS AND GENERAL INFORMATION).

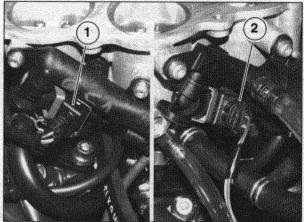
- Partially remove the fuel tank, see 7.1.4 (REMOVING THE FUEL TANK).
- ◆ Remove the air filter case, see 7.1.6 (REMOVING THE AIR FILTER CASE).
- Disconnect the electrical connectors:
- right injector (1);
- left injector (2);
- throttle valve potentiometer (3).

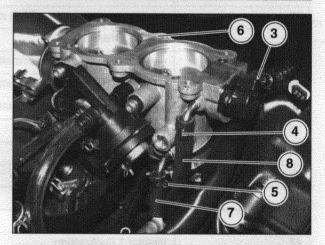
# **A WARNING**

When reassembling, make sure the electrical connectors are properly inserted.

NOTE Use the special click clamp installation pliers (code 0277295); during reassembly, replace each clamp with a new one of the same kind.

- Release the click clamps (4-5).
- ◆ Pull the lines (7-8) from the throttle body (6).

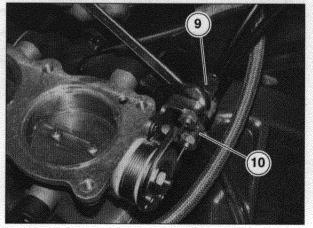




• Disconnect the two throttle cables (9-10).

### **A WARNING**

When reassembling make sure that the two throttle cable adjusters are properly fastened to their respective couplings; check and, where necessary, the correct clearance, (ADJUSTING THE THROTTLE CONTROL).





- Move the clamp (15)
- Remove the pressure regulator hose (11).
- Loosen the two clamps (14-13).

#### **A** WARNING

Before removing the throttle body, you must thoroughly clean the two intake flanges, to prevent foreign matter from entering the cylinders.

- Firmly grasp the throttle body (6), and gradually wiggle it back and forth while pulling upward, until you are able to slide it off the inlet manifolds.
- Place the complete throttle body (6) on a clean surface.
- Plug the inlet manifolds to prevent foreign matter from entering the cylinders.

### **A** WARNING

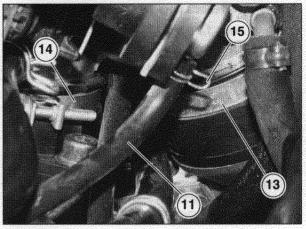
**During reassembly:** 

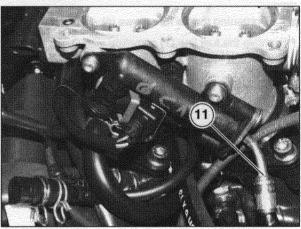
- the fuel delivery line (12) must not be twisted, or placed where it is likely to be squashed by other components; it must be replaced if found to be damaged or deteriorated;
- the fuel delivery line (12) must be placed so that it arrives on the right-hand side of the throttle body (6), passing under the body between the two intake flanges;
- the throttle body (6) must be fitted perfectly on the intake flanges;
- the clamps (14-13) must be properly tightened.

When replacing the throttle body (6), you must align the throttle valve location: sensor, see 4.10.6 (ALIGNING THE THROTTLE VALVE LOCATION SENSOR).

### 4.8.2 REMOVING THE INJECTORS

See 4.8.1 (REMOVING THE THROTTLE BODY).
To check, see 6.6.1 (CHECKING THE INJECTORS).



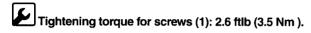




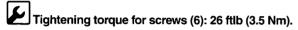
#### 4.9 DISASSEMBLING THE THROTTLE BODY

Carefully read 1.3.9 (PRECAUTIONS AND GENERAL INFORMATION).

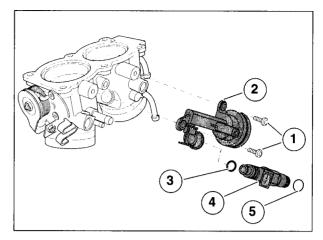
- ◆ Empty all fuel from the tank, see 2.8 (DRAINING FUEL FROM THE TANK).
- ◆ Remove the complete throttle body, see 4.8.1 (REMOVING THE THROTTLE BODY).
- Unscrew and remove the two screws (1).

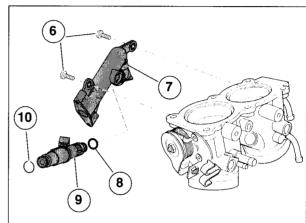


- ◆ Remove the fuel pressure regulator (2) complete with O-ring (3), left injector (4) and O-ring (5).
- ◆ Unscrew and remove the two screws (6).

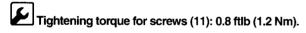


◆ Remove the fuel line (7) complete with O-ring (8), right injector (9), and O-ring (10).





Unscrew and remove the two screws (11).

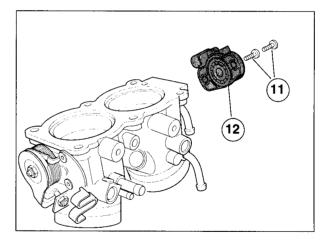


◆ Remove the potentiometer (12).

NOTE Replace all sealing gaskets during reassembly. These components are supplied in the repair kit.

# **A WARNING**

The lever mechanism of the throttle body cannot be disassembled or adjusted. If you encounter any problems, replace the entire throttle body, see 4.8.1 (REMOVING THE THROTTLE BODY).





#### 4.10 INSPECTING THE THROTTLE BODY

#### 4.10.1 TESTING THE INJECTORS

### **A** DANGER

Gasoline is extremely flammable and becomes explosive under certain conditions.

KEEP GASOLINE AWAY FROM CHILDREN.

NOTE The injectors may be tested even when mounted.

Check the following components:

- electrical cables and connections:
- injector or injection signal of the electronic control unit, see 6.5 (IGNITION/INJECTION SYSTEM).

Checking injector resistance: See 6.6.1 (CHECKING THE INJECTORS).

#### 4.10.2 THROTTLE BODY

### **A WARNING**

Use only neutral cleansers. Use only proprietary gasket removers, degreasers or cleansers that do not require heating.

 Clean all openings and passages in the throttle body with compressed air.

# 4.10.3 THROTTLE VALVE POTENTIOMETER

# **A WARNING**

The two HS screws fastening the throttle valve potentiometer (1) are painted over during the manufacturing process, and cannot be loosened. The throttle valve potentiometer may be adjusted only when being replaced.

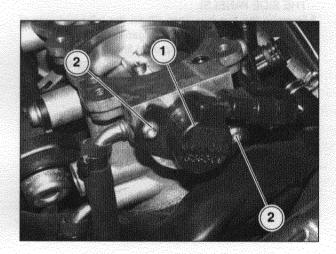
• Place the throttle valve location: sensor (1) horizontally on the throttle valve shaft and turn it downward.

NOTE Apply LOCTITE® 243 on the thread of the screws (2).

◆ Tighten the two hex screws M4x12 (2).

Tightening torque for screws (2): 2.58 lbft (3.5 Nm).

 Align the throttle valve location sensor (1), see 4.10.6 (ALIGNING THE THROTTLE VALVE LOCATION SENSOR).



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#### 4.10.4 SYNCHRONIZING THE CYLINDERS

Carefully read 1.3.9 (PRECAUTIONS AND GENERAL INFORMATION), and 1.4.1 (FUEL).

The cylinders need to be synchronized when the engine no longer idles smoothly. The cylinders must be synchronized before adjusting the CO, see 4.10.5 (ADJUSTING THE CO).

· Ride a few miles until the engine reaches normal running temperature.

### **A WARNING**

The cylinders must be synchronized when the engine is warm:

- coolant temperature 80-100 °C (176-212 °F);
- ambient temperature 20-30 °C (68-86 °F).

NOTE Have any special tools or ready.

digital vacuum gauge (1).

### **A** DANGER

Gasoline fumes are harmful to your health.

Before proceeding, make sure that the work area has adequate air circulation.

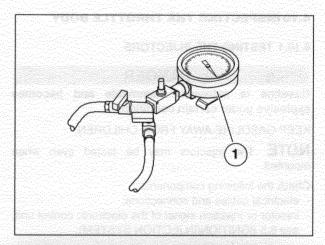
Do not inhale the fuel fumes.

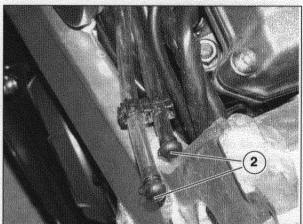
Avoid skin contact with the gasoline.

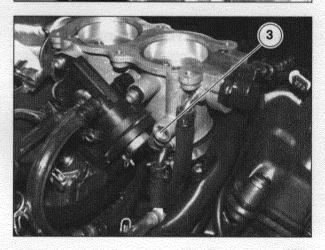
Do not smoke or use open flames.

Always dispose of fuel in compliance with environmental regulations.

- Remove the left side panel, see 7.1.3 (REMOVING THE SIDE PANELS).
- \* Remove the two free lines (2) on the left-hand side of the motorcycle, under the side panel.
- Unplug the two free transparent lines (2) and connect them to the vacuum gauge lines (1), using two 6-mm diameter fittings..
- · Completely close the two by-pass screws (3) on the throttle body.
- The instrument LED should be brought to the center of the screen, on the zero line, by adjusting one of the bypass screws (3). The other will remain completely closed.









#### 4.10.5 ADJUSTING THE CO

 Remove the radiator spoiler, see 7.1.26 (REMOVING) THE RADIATOR SPOILER).

#### **A WARNING**

The CO must be adjusted when the engine is warm.

◆ Coolant temperature 75-90 °C (167-194 °F).

**NOTE** Have the following special tools or ready:

- exhaust gas analyzer (1) (code 8140196);
- tubing kit for exhaust gas analyzer (2) (code 8140202).
- Axone 2000 (5) (code 8140595).

### **A** DANGER

Gasoline fumes are harmful to your health.

Before proceeding, make sure that the work area has adequate air circulation.

Do not inhale the fuel fumes.

Avoid skin contact with the gasoline.

Do not smoke or use open flames.

Always dispose of fuel in compliance environmental regulations.

 Unscrew and remove the two plugs (3-4) from the front and rear exhaust pipes.

NOTE When reassembling apply LOCTITE® 8150 to the threads of plugs (3-4).

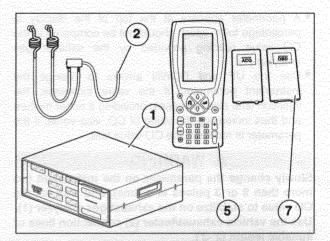
- Connect the tubing kit for exhaust gas analyzer (2):
- connect the two rigid tubes to the appropriate exhaust pipe outlets:
- connect the other tube to the exhaust gas analyzer (1).
- Make sure that the idle speed is 1250 ± 100 rpm. If not, adjust as needed, see 2.10.2 (ADJUSTING THE IDLE SPEED).
- Check the tester (1) for the CO values, which should match those indicated and be the same for both cylinders.

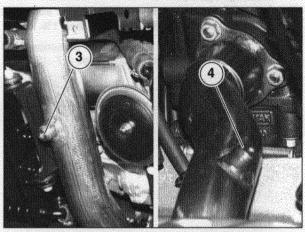
### CO values for both cylinders:

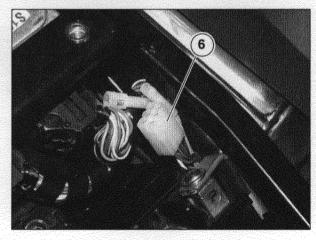
- 1.5 - 2% at 1250 ± 100 rpm.

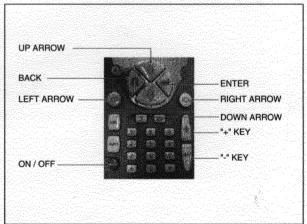
#### CO values for both cylinders ( :

- 1 1.5% at 1250 ± 100 rpm.
- Insert the "OBD" module (7) in the Axone 2000.
- Remove the passenger saddle, see 7.1.1 (LOCKING/ RELEASING THE PASSENGER SADDLE).
- Connect the Axone 2000 (5) via the connector (6) under the saddle, and power the Axone 2000 (5) using the vehicle battery.
- Start the procedure from the rear cylinder.
- Use the red on/off button to switch on the Axone 2000 (5).
- Select the Autotest icon on the display and press the enter key.
- The next screen shows a series of data regarding the various control unit parameters.
- ◆ Press the + or key, then use the UP and DOWN arrows to select the item "Idle fuelling adjustment", and press enter.











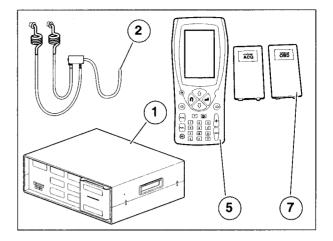
- ◆ A parameter appears at the top of the display in percentage form, which should not be compared to the CO value reading provided by the exhaust gas analyzer (1).
- ◆ Use the UP and DOWN arrows to change the instrument parameter: if the value increases, the injection time also increases, providing a richer mixture and thus increasing the value of CO; vice-versa, if the parameter is reduced, the CO value falls.

# **▲** WARNING

Slowly change the parameter on the instrument (no more than 2 or 3 pulses at a time), and wait for the CO value to stabilize on the exhaust gas analyzer (1). Use the vehicle exhaust/tester (2) connection lines of suitable length (2'-3').

Check the CO on both exhausts, and make sure that the maximum difference is no greater than 1%.

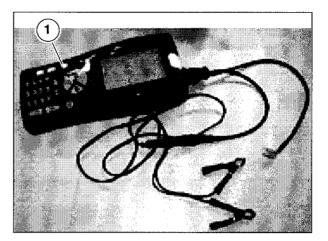
NOTE If you are unable to obtain the prescribed CO values, replace the spark plugs, see 2.7 (SPARK PLUGS).

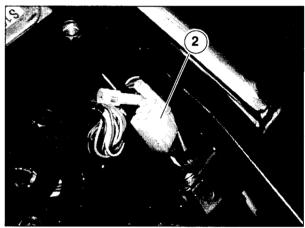


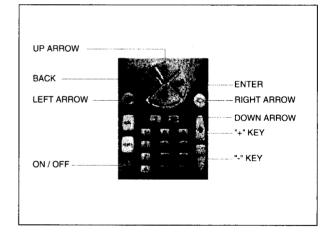


#### 4.10.6 ALIGNING THE THROTTLE VALVE LOCATION **SENSOR**

- ◆ Remove the passenger saddle, see 7.1.1 (LOCKING/ RELEASING THE PASSENGER SADDLE).
- ◆ Connect the Axone 2000 (1) via the connector (2) under the saddle, and power the Axone 2000 (1) using the vehicle battery.
- Start the vehicle.
- ◆ Use the red on/off button to switch on the Axone 2000
- Select the Autotest icon on the display and press the enter key.
- The next screen shows a series of data regarding the various control unit parameters.
- ◆ Press the "+" or "-" key, then use the UP and DOWN arrows to select the item "Closed Throttle Position", and press enter.
- ◆ A throttle valve alignment reference parameter appears at the top of the display; use the UP arrow to increase the value of the parameter until it stabilizes, at which point the control unit acknowledges a stable idle condition and enters the adaptive phase.
- Press the enter key and exit the procedure.







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