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The logo used from 1968 to 1973. The falcons body is placed centrally in the badge.

Electrical System

Charging and Ignition system

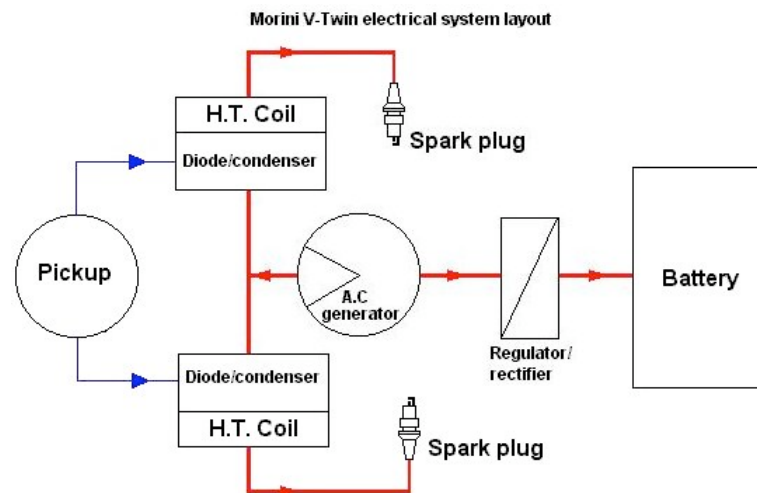
Operational and checking directions

The electrical system is divided into two separate parts: the charging circuit and the ignition circuit.

IGNITION CIRCUIT

The electronic (capacitor discharge type) ignition system layout can be seen below. The main components are:

1. Alternator flywheel magneto
2. Magnetic pickup
3. Transducer unit (one for each cylinder)



Operation

A winding fitted on the flywheel stator plate supplies the electrical current which charges the capacitor located inside the transducer. The capacitor acts as a tank which fills up with energy until an electrical signal sent by the magnetic pickup reaches it. (In this ignition system the pickup replaces the contact breaker points). The instant in which the signal is sent is properly phased with the crankpin position in order to achieve the correct ignition timing. When the signal reaches the diode (fitted inside the transducer), this becomes conductive.

The diode acts as a valve which quickly discharges all the energy accumulated in the capacitor onto the primary winding of the H.T. coil (located inside the transducer). This induces high voltage current in the secondary winding of the coil, which causes a spark to occur between the spark plug electrodes.

Each cylinder features an independent ignition circuit. Only the energy which charges the capacitors (supplied by the stator plate) is shared between the two circuits.

Charging System

The charging system is composed of:

1. Alternator flywheel magneto
2. Electronic regulator
3. Battery

Operation

The stator is provided with five charging coils which supply the current needed to re-charge the battery. The sixth coil fitted on the stator feeds current to the ignition system.

The A.C. current is rectified by the electronic rectifier-regulator and is supplied to the battery.

N.B. Ignition and charging systems share only the flywheel magnetic field, all the other components are completely separate.

TROUBLESHOOTING

An electric circuit tester (with a D.C 20 Amp scale) and a discharger (for 90V tension - Siemens-BI-C90 type) are needed to detect damaged parts of the charging system.

IGNITION

The engine is hard to start

1. Check the condition of the spark plugs
2. Check the spark length

To check the spark length, unscrew the spark plug cap from the H.T. lead. Hold the end of the H.T. lead (with insulated pliers) near to the end of the engine casing, or to a cooling fin. Crank the engine using the kick starter or electric starter and check that the spark jumps across a distance of at least 5mm. Should the distance be less than 5mm in one HT lead only, **the relevant transducer unit is faulty**. (The current which charges the capacitor and the electric signal from the magnetic pickup are supplied regularly).

Make sure the HT lead is not grounded on the frame (this may be caused by faulty insulation).

If both sparks are weak (spark length 2 ~ 3 mm) the causes may be:

- a. The electrical current supplied to the capacitor is insufficient
- b. Both transducer units are defective (this seems highly improbable)

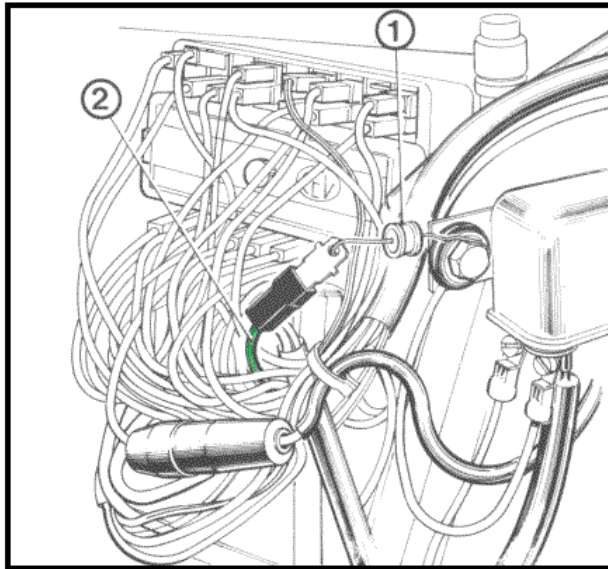
The energy deficiency can be caused by:

1. The flywheel magneto AC generator is defective due to a weakened magnetic field or to a short circuit in the windings of the stator (bear in mind the windings supply current to both transducers at the same time).
2. There is a current dispersion (due to faulty insulation or defective connections) along the green cable route from the AC generator to the transducer unit. Check cable insulation with care.

In order to determine if the flywheel or the various wires and connections are defective, proceed as follows:

Disconnect the GREEN lead which goes from the AC generator to the fuse box

Ground a post of the discharger and connect the other to the green lead (see below). Crank the engine by means of the kick or electric starter. If the discharger comes on there is a current loss along the green lead route. If the discharger remains off, it is necessary to check the flywheel.



1. Discharger

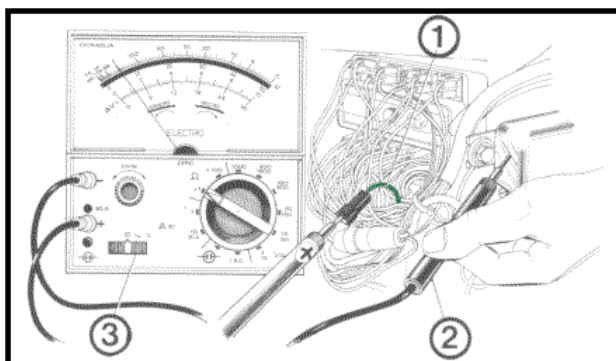
2. Green lead (from generator)

If the current supplied from the generator when the kickstarter pedal is operated is not sufficient to turn on the discharger, check if the flywheel is de-magnetised or if the stator coil is defective. Use the OHM scale (Ohm x 1 range) of the meter, connect a test prod to the green lead from the generator and ground the other.

The meter reading should be approx. 300 Ohms.

If the value obtained is very low or even zero, the stator must be renewed/rewound.

If the meter readings show that the stator is in good condition, the flywheel needs to be renewed or re-magnetised.



1. Green lead from generator

2. This prod grounded

3. Switch on Ohm scale

If, having checked all the connections of the green leads (which feed the transducers), the spark length is still insufficient, disconnect, from the fuse box, the green lead coming from the engine run/kill switch. It is possible there may be electrical loss due to oxidation in the switch. If, cranking the engine with this green lead disconnected, the sparks reach the specified length (about 5mm) the kill switch should be cleaned or renewed.

If, having checked the generator, the connections and the switch, the sparks are still short, the two transducers should be renewed.

Only one spark plug fires

Remove the spark plugs and detect which one is not reached by HT current. This can be due to a fault in the transducer or in the magnetic pickup.

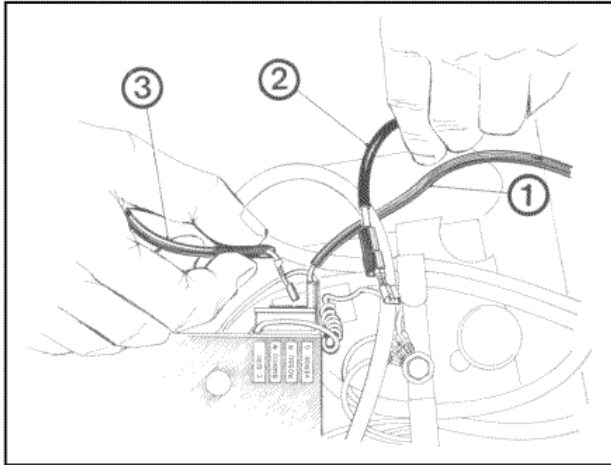
Disconnect the RED lead (coming from the pickup) from the transducer that does not supply HT current. Reverse the lead with that of the other cylinder. If the HT current is fed to the spark plug, the pickup is faulty. If the spark plug still does not fire, the relevant transducer should be renewed.

No current reaches the spark plugs

Make sure the engine kill switch is in the Run position. Disconnect the GREEN wire coming from the main switch. If no current is fed, check the connections of the wires which join stator, transducers and magnetic pickup.

After this brief check, if no current is supplied, it is necessary to detect which part of the circuit is faulty. Proceed as follows:

1. Make sure that current is supplied from the AC flywheel magneto to the transducers. Carry out the test with the discharger. If the discharger does not come on, check the AC flywheel magneto. If it comes on, connect the GREEN lead to the fuse box and proceed to the following test.
2. Disconnect the RED lead (coming from the pickup) from the transducer. Rapidly touch a small wire attached to the GREEN lead (which comes from the flywheel magneto) to the transducer terminal tab that the RED lead was connected to. This test should be carried out with the spark plugs removed from their seats and grounded on the cylinder heads, and cranking the engine with the kick or electric starter.



1. Green lead
2. Red lead
3. Wire connected to the green lead

If the spark plug connected to that transducer fires, the magnetic pickup should be renewed (in this test the pickup action is simulated).

If the spark plug does not fire the transducers should be renewed. In this case one of the two transducers may be faulty. In fact if the diode of one of the transducers is grounded, it absorbs all of the current supplied (bear in mind that the generator feeds both transducers at the same time)

To check this, detach the GREEN lead which supplies current to a transducer and perform with the other transducer the intermittent connection test. Repeat the test for both transducers.

If one of them produces a spark, the other should be renewed.

(It is highly improbable that both transducers are defective, even if this may occur)

When a fault is detected in the transducers, it is advisable to **thoroughly check that the system is properly grounded**. (carefully clean the connection of the transducer BLUE lead to the frame). Check the GREEN lead (which connects the generator to the transducers) for insulation. There should be no contact between the battery current and the GREEN lead current, check this carefully in the fuse box area and in the kill switch.

When, with the engine warm, only one cylinder fires and, letting the engine cool down both cylinders operate properly, the magnetic pickup is cracked and should be renewed.

CHARGING SYSTEM

When the battery self-discharge rate is high:

- 1) Inspect the battery condition
- 2) Check the charging system for proper operation

To check battery condition the following tests should be carried out:

1. Check the electrolyte level. With a hydrometer measure the specific gravity of the electrolyte. **The battery is fully charged when readings of more than 1.260 are obtained for all cells.**
2. Batteries with a transparent case should be visually examined for sulphated plates. Lead sulphate formation on the plates or white sediment on the bottom of each cell is caused by **an incorrect battery activation or by not charging in time a badly discharged battery.**

If sulphates are present only as deposits on the bottom of the cells, it is often possible to salvage the battery by slowly charging it - **for 25-30 hours**. If the plates are sulphated the battery should be replaced.

A clean sulphation line which parts one or more cells at a certain height means that the electrolyte was not kept at the correct level.

Fully discharged batteries, showing no sulphation traces, may at the beginning refuse to accept a charge; in this case go on charging them until they accept the charge (some days may be needed).

A fully discharged battery is easily detected by visual examination because the positive plates become grey or red-brown while in a charged battery the positive plates are dark-brown verging on black and the negatives are silver-grey.

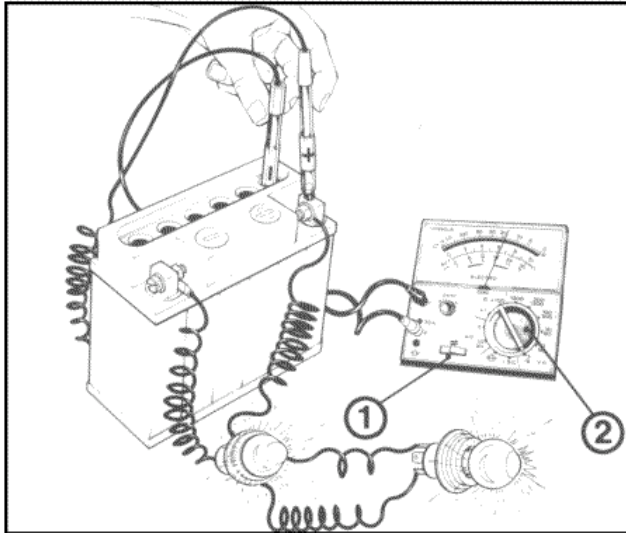
When the battery cannot be visually inspected, an **electrical test** should be carried out.

1. Charge the battery until some cells start to gas.
2. Connect two 40-50 W bulbs to the battery terminals in order to apply a load on the battery.

The normal test prods of the circuit tester should be replaced with two extensions made of solder and the plastic sheath of a ball point pen. These makeshift prods should be inserted into the cell filler holes until the tin tip is dipped in the electrolyte without touching the plates. The meter reading should be approx. 2 Volts for each cell pair.

Note Dip the tip of the negative makeshift prod into the electrolyte and connect the positive prod to the

positive terminal post of the battery. A meter reading of less than 1.5V is correct. The cell is defective only if the voltage is lower than 1V or if the pointer of the meter moves in the opposite direction. Bear in mind that in old batteries the cells do not age evenly. Often the battery develops defects only in one or two cells before it is completely unsuitable for any further operation.



1. DC setting
2. 3V scale

Checking charging system for proper operation

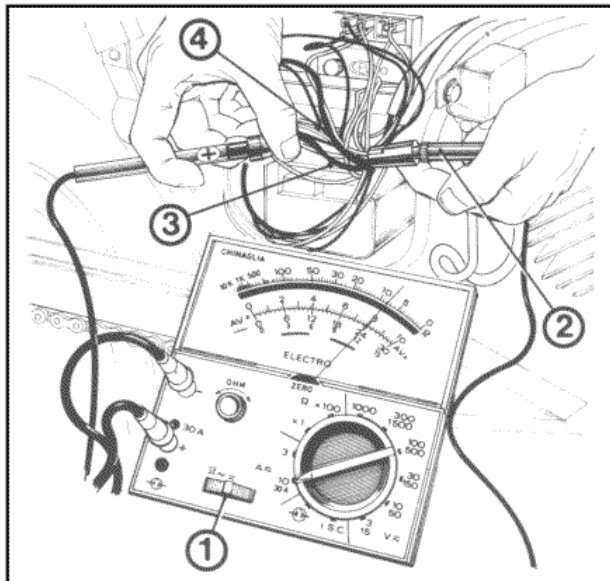
Make sure all the connections of the system are in good condition and properly insulated. Check charging current using the circuit tester (use the DC 10 Amp scale) or an ammeter for DC with a 10 Amp or higher scale.

The test should be performed connecting the meter in series to the RED lead which goes from the generator to the battery.

Check that when the engine is run at 6000 rpm the current output is approx 8 Amp.

At 2000 rpm the output should be approx 1.8 Amp (350 and 500 models)

If the meter reading is **definitely lower** than these figures, it is necessary to find out if the fault is in the **AC generator** or in the **regulator**.



1. DC setting
2. Negative test prod
3. Red lead to battery
4. Red lead from generator

Checking the AC generator

Disconnect from the regulator the three leads which come from the AC generator (Detach the RED and two YELLOW leads; the GREEN lead feeds the ignition circuit and can therefore be left connected to the regulator)

Use the circuit tester (**AC current - 150 V scale**) or a 70 V (or more) voltmeter. Measure the voltage between the ends of the two YELLOW leads; it should be approx 60 V. Measure the voltage between the RED and one of the YELLOW leads; it should be 30 V (Carry out this test with the engine running at 6000 rpm)

If the values obtained are low and one is half that of the other, the coils of the stator are in good condition but the magnetic field is weak. In this case the generator rotor should be re-magnetised or renewed. (When the rotor is de-magnetised it is difficult to start the engine)

If one of the two values obtained with this test is not half that of the other, and the two values are lower than normal values, the generator coils are defective. To understand this bear in mind that the coil circuit on the stator is of the push-pull type.(contra-phase)

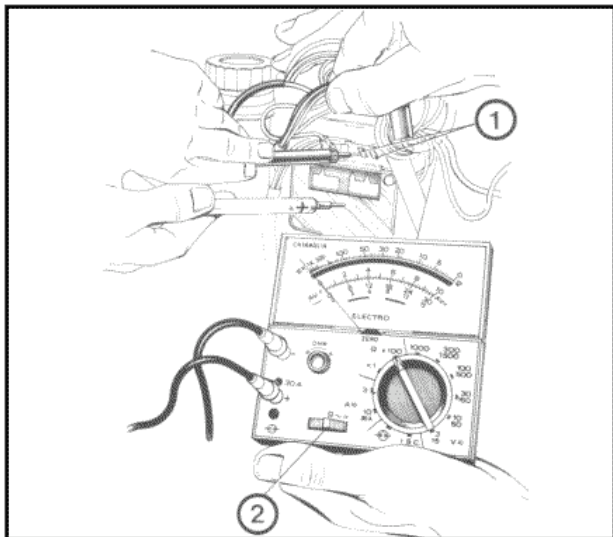
When the voltages , measured as described above, agree with the specified values, the generator is in good condition, but the regulator should be renewed.

If having removed the rotor, any stator coil burnt or coloured due to overheating (brown-bluish) can be seen, before renewing the generator assembly it is advisable to check the regulator. If a diode of the regulator is grounded, a part of the current of the battery reaches the stator plate, overheating the coil and de-magnetising the rotor. It is a good rule **to check or to renew** (as a precautionary measure) **the regulator**, to avoid the risk of damaging a new generator assembly.

Partially checking the regulator

Disconnect the regulator from the circuit. Use the Ohmic scale of the circuit tester (OHM x 100) and touch one of the test prods on the regulator body (Ground). Contacting the two connector tabs of the YELLOW leads, one after the other, with the other test prod, the pointer of the meter should not move.

(Make sure that the battery of the circuit tester is charged) If the pointer moves the regulator should be renewed.



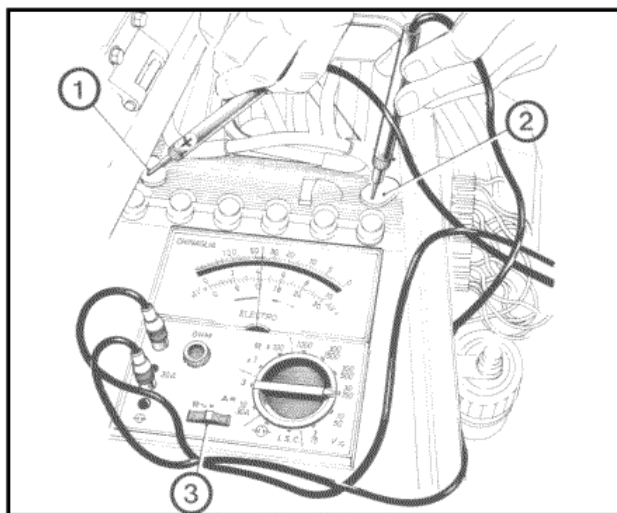
1. Yellow lead tabs
2. Ohm scale position

Final regulator check

Connect the three leads (RED and two YELLOW wires) to the regulator. Check that the battery is partially or fully charged (the electromagnetic fuel tap should click). Start the engine revving it to over 4000 rpm and connect the circuit tester to the battery terminal posts (Use the 30V DC scale).

Make sure the **voltage settles to 14 ~ 14.8 Volts after a few minutes.**

In motorcycles with a 6 V electrical system, the voltage should settle to 7 ~ 7.4 Volts (With higher voltages the battery will overheat and the electrolyte boils)



1. Positive battery post
2. Negative battery post
3. Switch in DC position

NOTE - If the battery is almost completely discharged, it is advisable to replace it with a charged one or to ride the bike for several kilometers with the lights off in order to re-charge the battery. This should be done to avoid extending the test with the consequent risk of overheating the engine.

When the voltage is higher than normal, acid is likely to spill from the battery. The regulator should be renewed.

Acid comes out from the battery

If this occurs when riding the bike mainly in town, there is 80% probability that the fault is in the battery and 20% that it is in the regulator (battery case is cracked)

If the acid comes out only when long distances are covered, there is a 90% probability that the regulator is faulty and 10% that the battery is defective.

When the voltage exceeds 14.8 V the regulator should be renewed.

Testing the input of the lighting system and of other electrical systems of the motorcycle

Use the 10 amp DC scale of the circuit tester. Disconnect the positive cable from the battery. Connect the positive test prod to the positive battery terminal and the other test prod to the cable previously detached.

With the main switch off **there should be no current flow**. Otherwise the electric circuit is defective due to faulty insulation or an incorrect connection.

When the main switch is on, only the electromagnetic fuel tap should click.

The circuit tester should read 0.5 amps

When the lights are on (high beam) with the engine not operating, the meter readings should be as shown in the table below.

When these values are obtained the input of the electrical devices is correct.

Getting a new battery ready for service

This operation is of utmost importance because it has a great influence on the life and the efficiency of the battery. Proceed as follows:

1. Fill the battery to the upper level with the correct type of electrolyte (solution of water and sulphuric acid)
2. Let the battery rest for at least 4 hours
3. Charge the battery adjusting the current flow to no more than 1/10 of the capacity of the battery (i.e. a 10 Ah battery should be charged with a current of no more than 1 Amp). The battery should be charged for at least 6 hours and in any case until all the cells are gassing freely.
4. Add electrolyte, if necessary, to bring the level up to the proper height (this should be done only when getting a new battery ready for service)
5. If the battery is of the dry charged type it can be used immediately after step 2 but only if it is put into service within 48 hours, and if journeys of no less than 100Kms will be made (in which case the generator will be able to fully charge the battery). It will be necessary to carry out the operation described in step 4) within a week.

NOTE If these directions are not followed the battery will be damaged by sulphation or in any case its efficiency will be low.

Having performed the operation described in step 4) the following topping ups should be made using only **distilled water**

REV COUNTER

The electronic rev counter operates by counting the discharge pulses of the capacitor. The pulses reach the meter by means of the GREY wire (terminal tab marked 1).

The energy needed to operate the electronic circuit and the pointer of the rev counter is supplied from the battery through the main switch, on the tab marked + (RED wire)

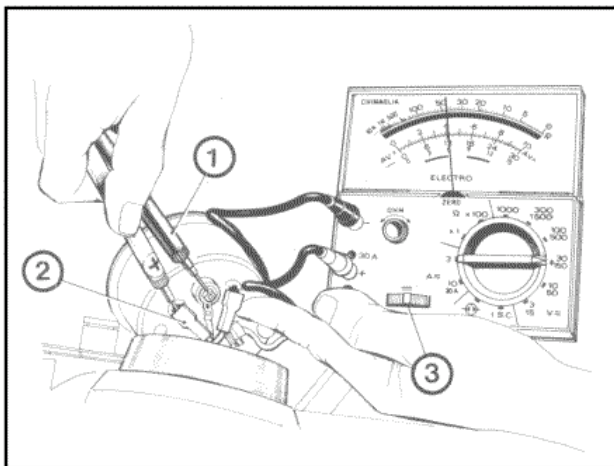
Troubleshooting

Not all of the faults or the operation troubles are caused by a defective meter; some of them are caused by faults in the electrical system of the motorcycle.

Refer to the following directions in order to determine the causes of the rev counter faulty operation.

The rev counter does not operate (the pointer does not move). This can be caused by faults in the motorcycle or in the meter. Check various connections.

- a) check that the rev counter and the electrical systems of the motorcycle are correctly grounded.
- b) Check the connections between rev counter and transducer; Check that the current reaches the positive terminal tab of the instrument (main switch on).
- c) To carry out this check with the circuit tester or with a voltmeter make sure that the voltage between the RED wire connected to the instrument and the ground is at least 12 Volts (It is not necessary to disconnect the wires from the instrument; use the voltmeter test prods). If the voltage is less than 11 Volts, check the charge of the battery and then make sure that the connections between the battery and rev counter are in good condition, particularly the main switch. To check main switch operation detach the BLUE wire (ground) from the main switch, which in this way will be disconnected from the frame. If the rev-counter operation is then correct, the main switch should be renewed



1. Test prod connected to ground of instrument
2. Red wire
3. Switch in DC position

If having performed these checks the instrument does not operate, it should be renewed.

The pointer sometimes goes back to zero or in any case flutters and when this occurs it reads less than the real engine speed. This case is a sign that there is a faulty connection (mainly with the earth - tighten the ground screw on the instrument) or that there is a fault in the location of the connectors that supply the pulse (GREY wire). Note that the connection should be made with the transducer of the REAR cylinder.

The instrument reads, when the pointer begins to flutter, more than the real engine speed (this happens mainly at high engine speeds). This can be caused by the following:

- a) The AC generator rotor is de-magnetised. (in fact when this occurs the pulse which controls the instrument weakens and therefore the integrated circuit in the meter cannot operate properly)

b) Mechanical fault of the instrument. Remove the rev-counter from its rubber housing and check its operation when it is held in your hand (in this way the instrument is totally insulated from the vibrations of the motorcycle). If the pointer operates correctly, the rev-counter should be installed in a more elastic manner (check the condition of the rubber bracket). Otherwise the instrument should be renewed because the mechanical damper is defective.

This defect may also be due to disturbances coming from the leads or from the transducers by radio waves. It is necessary to make sure that there is the WHITE connecting lead (bridge) between the transducers.

Model	Regulator Voltage Check	Electrical devices input check	Re-charge efficiency check
	Check performed with half charged battery, lights off, high engine speed.	Check performed with half charged battery, high beam on, engine off.	The check is performed observing the balance between generator output and high beam input.
125	7 - 7.4 V	4.5 - 5.0 A	2750 - 3000 rpm
250	7 - 7.4 V	5.7 - 6.2 A	2300 - 2600 rpm
350 - Electric starter - 1st series, 3 magnet flywheel	14 - 14.8 V	3.6 - 4.4 A small bulbs	2800 - 3200 rpm
500 - 1st series, 3 magnet flywheel	14 - 14.8 V	4.8 - 5.3 A small bulbs	3400 - 3700 rpm
350 - Electric starter - 2nd series, 6 magnet flywheel	14 - 14.8 V	4.5 - 5.0 A normal bulbs	2200 - 2400 rpm
500 - 2nd series, 6 magnet flywheel	14 - 14.8 V	4.8 - 5.2 A normal bulbs	1500 - 1800 rpm

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