THREE PHASE RECHARGING SYSTEM DIAGNOSIS

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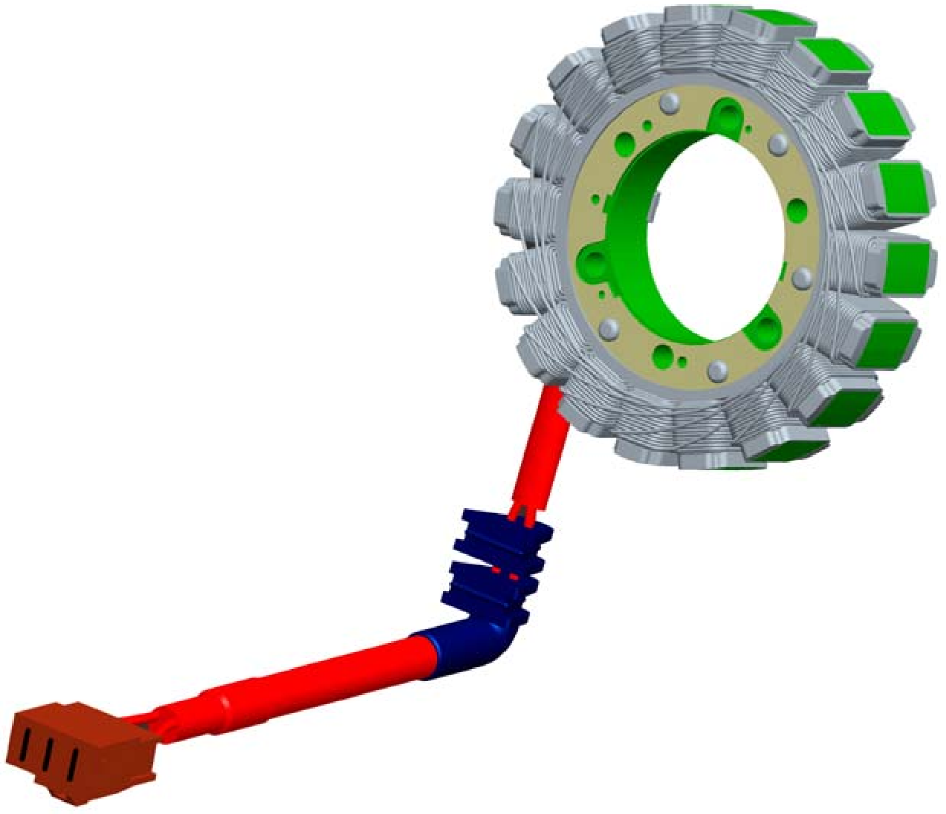


1. FOREWORD

With this document it is our intention to offer you an operational guide for diagnosing the three-phase recharging systems used in our product range.

The following two types of functional faults can occur on the recharging systems:

- excessive recharge. - partial or no recharge.

As far as the issues concerning excessive recharging are concerned (frequent lamp burning, excessive water consumption of traditional batteries, warning lamp switching-on due to high voltage) check the regulation voltage straight away, as specified at the end of the document.

As far as the faults concerning partial or no recharge are concerned, a diagnosis is usually necessary when the user has difficulty starting due to a reduced start-up speed.

The recharging system is involved in maintaining the optimal battery charge although it is not the only element since the way the vehicle is used (reduced kilometres travelled, halt in idle conditions and high number of start-ups) as well as self discharging are important negative variables.

With reference to these aspects concerning the vehicle's energy balance, it is important to ensure correct idle speed in particular for the carburettor versions where the system does not set speed by default.

For the vehicle used at idle speed for a long time, speed close to the maximum enable range is preferable (1650÷1700 rpm for 2V engines and 1800÷1850 rpm for 4V engines).

If battery and recharging system functional checks are needed, it is advisable to begin with the static checks when the vehicle is cold.

2. BATTERY VOLTAGE

Check battery voltage using a digital multimeter.

The "rested" (15 min.) battery no-load voltage analysis can give useful information but it does not ensure good battery performance.

- - Voltage ≥ 12.8V: The battery was charged completely not long ago.
- - Voltage 12.5÷12.7V: The battery is normally charged.
- - Voltage 11.5÷12.4V: The battery is more or less discharged and therefore has to be recharged.
- - Voltage ≤11.4V: The battery is completely flat and could be damaged.

Maintenance free recombination batteries must not be allowed to remain completely discharged for a long time otherwise they will be irreversibly damaged.

For further details on actual battery performance it is advisable to use dedicated instruments which give information about battery capacity in relation to the internal resistance analysis.

If non-optimal charge levels are detected on a potentially good battery, check the recharging system as follows.

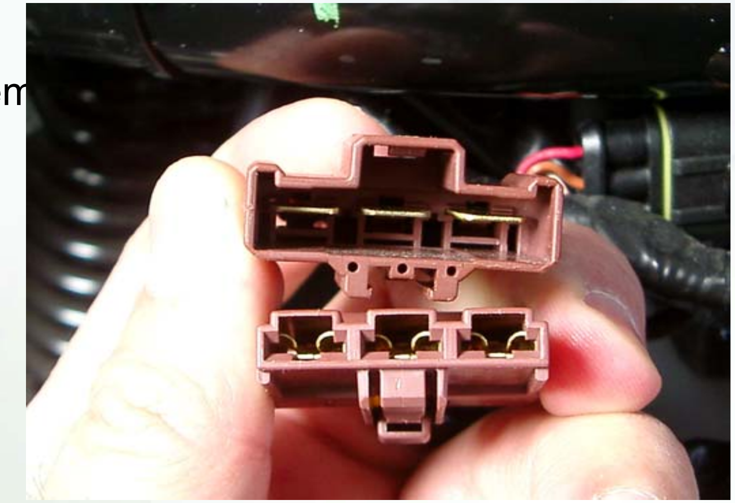
3. RECHARGING SYSTEM CONNECTIONS

First check that the recharging system connectors are correctly plugged in (stator-regulator or stator-vehicle system or vehicle system regulator).

For this check try separating the connections without operating the retention devices.

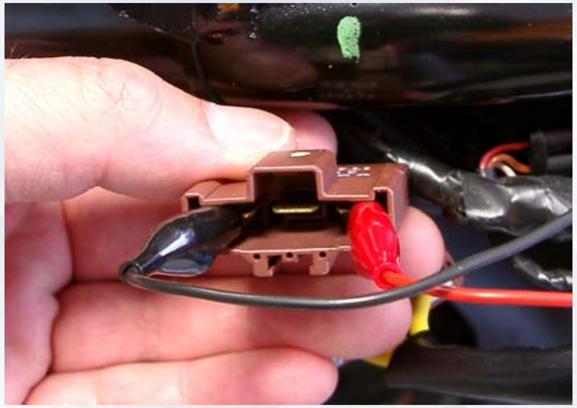
Also check that the cable terminals are plugged right into the connectors (up to the retention/stop point).

If no faults are detected, disconnect the recharging system connections and check that there is no overheating, oxidation or uncertain connections.

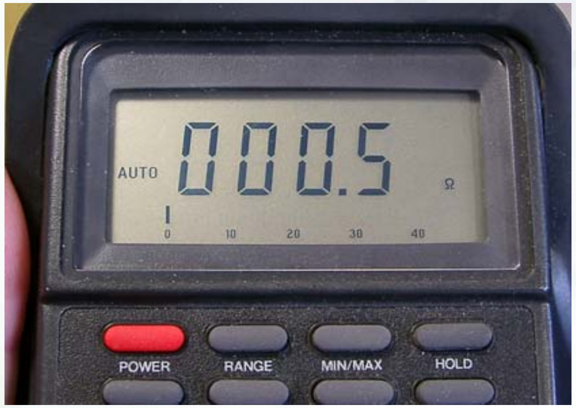


4. STATOR THREE PHASE CONTINUITY

Check continuity/resistance between each one of the three stator phases and the other two individually using a multimeter.

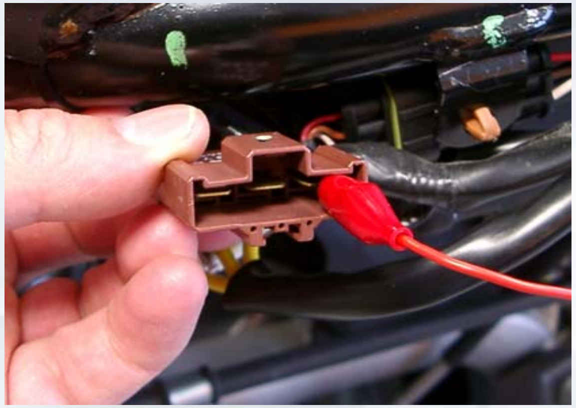


Where necessary, repeat the check also including the regulator connector connecting system.
Check that all measurements give the same resistance values and they are no less than 1ohm.
If one phase is open or higher resistance values are measured, check/replace the stator.



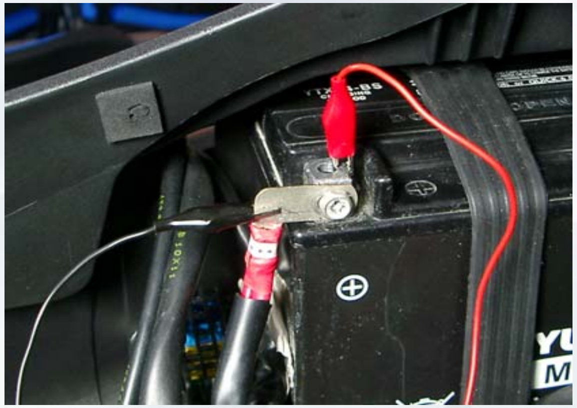
It is important to point out that the symptom of a phase interruption in Quasar iniezione, Master, 850 engines is an increase in resistance and not a lack of continuity.

5. ALTERNATOR PHASE INSULATION

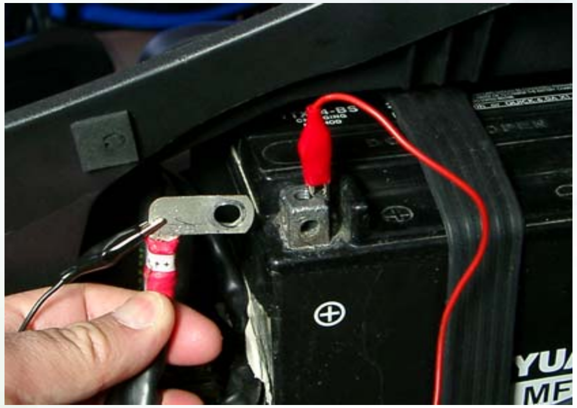


Check ground insulation for each phase using a multimeter (R≥1MΩ).
If the stator and its wiring continuity correspond, there could be a phase short-circuit towards ground which is detectable on the three phases.
If a short-circuit towards ground is detected, repair the wiring or replace the stator.

6. CHECKING ABSORPTION WITH THE SWITCH OFF



The battery might not be able to ensure good autonomy due to anomalous absorptions during the halt.
Use a multimeter with milliammeter function to check residual system absorption.
Set the multimeter with the alligator clamps instead of traditional probes and select the 40 mA scale for direct current (DC).
With the battery normally connected to the system, connect the alligator clamps to a battery pole and to the corresponding wiring terminal.
With the ignition key OFF and the electric loads inhibited (helmet compartment light, compartment-open warning light, etc.), remove the fixing screw and disconnect the terminal from the battery pole to obtain the milliammeter in series to the system load condition.



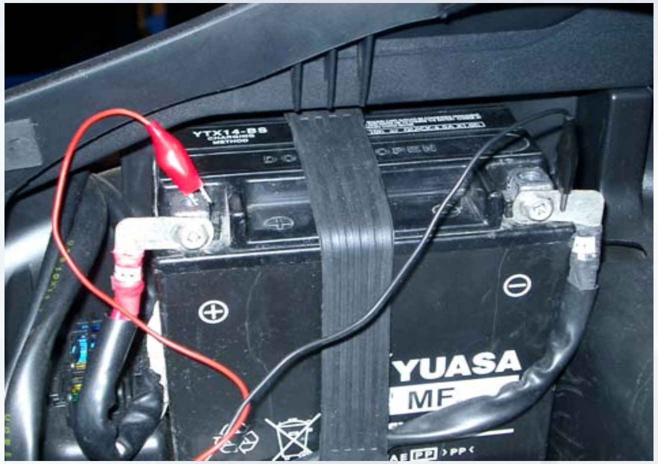
In the versions with immobilizer, the load pulses according to the flashing deterrent light frequency.
Values ranging between 2mA with the LED OFF and 15mA with the LED ON are to be considered as normal.

If considerably higher absorptions are detected, the direct battery power supply users must be progressively disconnected until the component, wiring section or water infiltrations, if any, are detected in the connectors which could lead to abnormal absorption.
In any case it is important to make sure that if the saddle is closed the helmet compartment light turns off before the saddle comes into contact with the lock.

7. BATTERY VOLTAGE ERRORS

In the vehicle with EFI Technology ignition with self-diagnosis or with an ignition system, it is advisable to check whether there are battery voltage errors.
The errors can be in the "Current" status but they are more likely to be in the "Stored" status, hence with the warning lamp OFF.
If the error is “Battery voltage higher than specified”, replace the voltage regulator.

If the static checks have not detected any faults, proceed with the dynamic checks.



8. PRELIMINARY RECHARGING SYSTEM CHECK

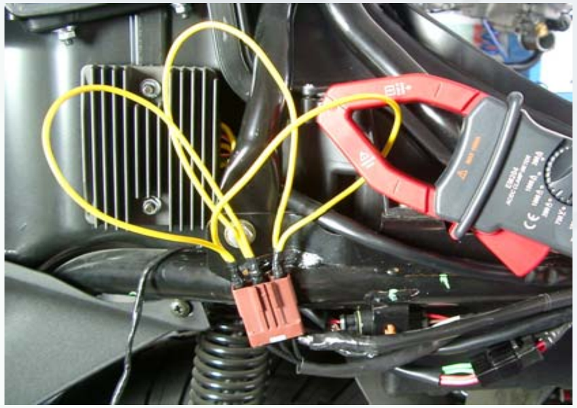
Recharge efficiency can be briefly checked by connecting the multimeter with voltmeter function to the battery poles.
Take note of battery voltage in the rest condition and then start the engine and accelerate progressively up to 3000 rpm.
If the recharging system is efficient, battery voltage increases progressively up to 13.5÷14.5V.

If battery voltage goes over 15V, replace the voltage regulator.
If the battery voltage is the same as the value measured in the rest condition and the previous checks (static) were successful, disconnect the voltage regulator and check that there is alternating voltage on the connector coming from the stator either with the engine at idle speed or at 3000 rpm.
With the engine at idle speed, the alternating voltages measured between each phase with the other two must be the same or similar (the difference must not exceed 20%).
Idle speed must be stable to obtain a reliable result.
If no voltage is measured between the phases, repeat the static checks on the stator.
If alternating voltages far below 10V are measured at idle speed, repeat the static checks on the stator and check efficiency of the magnetic flywheel rotor.
If alternating voltages higher than 10V are measured at idle speed, repeat the battery voltage check using a new voltage regulator.
If the battery recharge voltage is lower than normal even with the new regulator, first replace the stator, then verify whether the three phase short-circuit current check confirms the stator fault.
To check, remove the voltage regulator connection and plug in three cables with their terminals.
Stators can be star or delta connected which is why short-circuit connection must be done in two different ways.

For Purejet, Leader and Quasar carburettor engine stators connection must be done with the three cables knotted together.

For Quasar injection, Master and 850 twin cylinder stators connection must be done with the three cables connected with terminals.
The connection is easily done using the cable assembly of an old regulator.

In all versions, after connecting, the engine must be started at idle speed and the single phase short-circuit alternating current (AC) must be measured using an amperometric induction clamp.

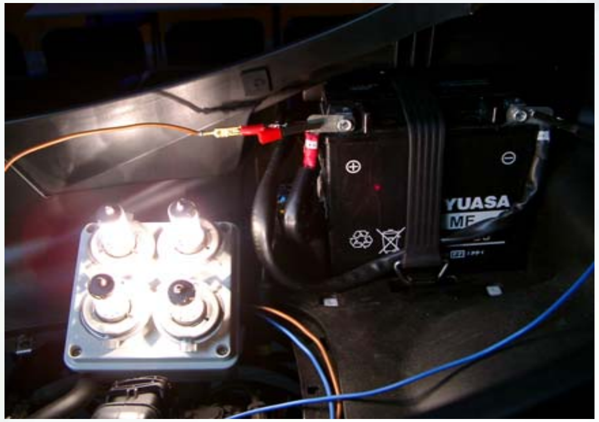


When the stator is working correctly, the three current values are the same or very similar.
In the case of a stator fault, one of the current values will be nil or lower than the other two. Idle speed must be stable to ensure these checks are reliable.
To avoid useless stator stresses, check at idle speed without running the test longer than the time required for measuring.

9. CHECKING MAXIMUM CURRENT OUTPUT

If the previous checks have not shown any faults, proceed as follows.
Connect an amperometric induction clamp to the positive (or negative) cables at the regulator output.
Prepare an additional load of 140W (e.g. 4 12V 35W lamps in parallel).
This electric load is suitable for all alternators, except for the 850 engine where the load must be twice as much.

Start the engine, then connect the additional load to the battery.



Accelerate progressively up to 5000rpm and take note of the maximum current output with the engine/alternator cold.

Decrease engine speed to approximately 3000rpm or to a speed that ensures stable rotation.
During these checks the alternator is loaded with the overall vehicle absorption and the additional load, totalling the maximum power output.
Wait a few minutes, making sure there are no sudden current variations.
When the voltage regulator has reached the correct temperature value, check again at 5000rpm taking note of the maximum current output with the alternator hot and stop the engine.

Make sure the current values comply with the attached table.

Engine	Maximum regulator output	
	Cold	Hot
Purejet	≥11A	≥10A
Leader 2V carburettor	≥11A	≥10A
Leader 2V injection	≥16A	≥15.5A
Leader 4V carburettor	≥11A	≥10A
Leader 4V (enhanced flywheel) carburettor	≥16A	≥15.5A
Quasar carburettor	≥17.5	≥16A
Quasar injection	≥22A	≥20A
Master	≥24A	≥21A
850	≥32A	≥28A

Let the alternator cool down and check the current output again with the regulator warm.
These test conditions are much more severe than normal vehicle operating conditions and allow occasional recharge failures to be detected as well.
If the current values measured are much less than specified or unstable, replace the voltage regulator.
If the fault persists, repeat the static check on the stator. It is important to bear in mind that hot stator resistance values will be slightly higher.

10. CHECKING REGULATION VOLTAGE

With the alternator hot, disconnect the additional load and check battery voltage or, better still that the regulator output voltage does not exceed 15V whatever the rpm value is.
Replace the voltage regulator if non-compliant voltages are measured.
In vehicles where the voltage regulator is far away from the battery, it is important to check both voltages under full alternator output conditions (regulator voltage and battery voltage).
A difference of about some tenths of a Volt is normal, whereas more considerable voltage drops must be further investigated and proper wiring conductivity should be restored if necessary.
A considerable voltage drop hinders effective battery recharge, whereas performance of the other components is still acceptable.
With reference to voltage regulators, it is important to stress that slight instabilities at the beginning of the regulation field are not to be considered a defect