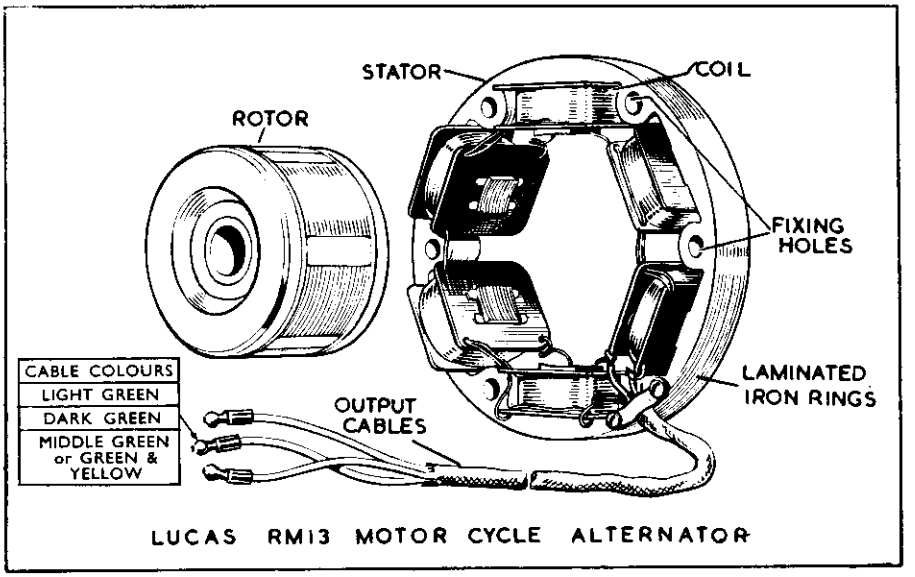
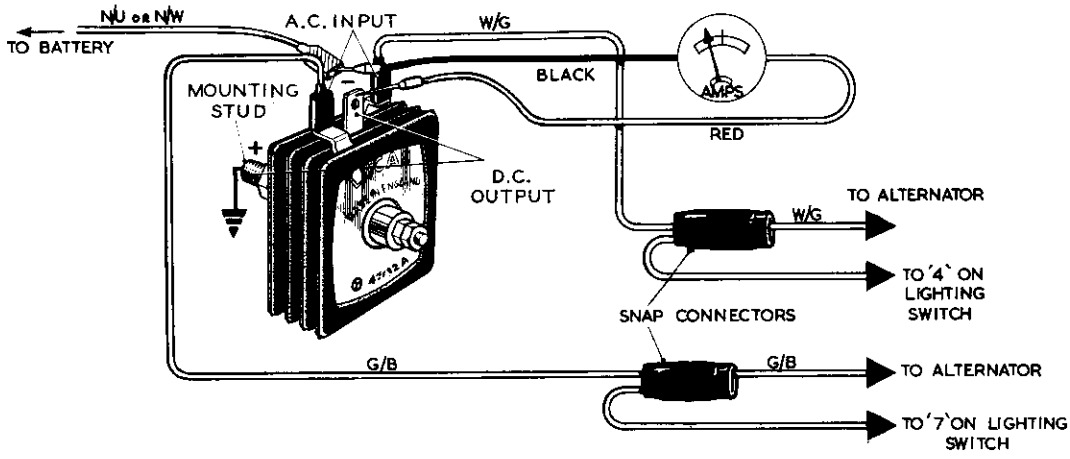
# TEST PROCEDURE




RM13 – RM13/15 – RM14 – RM15 – RM18 – RM19 – RM20/19 – 5AF – 9AF
ALTERNATOR SETS (6 and 12-volt)

# Checking the Rectifier D.C. Current Output — on the Machine



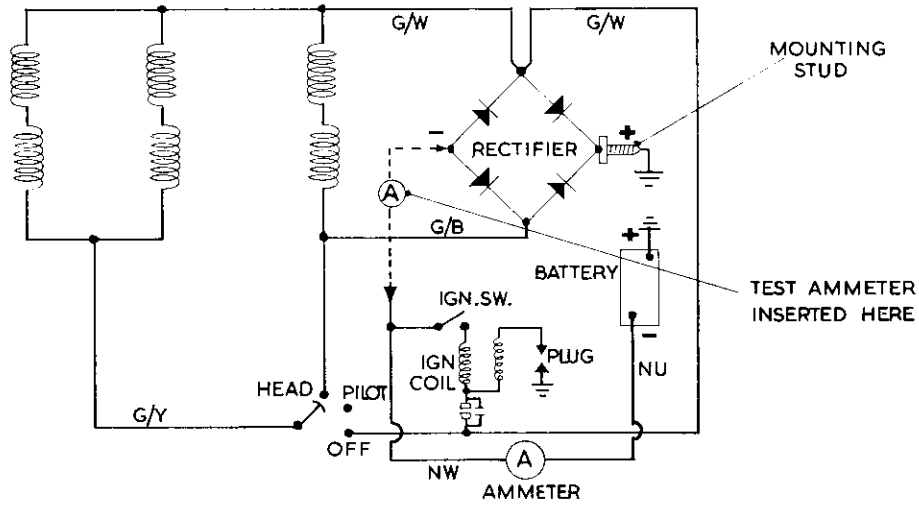

*SILICON DIODE RECTIFIER*

*SELENIUM RECTIFIER*

*The latest type of rectifier, fitted on current machines is a Silicon Diode type. The terminal arrangement is the same as for the Selenium type*

**NOTE**

**SEE TEST DATA CARD IN REAR COVER POCKET FOR LIST OF APPROPRIATE TEST VALUES**



# Checking the Rectifier D.C. Current Output — on the Machine

## TEST PROCEDURE

(*a*) First check state of charge of battery on machine. If it is not in a healthy, well-charged condition it must be temporarily replaced with a fully-charged one, *before* testing.

(*b*) Remove cable(s) from the centre terminal of rectifier.

(*c*) Disconnect Zener Diode, when fitted.

(*d*) Connect ammeter Black lead to cable(s) removed, and ammeter Red lead to rectifier centre terminal.

(*e*) Start engine and run at 3,000 rev/min.

(*f*) Note reading on ammeter, with the lighting switch in the "Off", "Pilot", and "Head" positions. Readings should approximate the values given in the test data card for the appropriate alternator. (See inside rear cover for Test Data Card).

## TEST CONCLUSIONS

If the ammeter registers the value stated for the equipment, the charging circuit and alternator are satisfactory.

No reading on the ammeter indicates either a faulty alternator or rectifier. To find out which is at fault apply the individual tests for the alternator and rectifier.

A faulty battery can cause "high" or "low" readings. If reading is "high" it can be due to a short-circuited battery cell, a "low" reading can be caused by a sulphated battery or faulty connections, or result from partial de-magnetisation of the alternator rotor.

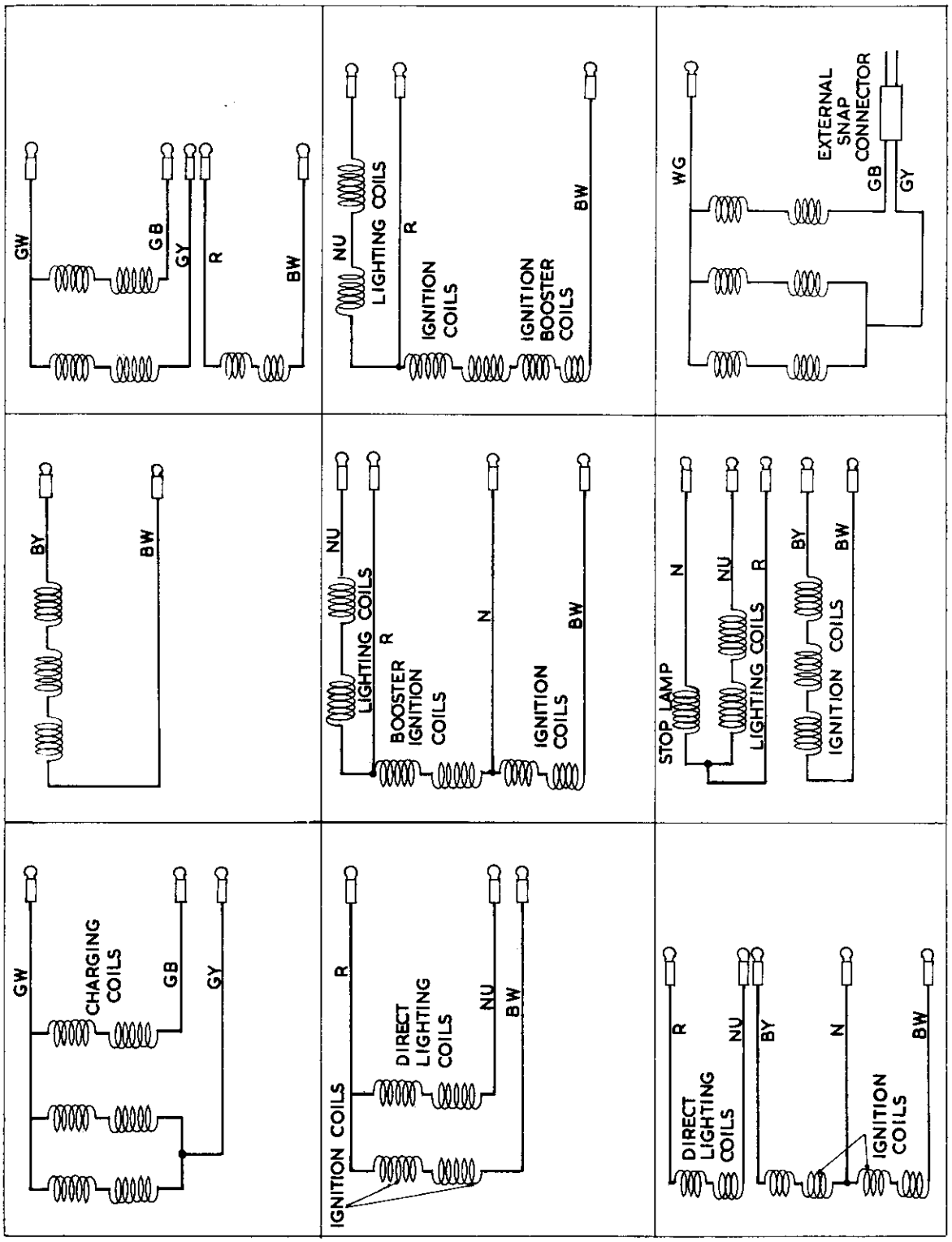
## IMPORTANT

No readings will be obtained if any wiring connections are open-circuited. Inaccurate readings can be due to faulty wiring such as poor earth connections, or "snap" connectors.

## SERVICE NOTE

Remember that some alternator sets are connected to give a two-rate output while others are connected to give a three-rate output. In practice, this means that the actual values registered by the ammeter will differ slightly in the "off" and "pilot" positions, according to which wiring arrangement is used.

## Alternators — Coil arrangements and connections

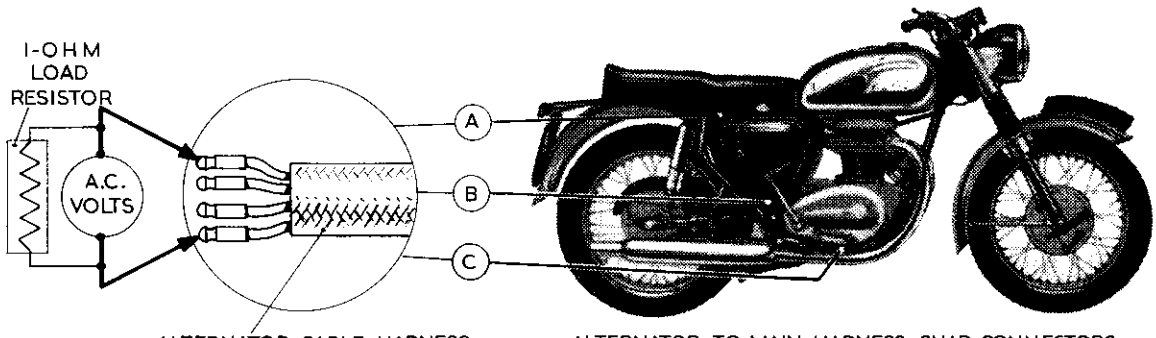


## For checking with A.C. Voltmeter and 1 Ohm Load Resistor

### TEST PROCEDURE

(*a*) Disconnect the alternator cables, at the snap connectors where they are joined to the main harness.

(*b*) Connect the A.C. voltmeter, with 1 ohm load resistor in parallel, across the alternator coils in the order detailed for the particular model under test. (See test data card in pocket of rear cover). The engine of the machine should be run at a constant speed, at approximately 3,000 rev/min, while making the test. The motor cycle should be on its rear stand, with Top Gear engaged. The speedometer can be used as a guide as to engine speed, a 45 mile/h reading approximately an engine speed of 3,000 rev/min. If a tachometer is fitted to the machine then an accurate assessment of engine speed is possible.




### TEST CONCLUSIONS

A. A low reading on any group of coils indicates partially earthed or shorted turns.

B. A zero reading on any group of coils will indicate an open-circuit coil.

C. If all coils read low, partial de-magnetisation of rotor may have occurred as a result of faulty rectifier. Check rectifier, and battery earth polarity before replacing rotor.

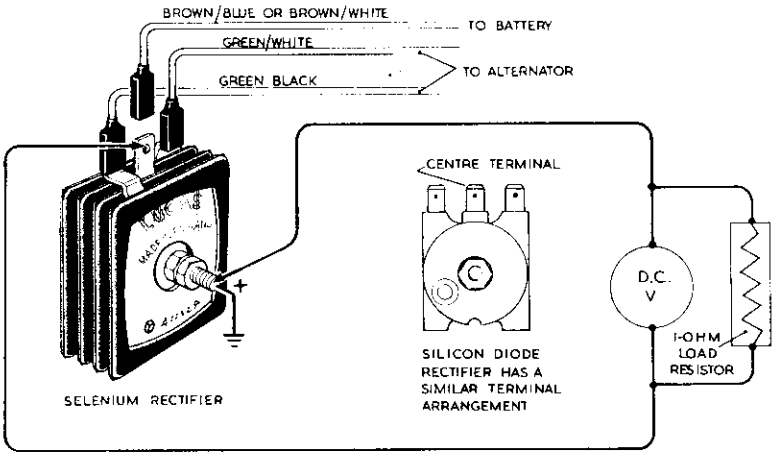
D. A reading between any one lead and the generator stator indicates an earthed coil. Replace stator or locate earth by isolating and testing individual coils.

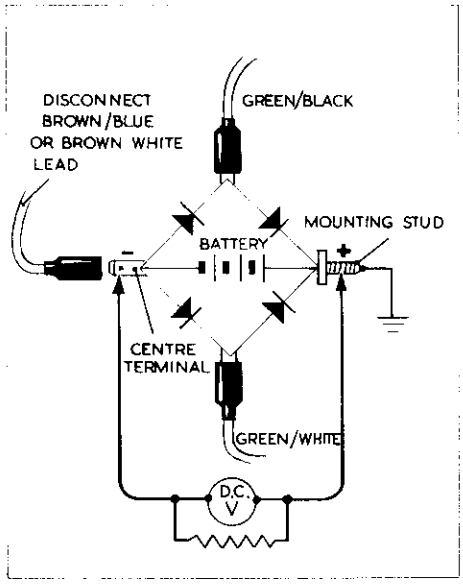
### NOTE

With the engine running at approximately 3,000 rev/min the output voltages are steady, and even if the engine is running a few rev./min. faster or slower the minimum values given in the Test Data Card will be obtained from a good alternator.

If the machine is not fitted with a rear wheel stand it will be necessary to find some other means of getting the rear wheels clear of the ground so that the engine can be run with top gear engaged.

# Checking Rectifier in Position on Machine




## TEST PROCEDURE

(*a*) Check that alternator cables are correctly connected to main harness.

(*b*) Disconnect Zener Diode, if fitted.

(*c*) Disconnect cable(s) from rectifier centre terminal, and Green/Yellow cable at snap-connectors. With a "jumper" lead connect Green/Yellow to Green/Black at rectifier or snap-connector (this is done to ensure alternator will give its full output).

(*d*) Connect D.C. voltmeter and load resistor, Red lead to rectifier mounting bolt (Earth), Black lead to rectifier centre terminal.

(*e*) Run engine at 3,000 rev/min (approximately 45 mile/h in top gear). Meter reading should approximate the value given for each model Alternator in the A.C. meter test, in which the connected across all six coils i.e., White/Green with Green/Black to Green/Yellow.

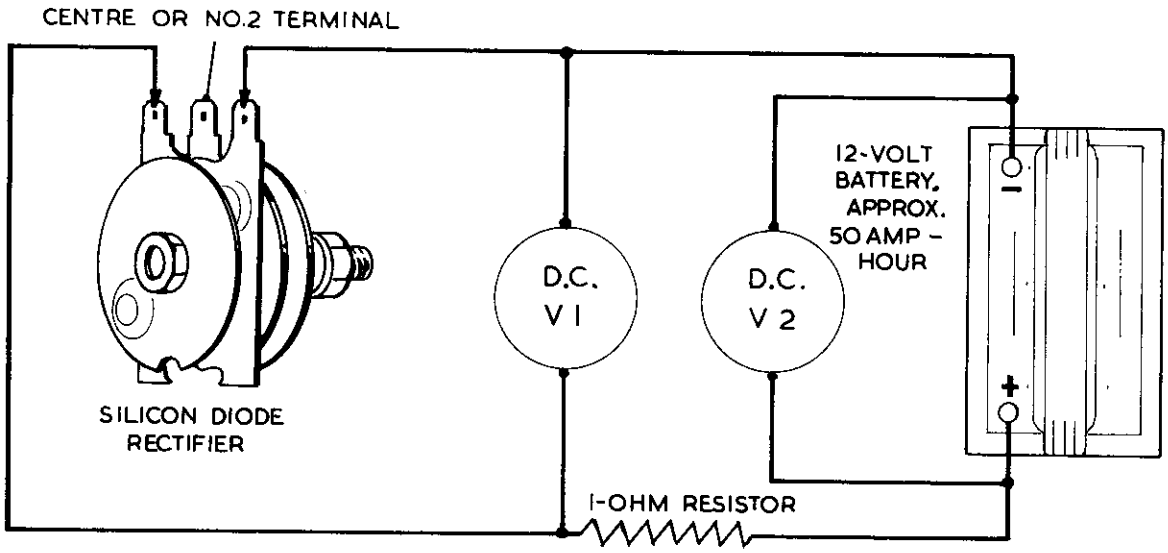
## CONCLUSIONS

If reading approximates value stated, rectifier is satisfactory.

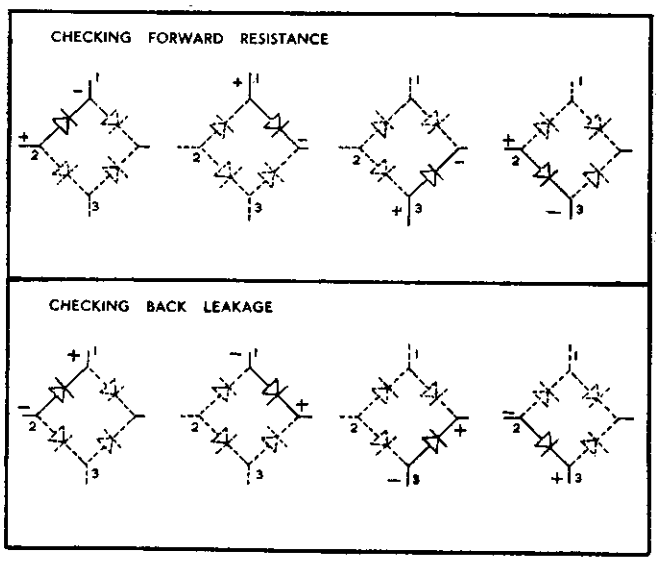
A low reading can result from a bad earth connection between rectifier and frame of machine.

A very low reading indicates a faulty rectifier, remove for bench testing.

# Rectifier (Selenium or Silicon Diode Types) — Bench Testing




**V1 — will measure the volt drop across the rectifier cell, which should not be greater than 2·5 volts.**
**V2 — must be checked when testiug the rectifier cell, to make certain the supply voltage is 12 volts on load.**




*It is essential that the supply is kept at 12 volts for these tests.*

FORWARD RESISTANCE TEST

*Test* 1. Connect test leads in turn across terminals 2 and 1 (Bolt and 1, Bolt and 3, 2 and 3. Reading in all positions should not be greater than 2.5 volts for Selenium types. For Silicon Diode types the reading should not be greater than 1.5 volts. Keep the testing time as short as possible to avoid overheating the rectifier cell.

BACK LEAKAGE TEST

*Test* 2. Proceed as for Test 1, and test each cell in turn, but reverse the test leads. Reading on V1 should not be less than 11 volts for Selenium types, and zero for Silicon Diode types.

## CONCLUSIONS FROM THESE TESTS

*Test 1.* If the voltage reading on V1 is more than 2·5 volts for selenium rectifier, or more than 1·5 volts for silicon diode rectifier, on any cell, it is aged and the rectifier should be replaced.

*Test 2.* If the voltage reading on V2 is well below 11 volts for selenium rectifier, or not zero for silicon diode rectifier, on all cells, then the unit is faulty and should be replaced.

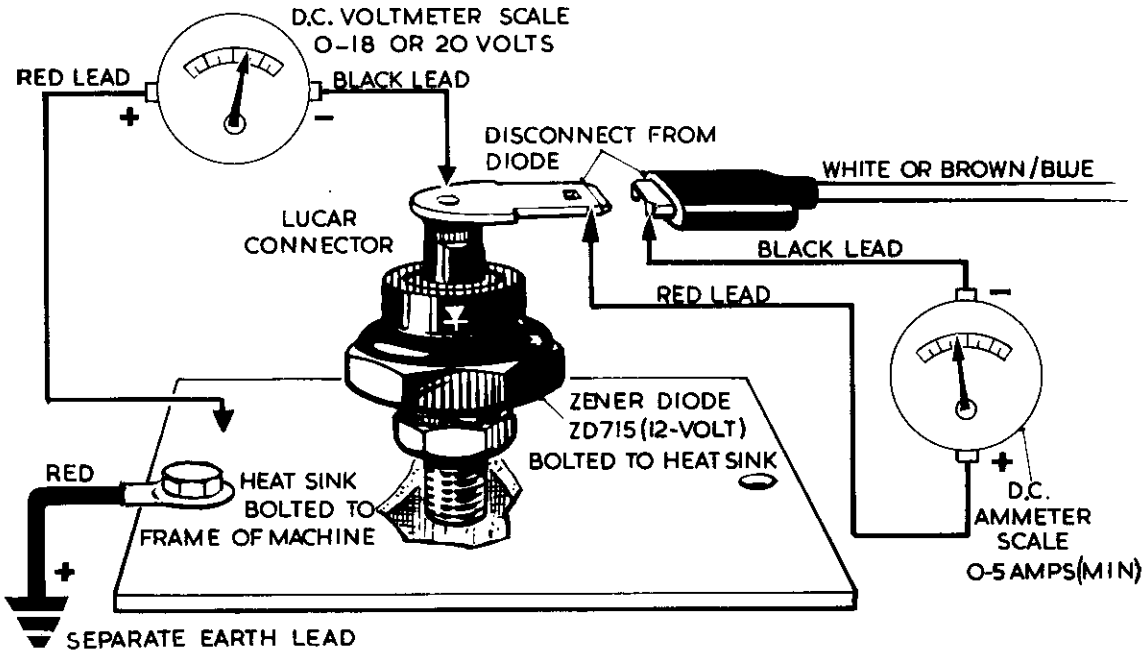
## IMPORTANT

Before fitting a replacement rectifier check the following points:

1. Check that battery is correctly connected, POSITIVE to EARTH.
2. Check rectifier visually for signs of damage.

NEVER disturb the tension of the nut which holds the elements together on the through bolt of selenium plate rectifiers. The efficiency of the rectifier depends upon the correct tension of the plates. The tension of the nut is set before leaving the works, and cannot be adjusted correctly in service.

## Checking the Zener Diode on the Machine (when fitted)




### TEST PROCEDURE

Disconnect the lead from the Zener Diode and connect ammeter (in series) between the Diode Lucar terminal and lead previously disconnected. The ammeter red or positive lead must connect to the Diode terminal.

Connect D.C. voltmeter across Zener Diode and heat-sink. The red or positive lead must connect to the heat-sink which is earthed to the machine frame by its fixing bolts and a separate earth lead. The black lead connects to the Lucar terminal.

Ensure that all lights are "off", start the engine, and gradually increase engine speed, while at the same time observing both meters.

### NOTE

It is essential that the batteries are in a good condition and in a reasonably good state of charge. If battery condition is uncertain, it should be temporarily replaced by a good battery for this test.

It may be necessary (particularly on magneto equipped machines which have only two coil charging) to reconnect the alternator for six coil charging or maximum output, i.e., join the alternator Green/Black and Green/Yellow leads together at the snap connectors.

(i) When the voltage across the Zener Diode reaches 12.75 volts, the Zener current ammeter must indicate zero.

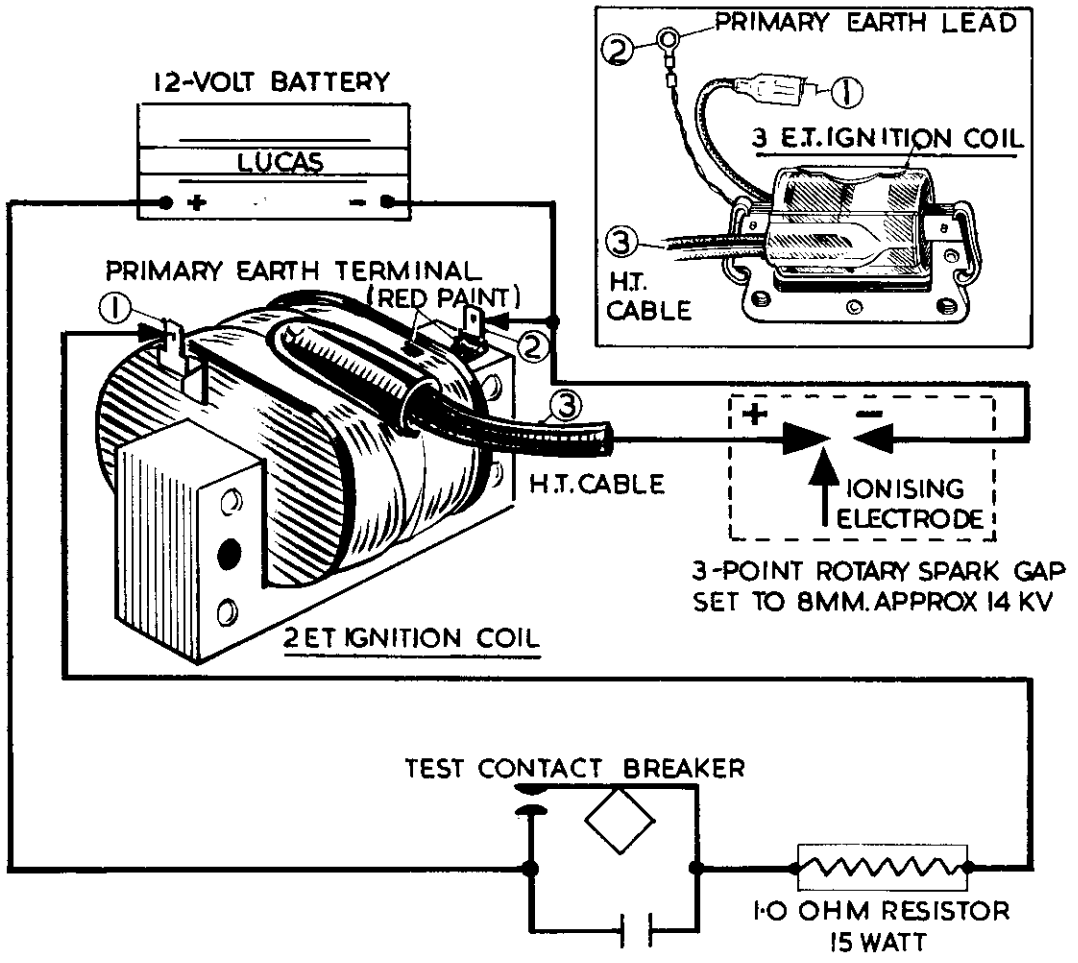
(ii) Increase engine speed until a Zener current of 2 amperes is indicated on the ammeter. At this value a satisfactory Zener Diode should cause a reading on the voltmeter of between 13.5 and 15.5 volts.

### TEST CONCLUSIONS

If the ammeter in test (i) registers any current at all before the voltmeter indicates that the voltage across the Zener is 12.75 volts, then a replacement Zener Diode must be fitted.

If test (i) proves satisfactory but in test (ii) a higher voltage than that stated is registered on the voltmeter, before the ammeter registers two amperes, then a replacement Zener Diode must be fitted.

# 2ET and 3ET Ignition Coils — Spark Performance Test Circuit




## TEST EQUIPMENT REQUIRED

A four lobe D.M. type contact-breaker having closed periods of not less than 42° and having an operating range up to 750 rev/min. is required. Also, a 12-volt battery, a 3 point rotary spark gap and a 1 ohm resistor approximately 15 watt.

## TEST PROCEDURE

(*a*) Connect the 12 volt battery, contact-breaker, and 1·0 ohm resistor in series with the coil primary winding. Circuit polarity should be such that the negative side of the battery is connected to the earthed end of the primary winding.

(*b*) Connect, with a "jumper" lead, the spark gap electrode that is farthest away from the ionising electrode, to the negative side of the circuit.

(*c*) Connect the H.T. lead from the ignition coil to the 3 point spark gap, to the main electrode nearest to the ionising electrode.

(*d*) Run the contact-breaker at 750 rev/min, when regular sparking should occur between the main electrodes when they are set to 8 mm. (approximately 14 kV.). Do not continue this test for longer than 30 seconds because arcing at the contact-breaker points will be fairly heavy, due to the slow running speed and low value primary resistance.

## TEST CONCLUSIONS

Intermittent or no sparking, replace the coil.

# Circuit Testing

## USING D.C. VOLTMETER WITH 1 OHM LOAD IN PARALLEL

1. Disconnect alternator leads from main harness. All other cables, and battery, to be connected as normal. Connect voltmeter across battery (which should be in a well charged state) terminals, note the reading and proceed to 2.

### Basic Charging Circuit

2. (*a*) Connect voltmeter red lead to earth.
   (*b*) Connect black lead to centre terminal on rectifier.
   (*c*) Turn ignition switch to "IGN" position; lighting switch to "off".
   (*d*) Reading on voltmeter should be not more than 1.0 volt below reading obtained in (1) above.

If a zero reading is obtained at rectifier centre terminal, check continuity of wiring circuit back through ignition switch to battery. A reading of more than 1.0 volt below the reading in (1) above, indicates high resistive or bad circuit connections.

### Charging Control Circuit

### TEST 1 — Low Output Position

**(Applicable to machines with Green/White lead at switch, and a link between switch terminals 5 and 6)**

3. (*a*) Bridge together the centre and Green/White terminals of the rectifier.
   (*b*) Connect D.C. voltmeter (with 1 ohm resistor in parallel), black lead to Green/Yellow cable from ignition switch, red lead to earth.
   (*c*) Lighting switch in the "off" position.
   (*d*) Ignition switch in the "on" position.
   (*e*) Reading on meter should be not more than 1·0 volt below reading obtained in (1) above. See note 1.

### TEST 2 — High Output Position

**(Applicable to all machines).**

   (*f*) With voltmeter connected as in Test 1, bridge together the centre and Green/Black terminals of the rectifier.
   (*g*) Lighting switch in the "Head" position.
   (*h*) Ignition switch in the "On" position.
   (*i*) Reading on meter should not be more than 1·0 volt below reading obtained in (1) above. See Note 1.

A reading which is more than 1·0 volt below that obtained in (1) above, indicates high resistive or bad circuit connections.

### NOTE 1

If Green/White lead is connected to terminal 4 on the PRS8, 63SA and 88SA switches, or terminal 7 on U39, 41SA. If no lead is fitted at 4 or 7 a zero reading will be obtained.

### Emergency Start Circuit (Twin cylinder machines with distributor)

4. (*a*) Disconnect alternator leads at the snap-connectors.
   (*b*) Connect Green/Yellow lead from switch to rectifier centre terminal, by means of a "jumper" lead.
   (*c*) Open distributor contacts.
   (*d*) Connect voltmeter with 1 ohm load, red lead to earth, black lead to "SW" (or "—") terminal of ignition coil.
   (*e*) Ignition switch in "EMG" position.
   (*f*) Reading on meter should not be more than 1·0 volt below reading obtained in (1) above.

### (Single Cylinder Machines and Twin Cylinder Machines without Distributor, i.e., Twin Coil and Twin Contact-Breakers)

5. (*a*) Alternator leads still disconnected.
   (*b*) Distributor or contact-breaker contacts open.
   (*c*) Connect D.C. voltmeter with 1 ohm load, red lead to earth, black lead to "SW" (or "—") terminal of ignition coil.
   (*d*) Ignition switch in "EMG" position.
   (*e*) Reading on meter should be not more than 1·0 volt below reading obtained in (1) above.
   (*f*) Connect Green/Yellow lead from switch to rectifier centre terminal, by means of a jumper lead.
   (*g*) Move voltmeter black lead from "SW" (or "—") terminal to "CB" (or "+") terminal.
   (*h*) Ignition switch still in "EMG" position.
   (*i*) Reading on meter should be not more than 1·0 volt below reading obtained in (1) above.

If a zero reading is obtained check wiring and connections for continuity.

A reading which is more than 1·0 below that obtained in (1) above indicates high resistive or bad circuit connections.

### NOTE 2

These tests are to be carried out in the case of "No Charge" or "No Emergency Start" if previous tests have been carried out and all is in order.

Remember, it is important that both ignition timing and rotor timing are correct for efficient operation of Emergency Start.

# Location and Remedy of Faults

Although every precaution is taken to eliminate all possible causes of trouble, failure may occasionally develop through lack of attention to the equipment, or damage to the wiring. The following pages set out the recommended procedure for a systematic examination to locate and remedy the causes of some of the more probable faults. The sources of many troubles are by no means obvious, and in some cases a considerable amount of deduction from the symptoms is needed before the cause of the trouble is disclosed.

## IGNITION CIRCUIT (see note, Substitute Ignition on page 58)

### Engine will not start in IGN position

(*a*) Turn switch to EMG position. If the engine will now fire, the alternator and rectifier are operating correctly and the indication is a discharged battery; this can be confirmed by poor light from the lamps and hydrometer readings below 1·200. Recharge the battery if necessary.

(*b*) Remove the H.T. cable from the sparking plug terminal and hold it about $\frac{1}{8}$-in. away from some metal part of the engine while the latter is slowly turned over. If sparks jump the gap regularly the ignition equipment is functioning correctly. Check for engine defects or examine sparking plug.

(*c*) If sparks do not occur in test (*b*), check for a fault in the low tension wiring, i.e., from battery to switch, coil and contact breaker. If the wiring proves to be in order, examine the contact breaker; if necessary clean the contacts and adjust the gap setting.

### Engine will not start in EMG position (if provided)

(*a*) Remove the H.T. cable and test as described under (*b*) above; if sparks appear, then the trouble is due to engine defects, etc.

(*b*) If the ignition equipment is not operative in the above test, check the snap connectors, rectifier connections and other wiring. All connections must be clean and tight.

(*c*) Examine the contact breaker; if necessary clean the contacts and adjust the gap setting.

(*d*) Make sure ignition timing is correct to engine maker's specification.

(*e*) See that the alternator stator is fitted the correct way round on the engine shaft.

### Engine misfires

(*a*) Examine the contact breaker; if necessary, clean the contacts and adjust the gap.

(*b*) Remove the sparking plug (or each plug in turn), rest it on the cylinder head and observe if a spark occurs at the plug points when the engine is turned. Irregular sparking may be due to dirty plugs, which may be cleaned and adjusted, or to defective high tension cables. Any cable on which the insulation shows signs of deterioration or cracking should be renewed.

(*c*) If sparking is regular at each plug when tested as described in (*b*), the trouble is probably due to engine defects, and the carburetter, petrol supply, etc., must be examined.

(*d*) If misfiring occurs after the engine has been running for some time, check that the ignition switch is in the normal IGN position. If run continuously in the EMG position, the rising voltage of the battery may eventually cause misfiring to occur.

## A.C. IGNITION

### Important

1. Keep the contact breaker clean and its maximum opening correctly set to 0.014″ — 0.016″.
2. Keep the sparking plug electrodes clean and correctly set.
3. Keep to the manufacturer's timing instructions.

Regarding notes 1 and 3 above, it is the magneto performance or spark energy developed by the alternator (in addition to the piston-to-spark relationship) that is involved. Since the rotor is keyed to the engine crankshaft, which, in turn, is coupled through the connecting rod to the piston, any movement of the piston whilst timing will affect the position of the crankshaft, and hence the magnetic timing position of the rotor. Thus the maximum magneto performance of the alternator can only be obtained with accurately set contact breaker and timing.

### Engine will not start, difficult to start or misfires

*a*) Remove the H.T. cable from the sparking plug and hold the cable end about $\frac{1}{8}$″ from the cylinder block. Sparks should jump this gap regularly when the engine is turned at kick-start speed.

(*b*) If sparks are obtained, check the sparking plug, reset and clean, or renew as necessary.

(*c*) If no sparks are obtained, inspect the H.T. cable and renew, as necessary. Check contact breaker gap setting.

(*d*) If the sparking plug, H.T. cable and contact breaker gap setting are satisfactory, check for engine defects, faulty fuel supply, etc.

## MAGNETO IGNITION

### Engine will not start or difficult to start

(*a*) See that the controls are correctly set for starting, petrol turned on, etc.

(*b*) Turn off the petrol tap. Remove the sparking plug (or plugs), and place on the cylinder head. If a spark occurs regularly at the plug points when the engine is slowly hand-cranked, the magneto is in order. Look for engine defects and check ignition timing.

(*c*) If a spark does occur in (*b*), disconnect the high tension cable from the plug and hold the cable end about $\frac{1}{8}$″ from a metal part of the engine. If a spark occurs regularly when the engine is cranked, the plug is faulty. If there is no spark, disconnect the high tension cable at the magneto, replace with a new length of cable and test again as before.

(*d*) Should there still be no spark, possible causes of trouble are: contact breaker gap out of adjustment or contacts dirty; contact breaker rocker arm sticking; or, with rotary armature magnetos, pick-up brush worn or broken, or slip ring track dirty. Remedy as described.

### Engine misfires

(*a*) Check as in para. (*b*) and (*c*) above to eliminate engine defects, faulty high tension cable and sparking plug.

(*b*) Check magneto as in para. (*d*) above.

# Location and Remedy of Faults

## CHARGING CIRCUIT

### Battery in low state of charge

(*a*) This state will be shown by poor or no light from the lamps when the engine is stationary, with a varying light intensity when the motor cycle is running.

(*b*) If the engine starts and runs in the EMG position, this indicates that at least one plate of the rectifier is functioning correctly. But it should be checked.

(*c*) Check the condition of the battery with a hydrometer. Top up, if necessary, and have battery recharged.

(*d*) Check wiring from battery to switch, rectifier and alternator, tightening any loose connections or replacing broken cables.

### Excess Circuit Voltage

(*a*) This will be indicated by burnt-out or blackened bulbs, and possibly poor engine performance due to burned ignition contacts.

(*b*) Examine all wiring for loose or broken connections.

(*c*) Check the earthing of battery and rectifier.

(*d*) Examine the battery for broken internal connections.

(*e*) If the ignition is affected, clean the contact breaker contacts or if necessary renew them.

THE BATTERY POSITIVE (+ve) TERMINAL IS EARTHED TO THE MACHINE. UNDER NO CIRCUMSTANCES MUST THE NEGATIVE (—ve) TERMINAL BE EARTHED.

## LIGHTING CIRCUITS

### Failure of lights (machinery stationary)

(*a*) If only one bulb fails to light, replace with new bulb.

(*b*) If all lamps fail to light, test the state of charge of battery, recharging it if necessary either by a long period of daytime running or from an independent electrical supply.

(*c*) Examine the wiring for a broken or loose connection, and remedy.

### Lamps light when switch on, but gradually fade

Test the state of charge of the battery, recharging if necessary.

### Brilliance varies with speed of motor cycle

Test the state of charge of the battery, recharging if necessary.

### Lights flicker

Examine the wiring for loose connections, or short circuits caused by faulty cable insulation.

### Headlamps illumination insufficient

(*a*) If the bulb is discoloured or filaments have sagged as a result of long service, a new bulb of the same type should be fitted.

(*b*) Check the setting of the lamp.

## NOTE: MACHINES WITH A.C. IGNITION

### SUBSTITUTE IGNITION EQUIPMENT

If an A.C. ignition machine cannot be started in order to carry out the test procedure, first check that the ignition timing and contact-breaker setting are in accordance with Manufacturer's recommendations. If they are satisfactory, and the ignition coil is suspect, a substitute ignition system can be connected to enable further tests to be carried out.

The procedure is as follows:—

Obtain a 6 or 12-volt battery and a standard type motor cycle ignition coil.

Connect battery Positive to frame of machine (Earth).

Negative to substitute ignition coil ("SW" or "—ve").

Connect coil ("CB" or "+ve") to motor cycle contact-breaker.

Remove existing cable from contact-breaker.

Start engine and proceed with tests.