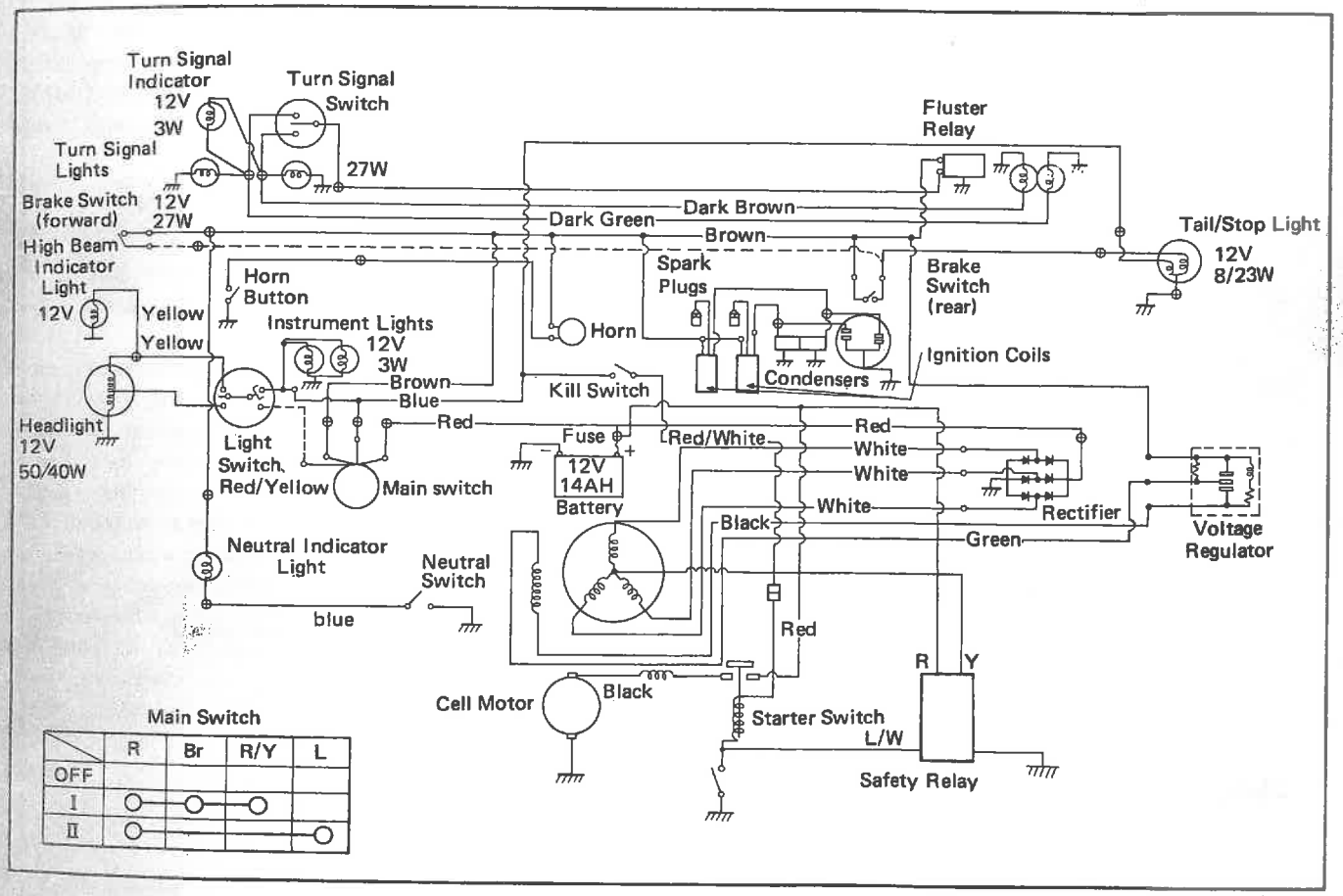
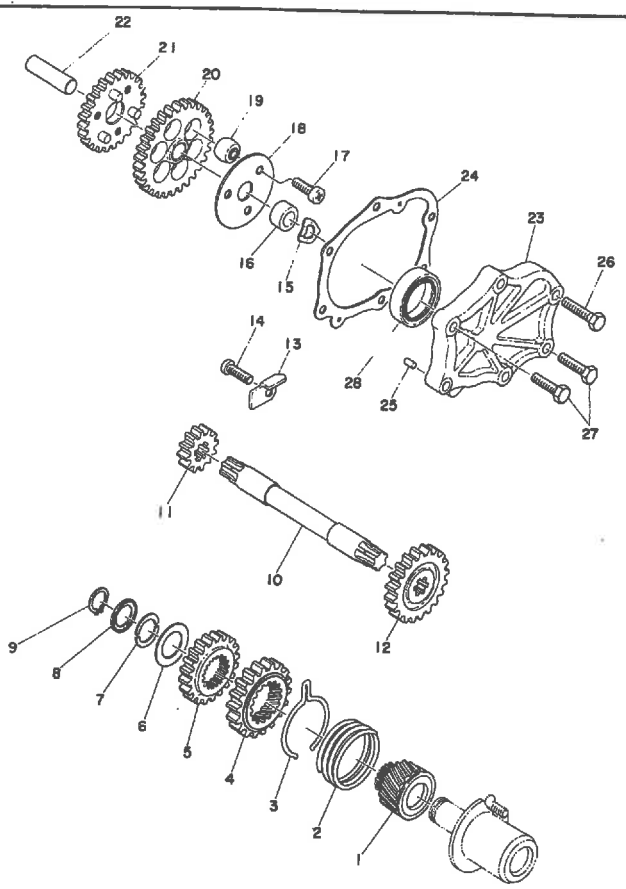
CHAPTER 6. ELECTRICAL

The XS650B electrical system uses an alternator to generate voltage which is then rectified to direct current. This direct current voltage is controlled by a voltage regulator which is set to maintain a 14 ~ 15V DC constant.

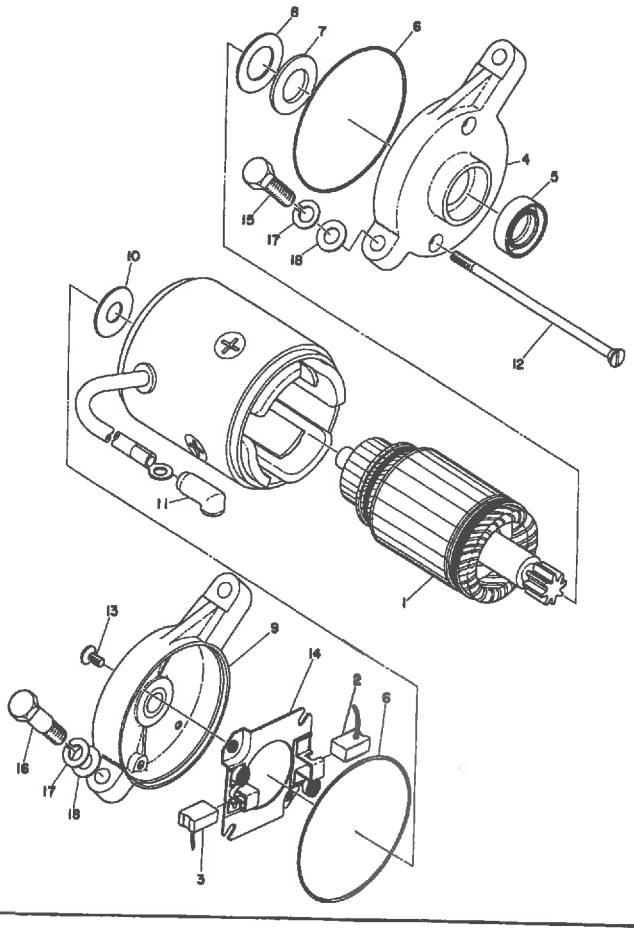
When the engine is stopped, a direct current to energize the lighting and ignition circuits is supplied by the battery, when running, it is supplied by the alternator/rectifier/regulator circuit. Excess voltage is shunted to the battery, if necessary, for recharging. If unneeded, the voltage regulator will decrease alternator output.



6-1. ELECTRIC STARTER

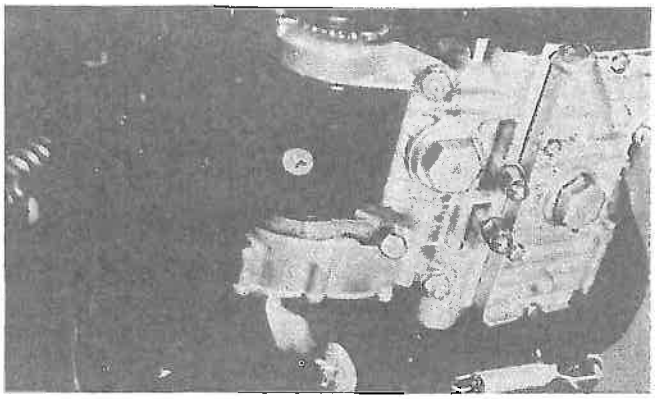


1. Starter wheel
2. Return spring
3. Starter clip
4. Gear 4
5. Gear 3
6. Washer
7. Clip
8. Clip holder
9. Circlip
10. Shaft 2
11. Gear 2
12. Gear 1
13. Stopper plate
14. Panhead screw
15. Wave washer
16. Collar 1
17. Panhead screw
18. Idle gear plate
19. Absorber
20. Idle gear 1
21. Idle gear 2
22. Shaft 1
23. Gear train cover
24. Gear train cover gasket
25. Dowel pin
26. Bolt
27. Bolt
28. Oil seal



1. Armature
2. Brush 1
3. Brush 2
4. Electric motor cover 1
5. Oil seal
6. O-ring
7. Special washer
8. Thrust washer 1
9. Electric motor cover 2
10. Thrust washer 2
11. Cap
12. Special screw
13. Flat head screw
14. Brush holder
15. Reamer bolt
16. Bolt
17. Spring washer
18. Plain washer

A. Construction

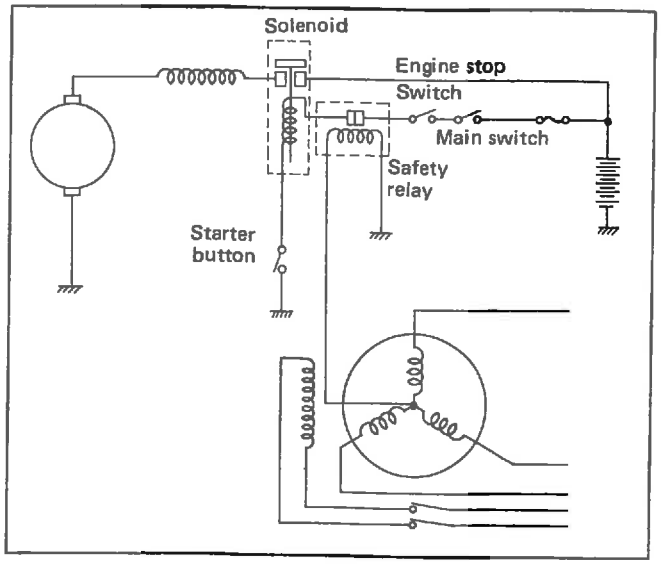


The starter motor is located under the crankcase. An idler gear is attached to the shaft. Torque from the motor, during operation, is transmitted from the idler gear, through the three reduction gears to the splined engagement gear (gear 4). The engagement gear works in the same manner as a splined kick gear, moving out to engage the gear mounted on the outer half of the right-hand crankshaft half. In this fashion, torque from the starter motor is transmitted to the crankshaft. As the engine starts, gear 4 is automatically disengaged.

The starter motor itself is a series-winding, 12 volt D.C. motor which draws 150 amps or less initially. (When the decompression lever is squeezed, at 20°C.)

A safety relay is incorporated within the starting circuit to automatically open the circuit when the engine fires. This provides for immediate disengagement of the starter motor gear train and, in addition, prevents the starter motor from over-revolving through a no-load condition as gear 4 disengages.

Operation



The electric starter switch closes. This creats current flow in the starter motor solenoid's windings and the solenoid closes.

When the solenoid (starting motor switch) closes, a direct circuit from the battery to ground through the motor circuit is created. Resistance is extremely low in this circuit and, consequently, a heavy current flow passes through the motor to ground, causing the motor to turn. As the engine starts, the ACG begins to generate voltage. As voltage rises to 4 V (±0.5 V) the safety relay opens. This opens the circuit to the cell switch which in turn opens the circuit to the solenoid. With no current flow in the solenoid windings, the solenoid arm return spring opens the heavy duty circuit between the battery and starter motor. The starter motor stops turning and the splined engagement gear (gear 4) returns to the "rest" position.

B. Specifications

Note:

The following specifications should be referred to while disassembly and troubleshooting (explained in following chapters) is taking place.

COMPONENT	ITEM	MAINTENANCE STANDARDS	REMARKS
Motor			
FIELDS	Resistance	0.05 ohms (20°C)	
BRUSH	W x T x L	16 x 7 x 11 mm.	
	Limit length	4.5 mm.	
AMATURE	Resistance	0.055 ohms (20°C)	No Grounded core
COMMUTATOR	Diameter, New	33ϕ	
	Wear limit	32ϕ	
	Mica undercut	0.5 – 0.8 mm.	
	Undercut limit	0.2 mm.	
	Max. allow runout	±0.15 mm.	
BRUSH SPRING	Pressure, std.	800 gr.	(+10%, -25%)
STARTER SWITCH	Yoke gap	——	(solenoid)
	Core gap	1.5 – 1.88 mm.	
	Point gap	0.88 – 1.11 mm.	
	Magnet windings	3.5 ohms (20°C)	
	Cut in Voltage	6.5 V	
	Cut out Voltage	4.0 V	
	Coil circuit	4A Draw. (20°C)	
SAFETY SWITCH	Yoke gap	0.2 mm.	
	Core gap	0.5 – 0.6 mm.	
	Point gap	0 mm.	
	Cut-out Voltage	2.5 V or less	
MISCELLANEOUS ELECTRICAL			
STARTER MOTOR DRAW:	35A 12V (20°C)		No load
FEATURE STANDARDS:			
LOAD:	8.3V 100A 3800 r.p.m.		
CONSTRAINT:	4V 300A or less		
NOMINAL ENGINE R.P.M.:	300 r.p.m. at 75A or less (When the decompression lever is squeezed, at 20°C)		

C. Disassembly

Starter Motor

1. Drain the engine oil.
2. Remove the four motor mounting bolts (8 mm.).

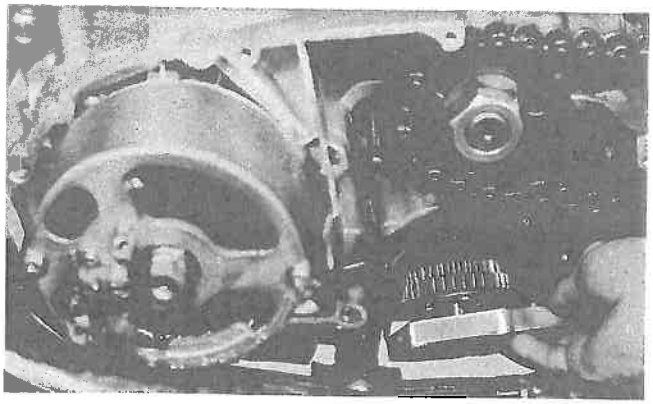
Note:

To ease removal, the machine should be placed on a lift or tilted towards the left.

3. Remove the motor. Pull straight back from its mounting location.

Note on reassembly:

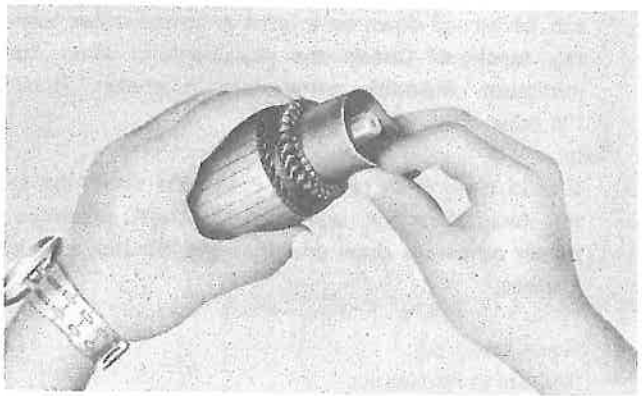
Make sure the gear shaft properly engages the reduction gear. Torque the 8 mm. securing bolts evenly, in gradual stages, to a setting of 2.0 kg/m. Refill the sump with 2500 cc. of SAE "SD" (MS) motor oil.



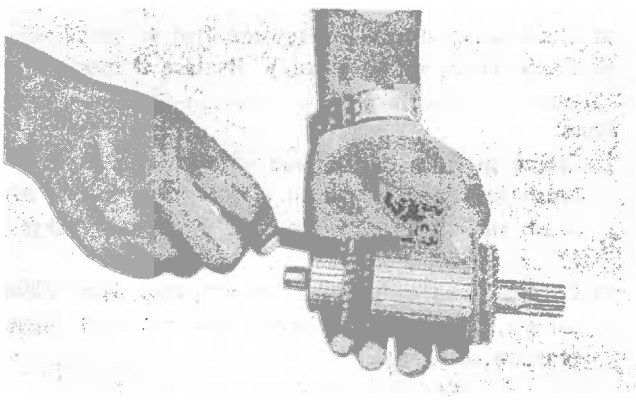
D. Servicing and Troubleshooting

1. Armature

a) If the commulator surface is dirty, clean with #600 grit sandpaper as shown in the drawing below. After sanding, wash thoroughly with electrical contact cleaner and dry with high-pressure air steam.

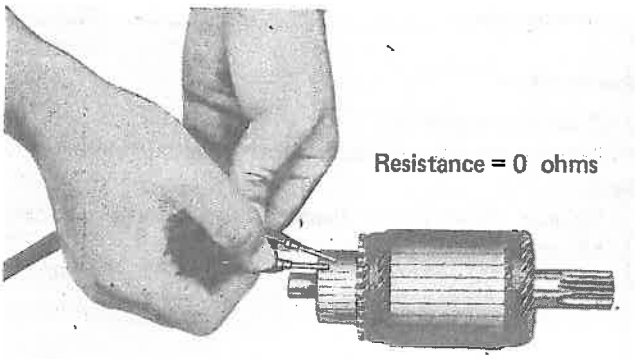


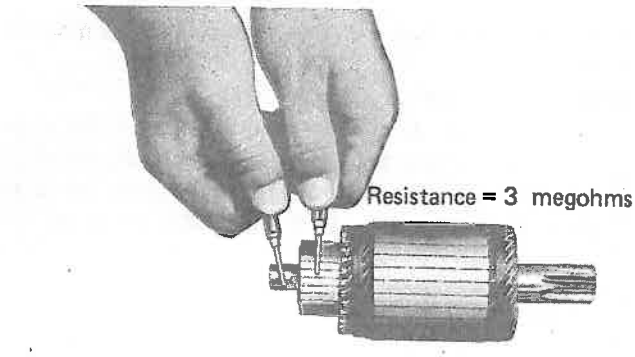
b) The mica insulation between commutator segments should be 0.5 ~ 0.8 mm. below the segment level. If not, scrape to proper limits with appropriately shaped tool. (A hacksaw blade can be ground to fit).



c) Each commutator segment should show zero ohm resistance to the others and at least three million ohms resistance to the core. If there is less than 00 ohms resistance to the core, or one of the segments is open, replace the armature.

In addition, the armature can be placed on a "growler" (testing device) and checked magnetically for internal shorts. Follow manufacturer's test recommendations.





d) If the commutator surface shows heavy scoring, it can be turned down on a lathe or commutator turning machine. Check the specification chart for minimum allowable commutator diameter. Recut the mica after.

Note:

Should turning be required, check the condition of the cover bearings, armature electrical properties starter amperage draw and rpm and, finally, carbon brushes.

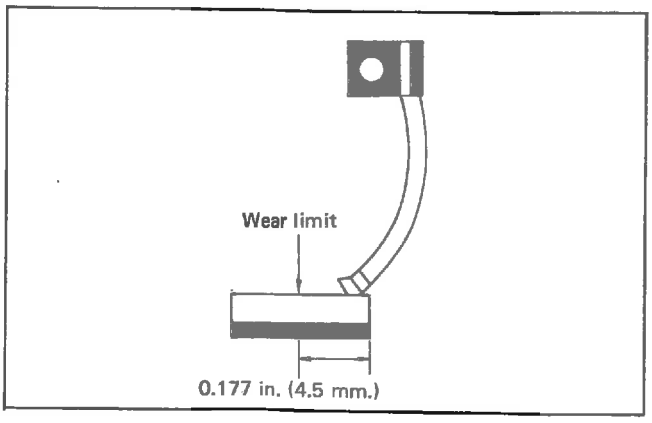
Cover bearings.
Replace as necessary.

2. Carbon brushes
   a) Check brush length and replace if at or near limits.
   b) Check brush spring pressure. Replace if over/under specs.

Note:

Spring pressure is measured with a nominal length brush installed. Lift until spring starts to lift off brush and note reading on scale. (Nominal: 800 gr.)

c) Clean the brush holders thoroughly. Use clean solvent, a soft-bristled brush, and dry with high-pressure air stream.

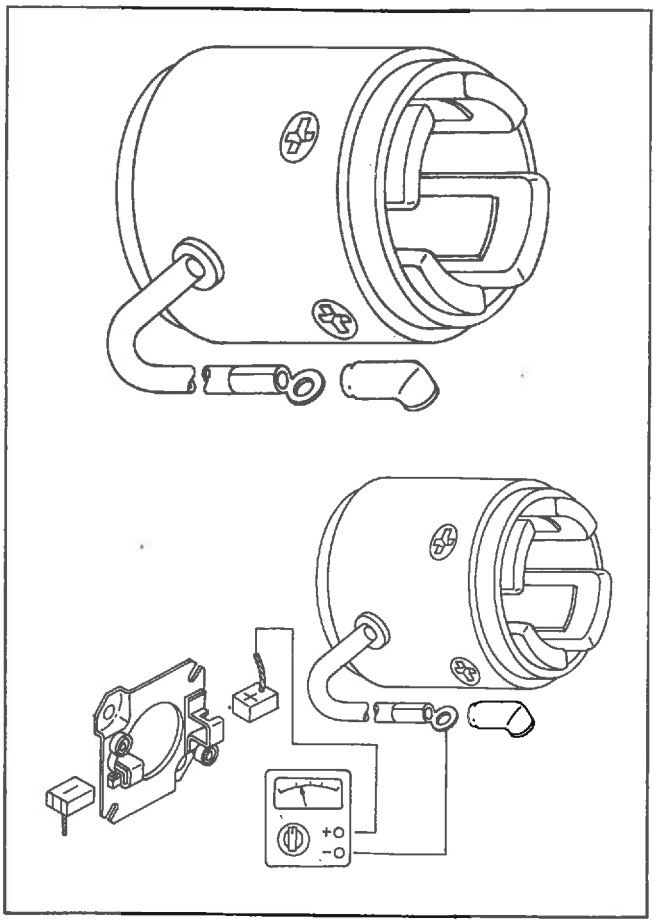


3. Yoke

a) If the yoke area is dirty, clean with solvent and dry with high-pressure air.

b) Yoke coil resistance is 0.05 ohm.
If coil resistance is more than 0.055 ohm or less than 0.045 ohm, replace it.
If the yoke shows leakage to ground (resistance is less than 0.1 million ohms) replace it. (20°C)

Note:
Immediately after cleaning, the yoke may show some insulation leakage. Wait for it to thoroughly dry before checking or reinstalling.



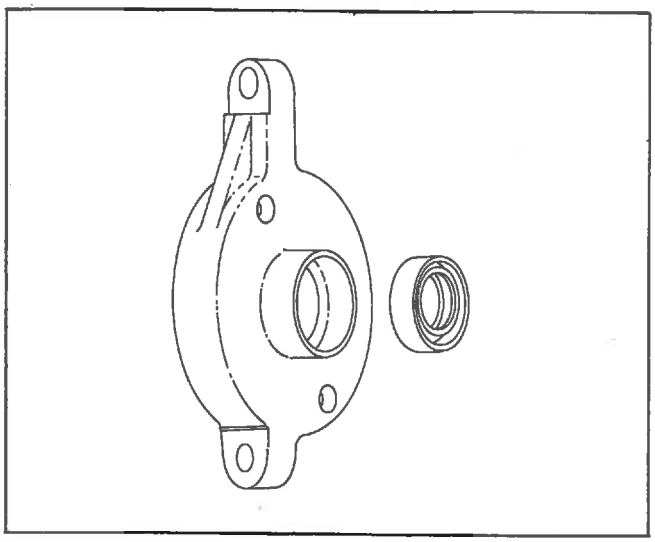
4. Covers

a) Check oil seals for hardening, cracking, worn lips.
Replace as necessary.

Note:
During reassembly, pre-lube the lips of all seals with "white" grease. (lithium soap base grease)

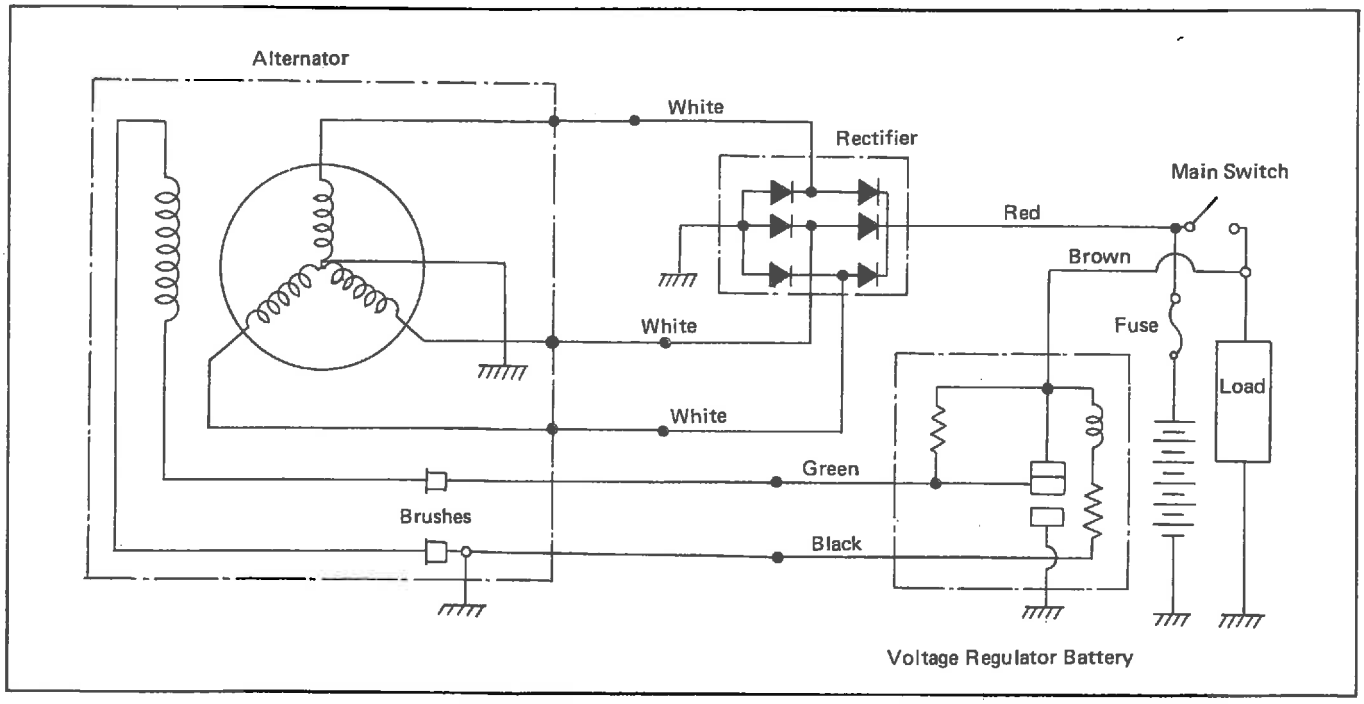
b) Clean the bearings thoroughly, lightly oil each and check for hard spots during rotation, cracked or broken balls and/or races, etc.
Replace as necessary.

Note:
During reassembly, all non-sealed bearings should be given a light coating of 20 W. or 30 W. "SD" (MS) motor oil.



5. Charging Circuit

This circuit consists of the battery to first provide voltage to the rotor field windings, regulator, ACG (alternating current generator), rectifier, and main switch.

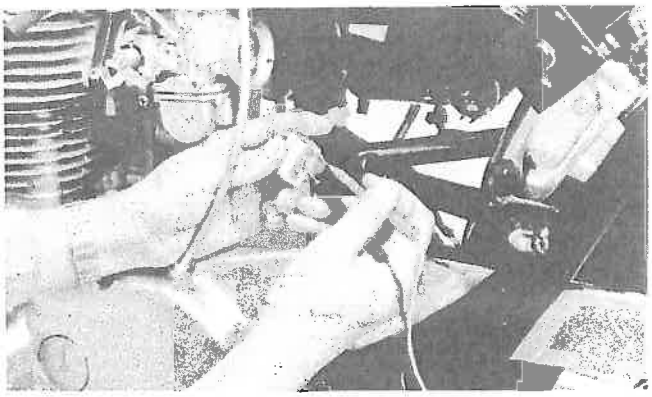


6. Alternator

Stator Winding

a) Trace the ACG wiring up to the multiple connector. Disconnect the connector and perform the following test to the three white wire ends at the multiple connector (there are a total of six wire ends in the connector).

b) All three white wires are interconnected in the stator windings. Use an ohmmeter to check resistance between any two white wires (three possible combinations). Each of the three measurements should show 0.8 ~ 1.0Ω resistance.



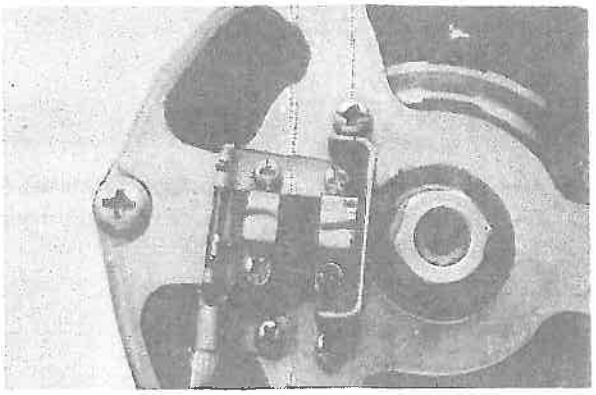
c) Set the ohmmeter scale to read at least in kilo-ohms. Clamp the ohmmeter probe to the stator housing and touch each white wire with the other probe. There should be infinite resistance.

d) If resistance values in steps two & three vary from those specified, then the stator windings are broken, shorted together, or shorted to the housing. Replace the entire unit.

7. Carbon brushes

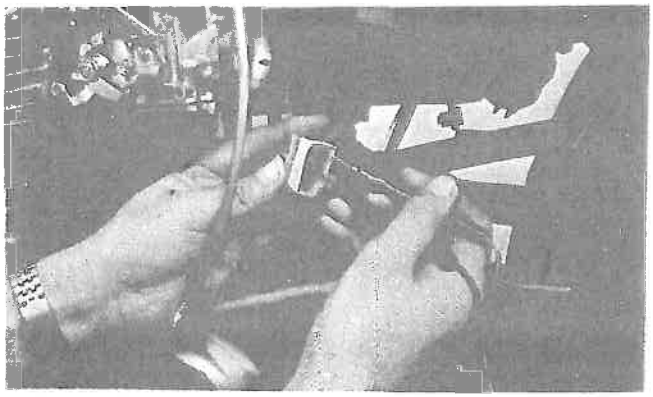
a) If the carbon brushes do not function correctly, electricity cannot pass to the rotor field windings. This reduces alternator output.

b) Visually inspect the carbon brush holder and brushes for obvious breakage or wear. Standard brush length is 0.571 in. (14.5 mm.). Wear limit is 0.276 in. (7.0 mm.)



c) Both carbon brush wires (black and green) are located in the same wiring loop as the three white stator wires. They share the same multiple connector which has already been disconnected.

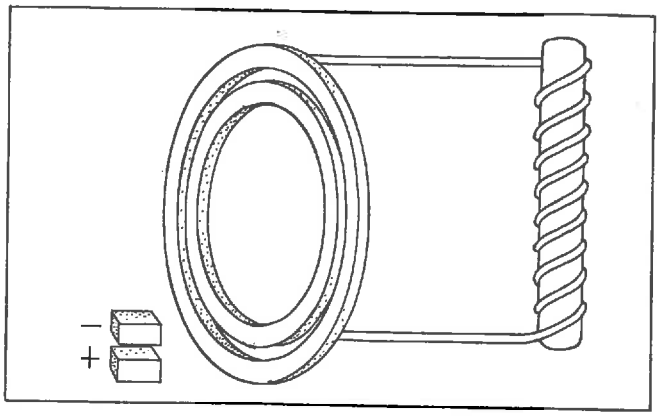
d) Check wiring resistance from the multiple connector to the carbon brush first through the green wire and then the black wire. There must be zero resistance.



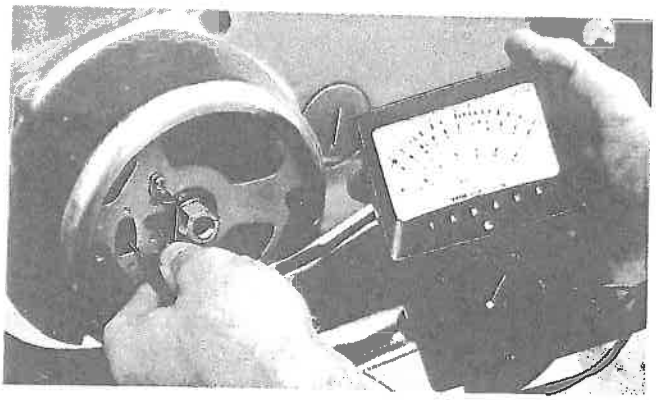
e) If high resistance exists in either wire, it is frayed or broken. Repair or replace the entire wire.

8. Rotor Windings

a) The field windings are one continuous coil of wire, each end attached to an insulated slip ring.



b) Use an ohmmeter (Ω x 1) to check resistance from one slip ring to another. Resistance should measure 5 ~ 7Ω.



Note:

Both slip rings must be clean or an inaccurate reading will result.

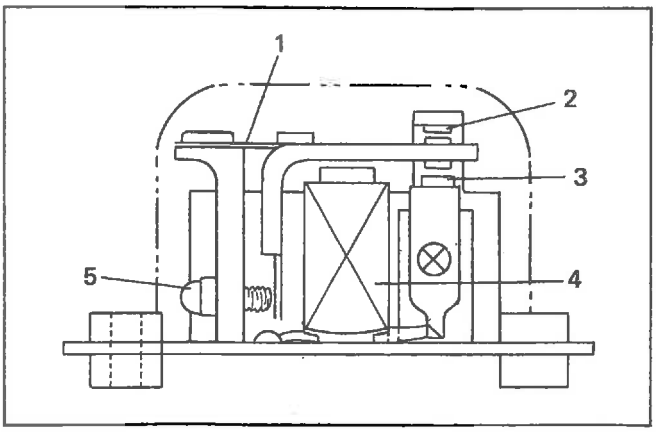
c) Use an ohmmeter set to register at least kilo-ohms resistance. Measure insulation between each slip ring and the rotor core. This must show infinite resistance.

d) If resistance measurements differ greatly from those specified, the winding is either broken, shorted to itself, or shorted to the core. Replace it.

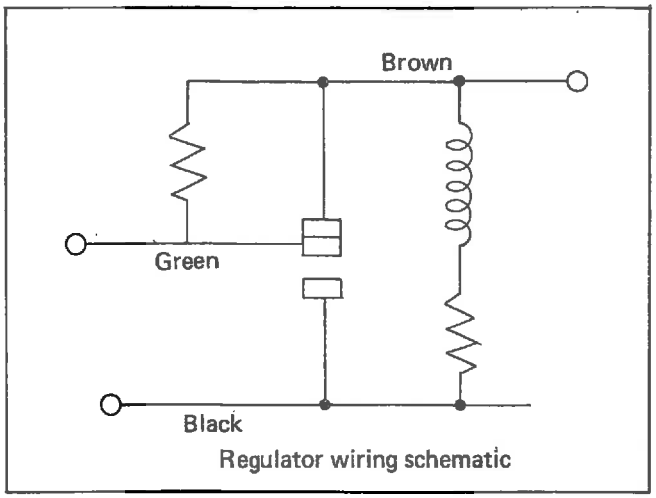
6-2. REGULATOR

This circuit consists of the battery to first provide voltage to the rotor field windings, regulator, ACG (alternating current generator), rectifier and main switch.

a) The regulator's function is to pass a controlled amount of voltage to the rotor windings which create a magnetic field that produces charging voltage in the stator.

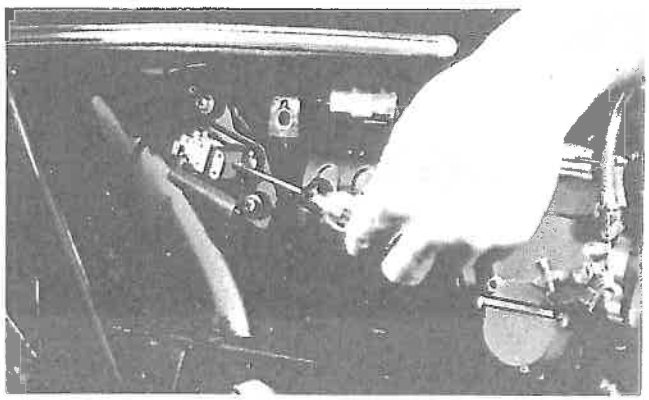


b) The regulator operates as a magnetic switch. As charging voltage rises, part of this voltage is routed through an electro-magnet in the regulator. Rising voltage creates greater regulator magnetism, which in turn pulls the central contact point through different positions. Different resistors are switched into the circuit as this central contact point moves. These resistors cut down the amount of voltage passing, to the rotor windings, which reduces the charging voltage output.

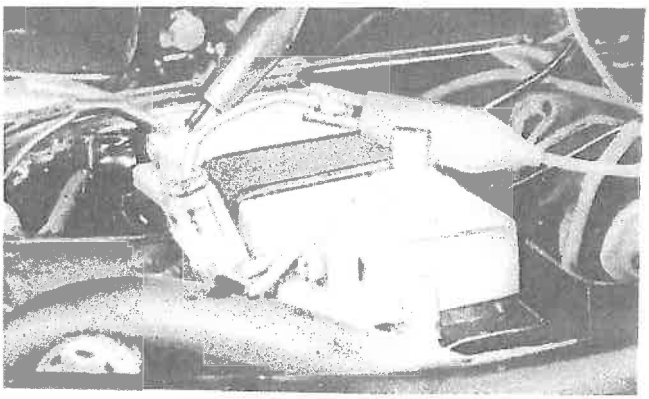


Regulator wiring schematic

c) Charging voltage output can be controlled at the regulator. Inside the housing is a screw that pushes against a flat spring steel plate. This is the adjusting screw.



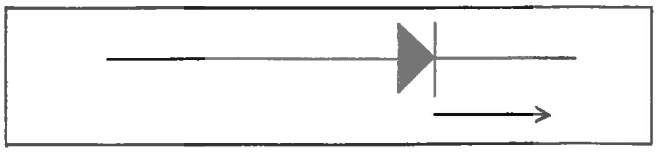
d) Start the engine. Disconnect the fuse box wire leading to the battery and hook up a voltmeter from the fuse box to ground. Accelerate the engine to 2,500 rpm. The voltmeter should read 14.5 ~ 15 volts DC. If it varies from this amount, twist the adjusting screw in to raise the charging voltage or out to reduce the voltage.



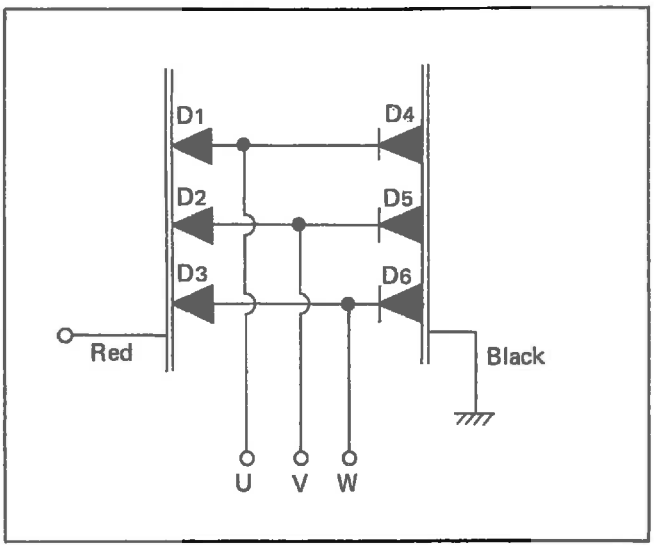
6-3. RECTIFIER

a) This unit is a full wave rectifier which changes alternating current generated by the alternator to DC current by passing this AC current through six silicon diodes. The diodes permit only one-way electrical flow. The DC current is sent to the battery and main switch.

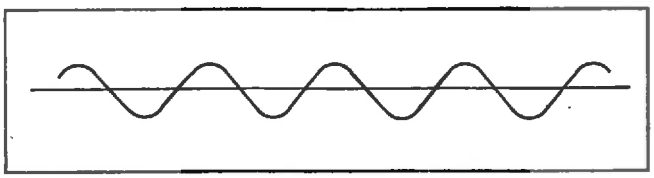
b) This sign indicates a one-way diode. Current flows in the direction the sign is pointing.



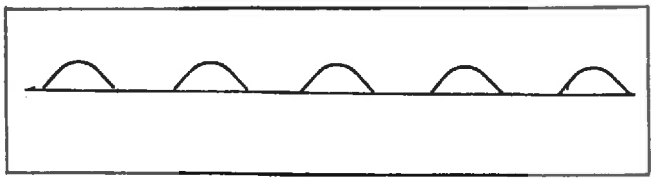
c) Schematic representation of the three phase, fullwave rectifier in the XS1-B generating circuit.



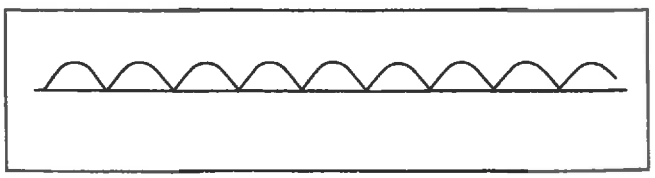
d) Wave form of standard alternating current.



e) Wave form of direct current after rectification by one diode (or half-wave rectifier).



f) Wave form of direct current after full wave rectification.



6-4. ROTOR (ALTERNATING CURRENT GENERATOR)

The rotor of the ACG. (Alternating Current Generator) is the source for the magnetic field which induces current flow in the stator windings. Current for the rotor windings comes from the voltage regulator and is supplied either by the battery (when the machine is not running) or by the stator windings themselves.

Note:

In order to make the explanation easier remember that current flows as a result of voltage (electromotive attraction). Current flows from Positive to Negative. Voltage does not "flow" but is instantly present when a circuit is closed. However, we shall discuss the operation of this circuit in terms of voltage "flow". As soon as voltage is present on a circuit, and there is a complete path for current to flow, it will. The amount of current flow is dependent upon the amount of voltage present to act upon the electrons and the amount of resistance present to oppose electron flow.

a) When the ignition switch is turned on, voltage flows from the battery, through the closed contacts in the voltage regulator, bypassing the dropping resistors in the voltage regulator.
b) From the voltage regulator, voltage passes through the positive brush, to the single rotor winding. If the winding is intact, and the negative brush has been electrical contact, current will begin to flow through the rotor winding.
c) When this current flows, it creates a magnetic field around the wire it flows in. Wind this wire into a tightly concentrated coil and the magnetism will become quite intense. The rotor has now become an electromagnet.
d) The rotor is attached directly to the crankshaft. When the crankshaft revolves, the magnetic field surrounding the rotor windings (due to current flow through the windings) rotates also. The brushes and slip ring on the rotor are necessary in order to maintain electrical contact and current flow during this rotation.

6-5. STATOR (ALTERNATING CURRENT GENERATOR)

The stator consists of three windings of wire surrounding the rotor assembly. It is within the stator windings that current is generated for recharging the battery and running the various electrical circuits on the machine.

a) When the magnetic field surrounding the rotor winding begins to spin, its lines of magnetic flux (force) intersect the windings within the stator. As this takes place, current is generated within the stator windings.
b) This current flow is in the form of alternating current. It is transmitted on the three (white) stator winding wires to the rectifier where it is changed to direct current by the diodes of the rectifier.
c) The stator assembly also holds the brushes for the rotor circuit.

6-6. TROUBLESHOOTING

Troubleshooting the electrical system of the XS650B is relatively simple if a few basic facts are kept in mind.
First, the entire electrical system is composed of the following assemblies.

1. Rotor
2. Stator
3. Rectifier
4. Voltage regulator
5. Turn signal relay
6. Ignition points/condensors
7. Ignition coils
8. Spark plugs
9. Main switch
10. Battery/fuse
11. Accessory switch
12. Light bulbs
13. Wiring loom
14. Horn

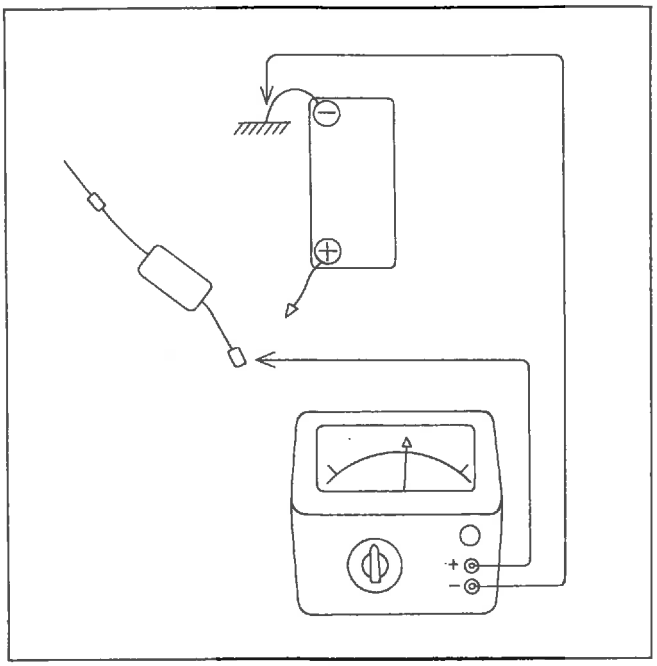
In the majority of instances where a failure occurs the assembly is replaced. This includes lights, switches, coils, plugs, relays, points, condenser and, in most cases, horn. Second; in the assemblies, remember that they are made out of wire and only two things can go wrong with a piece of wire:

1. It can break in two stopping current flow. (Lose continuity)
2. Its insulation can be lost causing it to short circuit with ground or another wire. This can be a direct short with zero ohm between or "insulation leakage" with as much as two million ohms between.

Our troubleshooting list defines the steps taken to search for these two possibilities.

Note:

All these test can be completed with the parts still attached to the machine. It is not necessary to remove anything except inspection covers or miscellaneous items to get to the part.



A. Charging Voltage Output

1. Start the engine.
2. Disconnect the red wire at the fuse box. Hook up a voltmeter from the regulator side of the fuse box to ground.
3. Accelerate the engine to approximately 2,500 rpm. and check the generated voltage. It must read between 14.5 ~ 15 V (DC).
4. If voltage output is off, (and not correctable by regulator adjustment), then each part of the charging circuit must be checked to locate the defective part. Perform these checks in the sequence listed below.

Caution:

Before each resistance test, be sure that the ohmmeter dial has been set at the correct position and needle adjusted to zero.

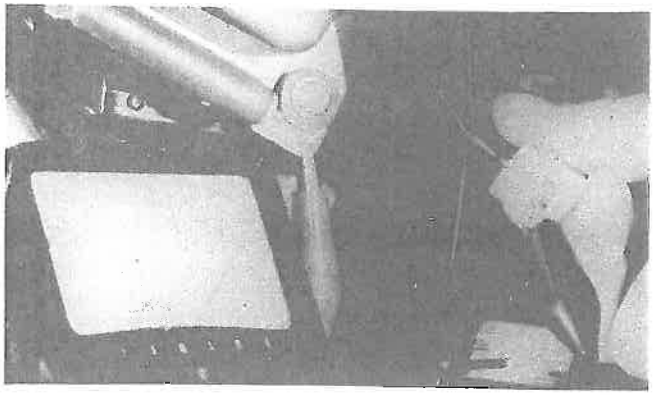
B. Broken wires

1. Check for obviously broken wires or separated connectors (especially multiple connectors). Pay particular attention to any parts that are subject to wear or might be subjected to vibration.

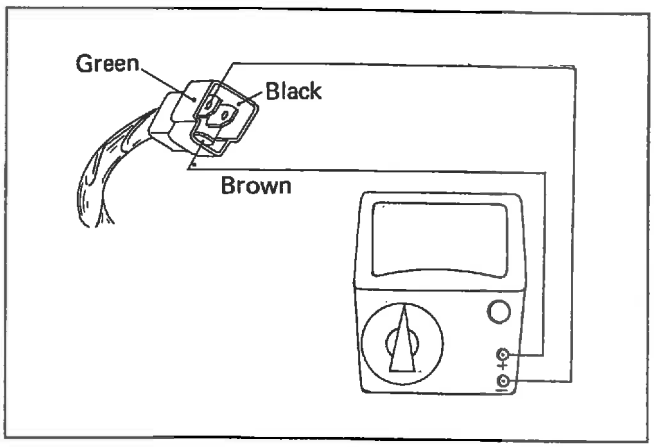
C. Regulator

1. A defective regulator can cause abnormally low or high voltage output. Remove the regulator cover and examine all internal parts for signs of failure. All point surfaces should be reasonably clean. If they are very pitted, or if the central contact point has fuse to a stationary point, then this is the trouble spot. Clean the points if possible. If this does not help, replace the regulator. Also, if any wire is broken, and cannot be soldered back in place, replace the regulator.
2. If visual inspection does not locate any trouble spot then check for proper resistance through all regulator circuits. This is done by separating the regulator multiple connector and measuring resistance through the green, black, and brown wires at the multiple connector.

3. Hook up an ohmmeter (0 ~ 20 ohms), one probe attached to the black wire and one probe to the regulator base. It must read zero ohm resistance. Several ohms resistance indicates a frayed or broken black wire.

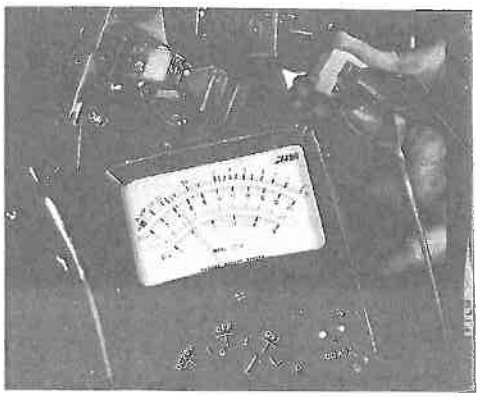


4. Hook one meter probe to the brown wire and the other probe to the green wire.

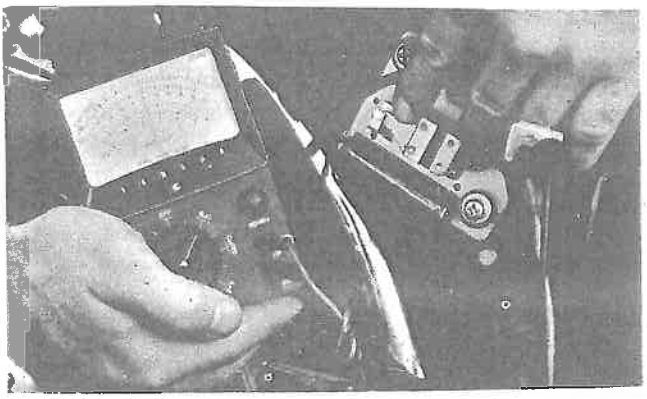


5. Remove the regulator cover.

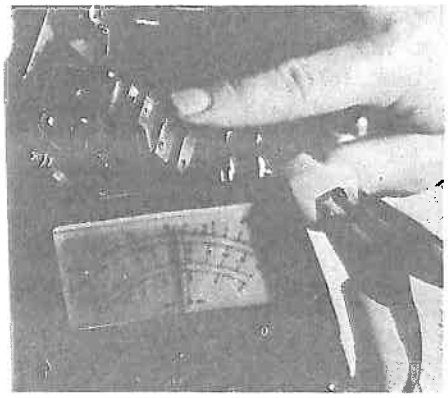
6. With the central contact point held against the top point by the spring (as in the low rpm. position), the meter should show no resistance at all (two ohms resistance is too much). If high resistance exists, one of the wires is broken, a soldered joint has separated, or the points are burned. The unit usually requires replacement if the problem cannot be cured by cleaning the points.



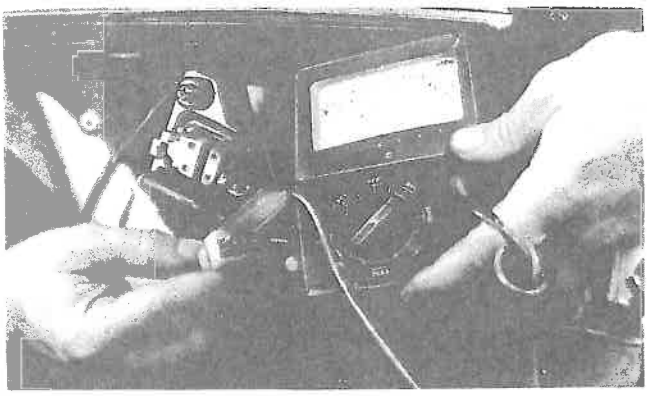
7. Maintain the same meter hook-up as step four.
Push the central point arm until the point is positioned mid-way between the top and bottom points. The meter must read 9 ~ 10Ω resistance. If the observed resistance varies from this figure, the 10Ω regulator resistor has failed; either internally or at its solder points.



8. Maintain the same meter hook-up as step four. Push the central point down until it contacts the bottom point. The meter must show a 7 ~ 8Ω resistance value. Check the condition of both contact points as burnt points can cause an improper reading.



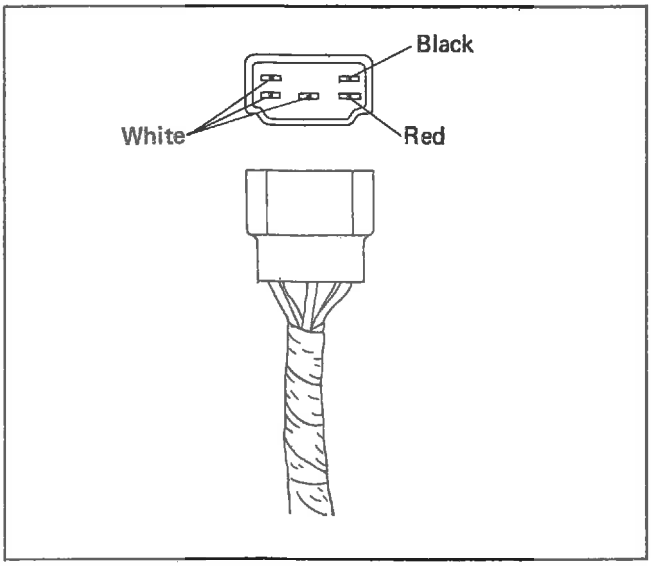
9. At the multiple connector, hook the ohmmeter to the black and brown wires. Permit the central point to spring up against the top point and measure the resistance. It must measure 36 ~ 38Ω resistance.



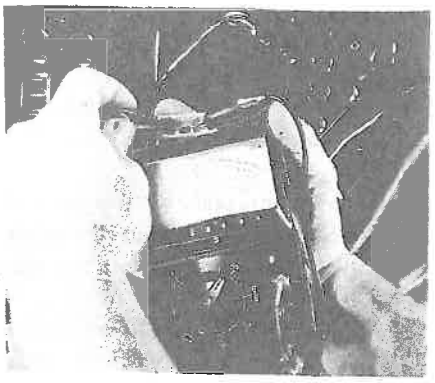
10. A correctly operating regulator will give the resistance values as listed in each test. If the measured values differ and the variation cannot be blamed on a broken or disconnected wire (that can be resoldered), replace the regulator unit. If a complete regulator resistance test shows all circuits to have correct resistance, the regulator is probably not the cause of improper voltage output. The next charging circuit component must be checked.

D. Rectifier

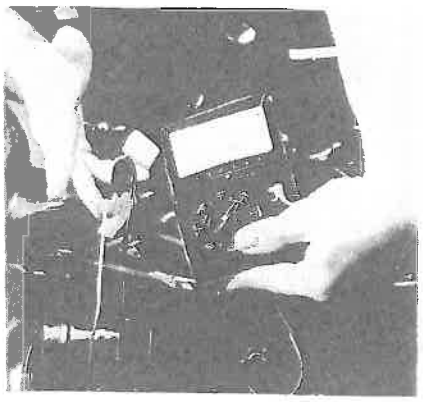
1. Check the rectifier for proper one-way electrical flow through the diodes. Trace the rectifier wiring back to its multiple connector and disconnect it. Inside the connector are five metal prongs.
2. The prongs are connected to three white wires (that hook up to the alternator wires), one black wire (to ground) and one red wire (to battery and main switch). Perform the following tests, using an ohmmeter (0 ~ 1000Ω scale) to check the condition of the rectifier.
3. Visually check all rectifier wires for breaks.



4. Clamp the black probe to the black wire and touch the other positive test lead to each white wire in the connector. Next, reverse the position of the meter probes and again touch each of the white wires. For these diodes to be good the meter must show a small resistance (75 ~ 150Ω) reading one way and almost infinite resistance with the probes reversed.



5. Attach one meter probe to the red wire and again touch each white lead with the other probe. Reverse the probes and again touch each white lead. The resistance readings must be identical to those in 4.



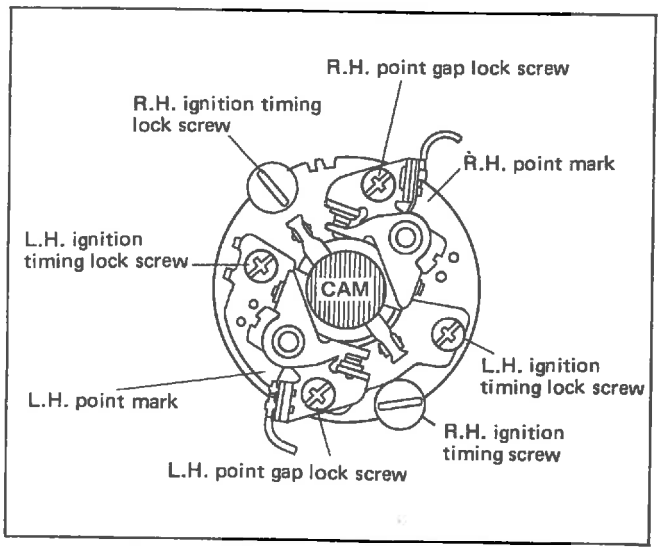
6. All rectifier wires directly attached to the diodes are fully insulated. If any are broken, replace the unit.
7. If resistance results of steps 4. and 5. show that current can flow both ways, or neither way, then one or more diodes have been damaged. Replace the unit.

E. Ignition breaker points

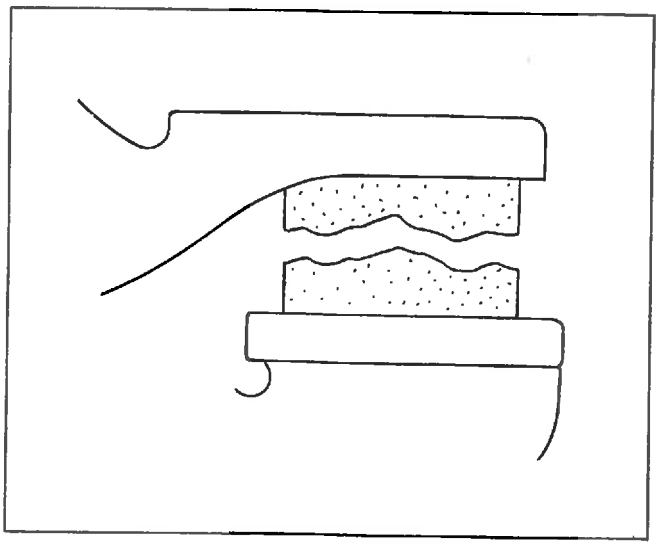
This unit is equipped with two independent sets of ignition points; one for each cylinder. They are both located in a single housing mounted on the left end of the camshaft.

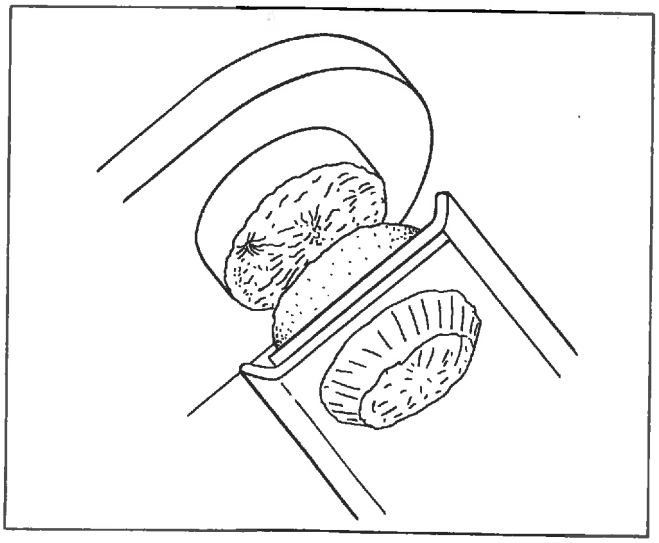
The points act as circuit breakers for the ignition system. A point cam spins counterclockwise in the center of the ignition unit. A lobe on the cam controls the opening and closing of the points.

When the points are closed, current flows to the primary coil (which begins to build a magnetic field). At a precisely calculated point of crankshaft rotation, the cam forces the points apart, which stops current flow to the primary winding in the ignition coil. High voltage is then generated in the coil's secondary winding and causes a spark to jump the plug electrodes.



1. Wear
   a) The points gradually become burnt and pitted. This is normal wear. However, metal from one point might transfer to the other. If this metal build-up cannot be cleaned off with a point file, the points should be replaced.

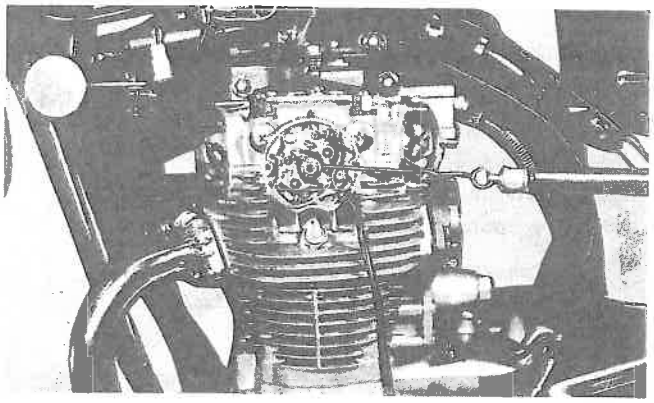




b) Oil may gradually seep past the seal and coat the points or wiring. This will burn onto the points creating an insulating film. It must be cleaned off with ignition cleaning solvent.

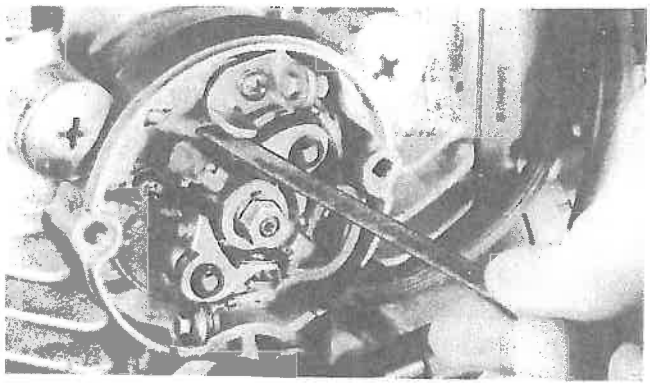
c) The fiber cam follower mounted on the pivoting point arm rubs against the cam. Eventually this block wears down which results in a reduction of the point gap and retarded timing of that cylinder. The remedy is to regap the points and check the timing (timing should be checked any time the points are re-gapped.)

d) If a point return spring becomes weak or broken, the pivoting point will bounce. Timing will become erratic and ignition firing will be uneven. Measure spring tension by attaching a scale (measured in grams) to the pivoting point. It should take 700 ~ 800 g. to cause the points to separate. (Use a point checker to measure the separation electrically).



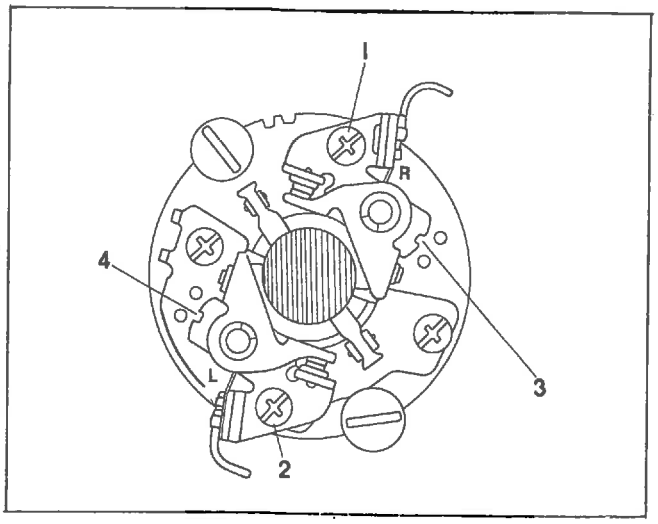
2. Repair

a) Point gap on each set of points must be set at 0.012 in. – 0.018 in. (3 – 45 mm.). Constant electrical arcs across the points cause some metal to burn away, changing point gap. Clean and regap the points every 2,000 miles. Check timing after re-gapping.



b) To clean the points, run a point file between the points until the grey deposits and pits have been removed. Spray the points with ignition point cleaner or lacquer thinner, then snap the points shut on a white business card (or paper of hard texture) and repeatedly pull the card through until no more carbon or metal particles come off on the card. (The card may be dipped in lacquer thinner or other cleaner to facilitate this procedure.)

c) To gap the points, first rotate the engine until the ignition cam opens the points to their widest position. Slip a 0.4 mm. feeler gauge into the gap. It must be a tight slip fit. If an adjustment is necessary, loosen the point lock screw (1 or 2) as shown in the accompanying drawing, insert a screwdriver into the adjustment slots (3 or 4), and open or close the points until the feeler gauge indicates the correct gap. Retighten the lock screw and recheck the gap.



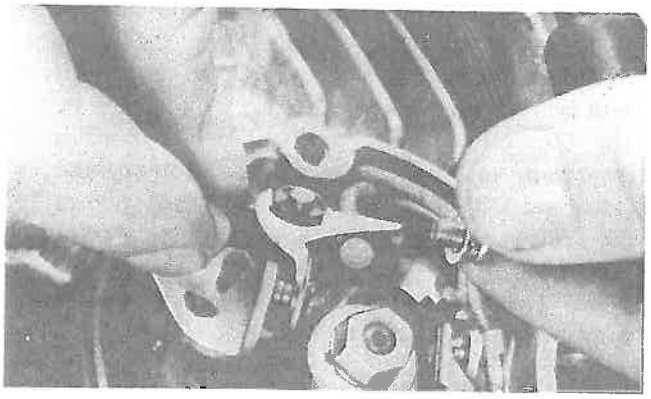
d) Next, rotate the camshaft until the second set of points opens to its widest point. Then perform the same steps as described in the previous paragraph.

Note:

Add a few drops of light-weight oil onto the felt rubbing pad after each point adjustment to lubricate the point cam surface. Do not over oil.

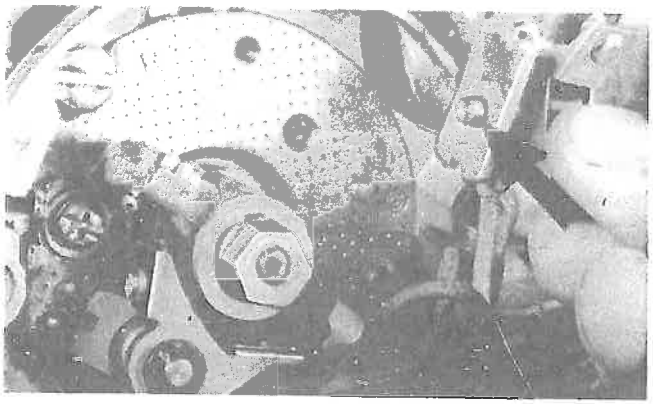
3. Replacement

a) Unscrew the point wire securing screw. Completely remove the point lock screw. Lift the entire point assembly up off the point base plate.



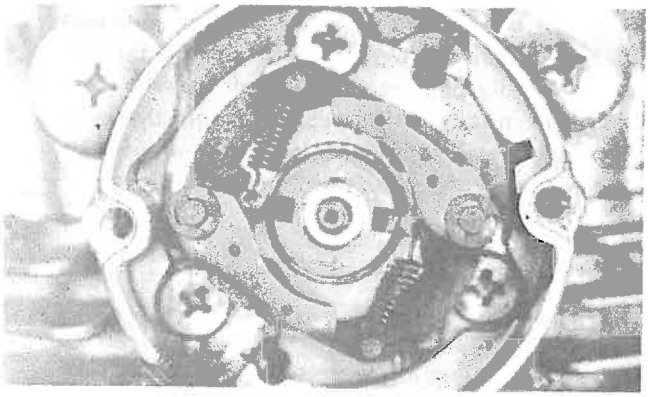
b) Locate the new set of points into position by slipping the point assembly locating pin into the appropriate locating hole in the base plate.

c) Insert and tighten the point lock screw. Finish this replacement by attaching the point wire to the stationary point and re-gapping the new point assembly.

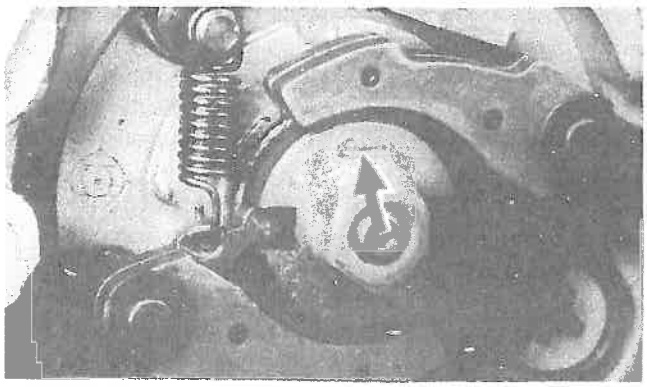


F. Advance assembly

1. The governor rod is threaded at one end and a notched disk is attached to it by a nut. Around this disk is the advance unit which mounts directly to the end of the camshaft (a ring nut holds it in place).
   Two centrifugal weights pivot on pins. Each weight has a small extension that fits into the disk notch. As engine rpm. increases, both weights begin to swing out on their pivot pins due to centrifugal force acting on the rotating unit. The weights continue to swing outward as rpm's increase until the weights are stopped by fixed stopper pins. As these weights pivot, the extensions in the disk notches cause the disk to rotate. Since the disk is directly attached to the point cam rod, the ignition point cam also rotates, which causes ignition timing to advance.

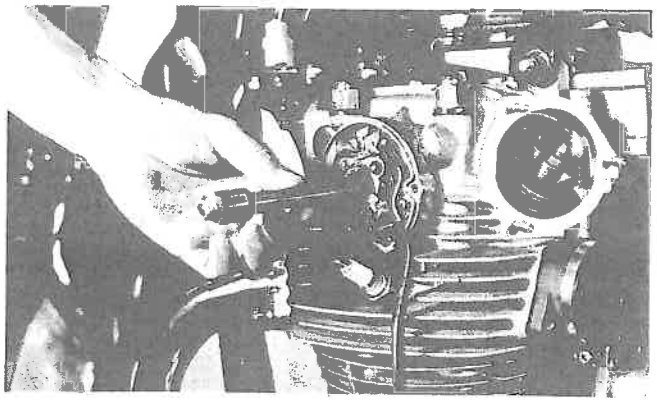


Advance arm stops

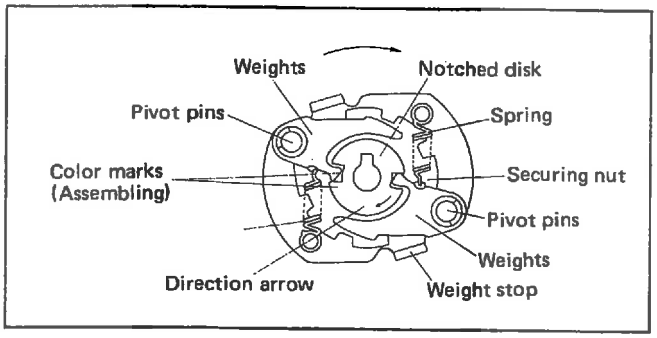


Proper assembly procedure (direction arrow)

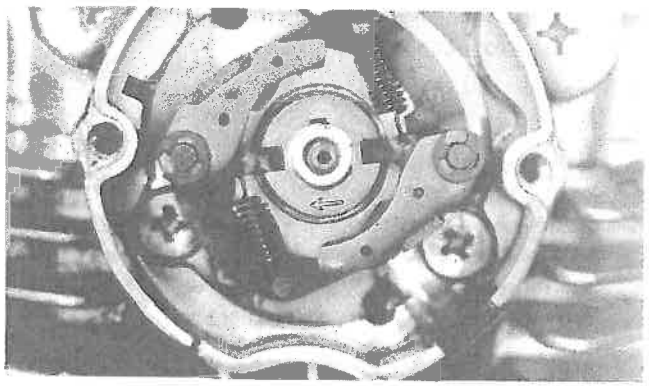
2. Both weights must pivot smoothly or ignition advance will not occur at the proper rpm., nor will it advance to its fullest extent. On occasion, light-weight grease must be applied to the weight pivot pins.



3. The advance unit mechanically changes ignition firing from 10° BTDC at low rpm. to 38° BTDC at high rpm. (full advance). The ignition point cam is attached to one end of a rod that travels completely through the center of the camshaft. The rod is bolted squarely to the camshaft. The point cam opens and closes the points. The other rod end provides a mounting point for the advance unit.



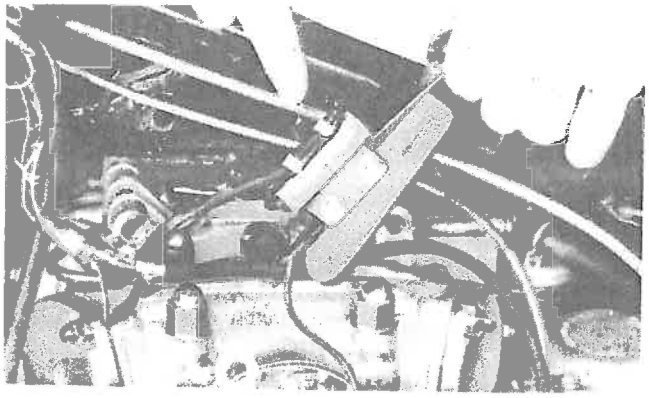
4. If a return spring is broken, the ignition timing will advance too quickly. This condition causes poor performance and excessive engine heat.



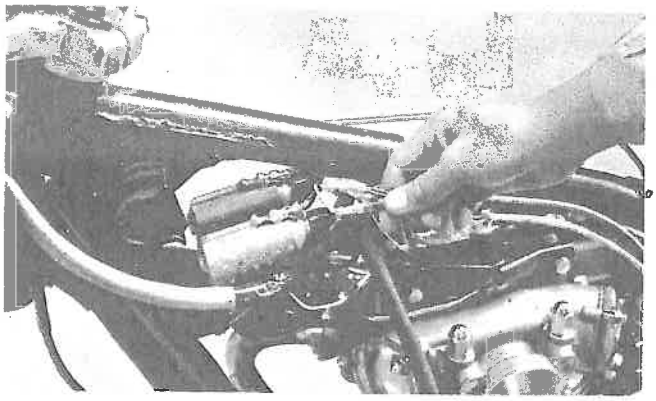
5. If the notched disk has been installed incorrectly, timing will be advanced too early. A groove in the mounting hole that fits over a pin in the rod, plus the color marks that have been matched up, prevents the disk from being installed 180° off. However, the direction of rotation arrow must face outward or the disk will be installed incorrectly.

G. Condenser

1. The ignition condensers are located on the left-hand side of the top engine mounting bracket. The two condensers are mounted as a single assembly and must be replaced as a set in the event of failure.

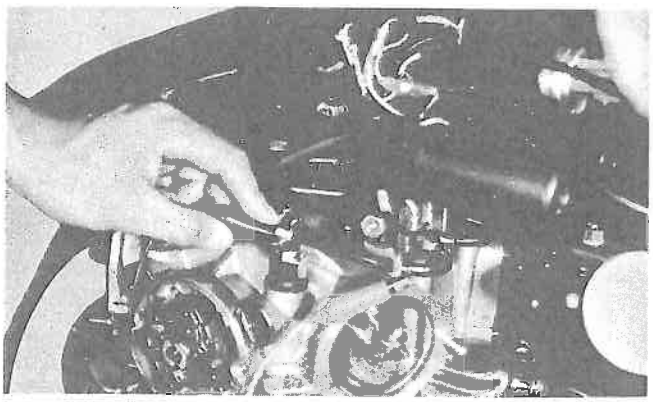


2. The condensers serve as a storage device to decrease arcing across the ignition points. Should one fail there could be either no spark or severe point pitting due to arcing. In the vent of severe arcing there is also the possibility that the strength of the ignition spark may be decreased.

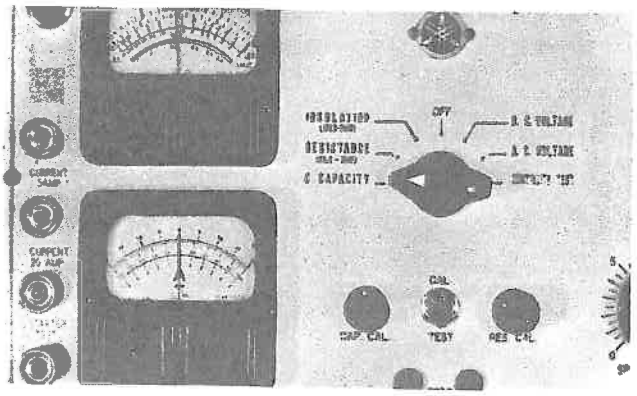


3. To test the condition of either condenser, pull the male/female connection apart.

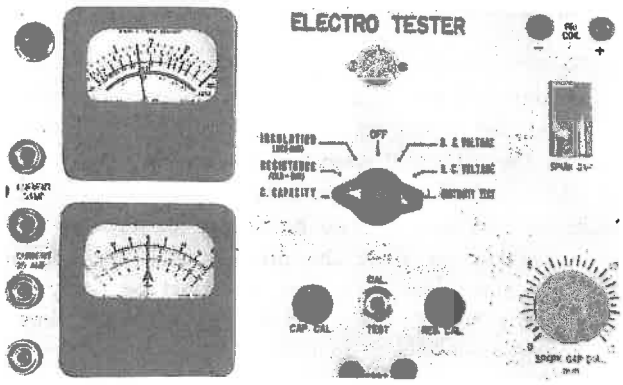
4. Hook an ohmmeter to the condenser. Black (Neg) lead to the condenser case, Red (Pos) lead to the wire running from the center of the condenser. There will be a momentary flow of current and then the condenser should show at least 5+ million ohms resistance between the positive terminal and ground.



5. Next, hook up an electrotester to the condenser. (leads in the same position). Turn the main function switch to "Capacity" and the calibration switch to "Cal.".

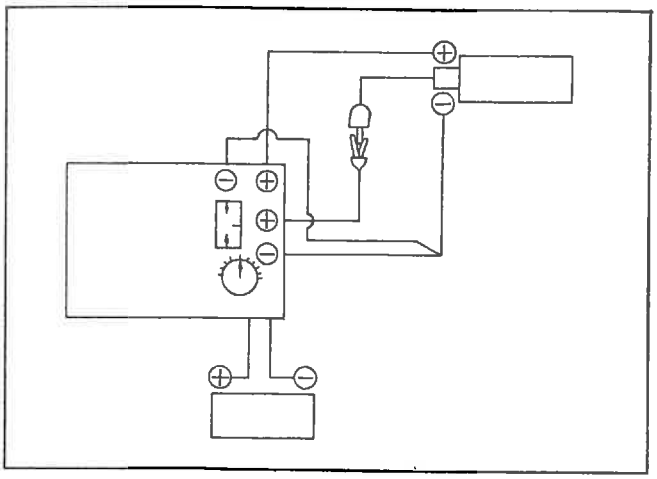


6. Turn the "Cap. Cal." knob until the meter needle is mid-range (in the black) on the red meter section for "Capacity".
7. Turn the Calibration switch to "Test". The needle should stay in approximately the same position. If it moves very far into the red, replace the condenser assembly.

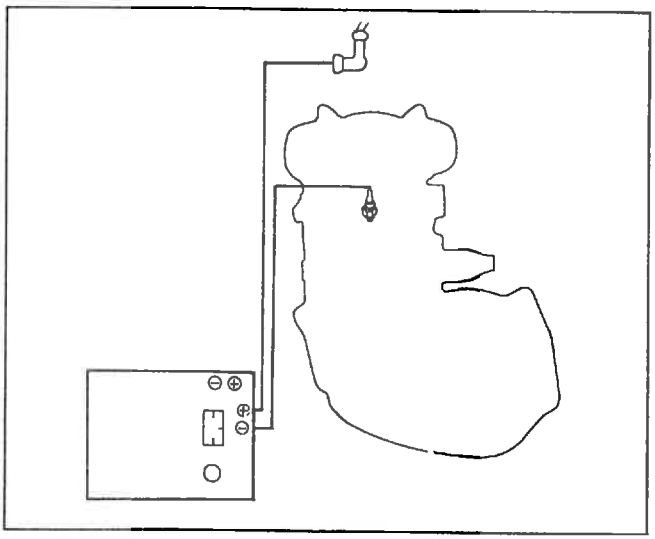


H. Ignition coil

1. Location
   The ignition coils are mounted to a bracket directly in back of the steering head. They can not be removed until the gas tank is removed.
2. The ignition coils can be checked on the machine. It is not necessary to remove either the coil or the gas tank unless the coil is defective and needs replacing.
3. Static Test:
   Follow the diagram at the right to check the coil. Leave the ignition key off and block the points open with a piece of paper. The coil should show at least 8 mm. spark gap. (Instructions for setting up the Electrotester can be found on the Electrotester cover.)



4. Dynamic Test:
   Follow the diagram at the right for setting up. Close the point gap on the Electrotester to zero. Turn the ignition on and start the machine. Rev. the machine to 2000 ~ 3000 rpm. (or the rpm. you wish to test at) and begin opening the tester's point gap. When the engine begins to misfire, close the point gap until it runs smoothly again. Point gap should be at least 7 mm.



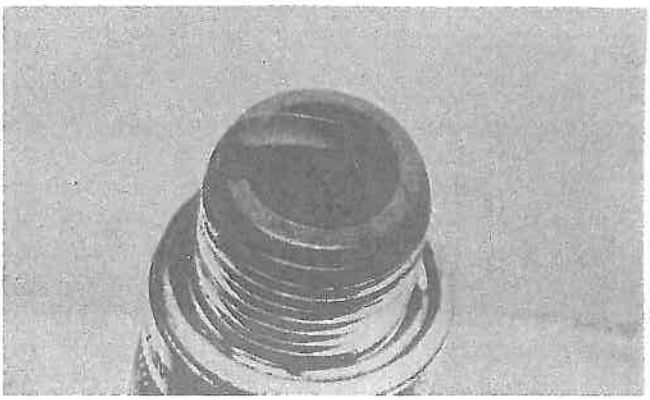
6-7. SPARK PLUG

The life of a spark plug and its discoloring vary according to the habits of the rider. At each periodic inspection, replace burned or fouled plugs with suitable ones determined by the color and condition of the bad plugs.
One machine may be ridden only in urban areas at low speeds, whereas another may be ridden for hours at high speeds, so confirm what the present plugs indicate by asking the rider how long and how fast he rides, and recommend a hot, standard or cold plug type accordingly.
It is actually economical to install new plugs often since it will tend to keep the engine in good condition and prevent excessive fuel consumption.

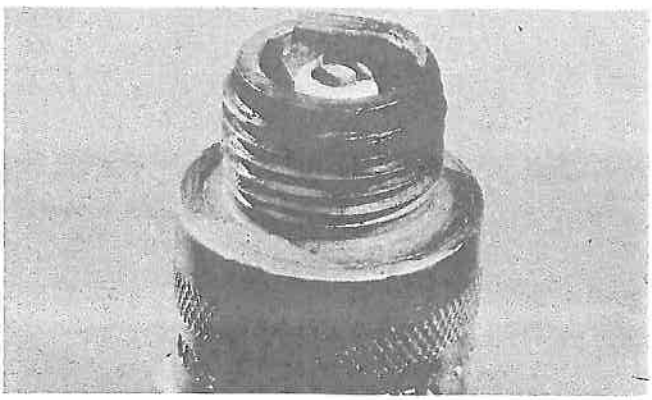
A. How to "read" spark plug (condition)

1. Best . . . . . When the porcelain around the center electrode is a light tan color.

2. If the electrodes and porcelain are black and somewhat oily, replace the plug with a hotter-type for low speed riding.



3. If the porcelain is burned white and/or the electrodes are partially burned away, replace the plug with a colder-type for high speed riding.

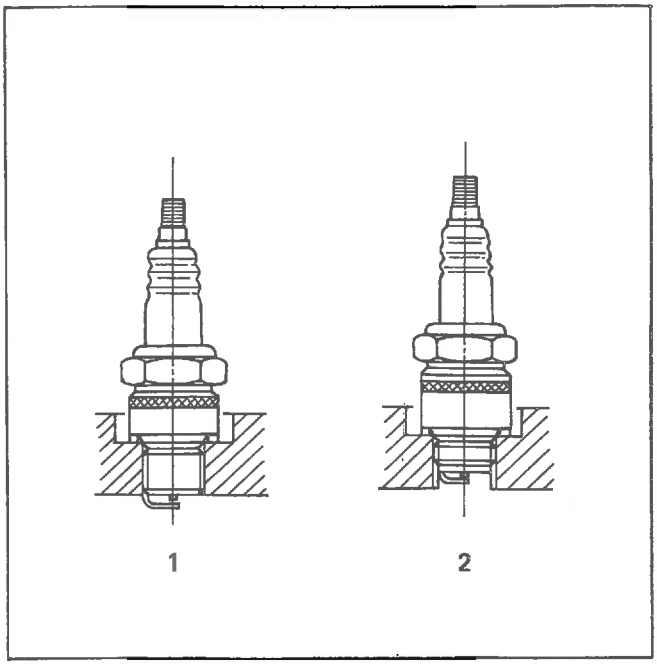


B. Inspection

Instruct the rider to:

1. Inspect and clean the spark plug at least once per month or every 500 ~ 1000 kms.
2. Clean the electrodes of carbon and adjust the electrode gap.
3. Be sure to use the proper reach plug as replacement to avoid overheating, fouling or piston damage.

	Model
Spark Plug Type	B-8ES
Spark Plug Gap	0.020 – 0.024 in. (0.5 – 0.6 mm.)



1. Proper reach 2. Insufficient reach

6-8. MAIN SWITCH

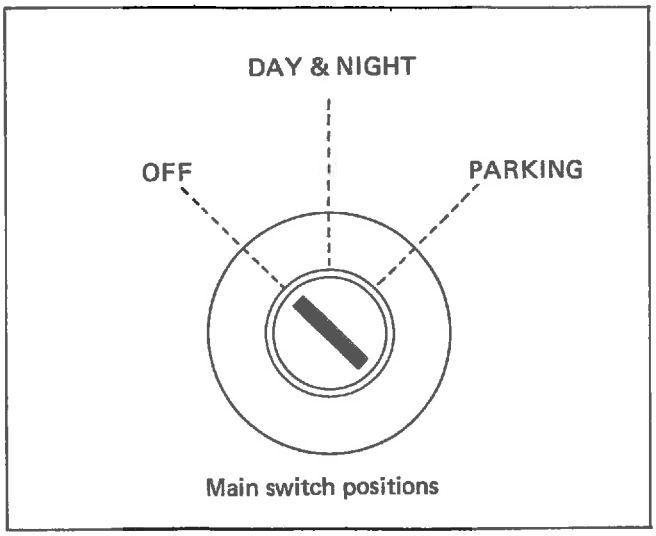
A. Main switch

The XS650B use a three position switch that directs current from the battery (or alternator) to the various lighting and ignition circuits.

1st position: Prevents current from flowing to any circuit.

2nd position: Supplies current to all day and night circuits, including (1) horn, (2) ignition coils, (3) front and rear stop switches, (4) turn signal switches, (5) all indicator lights, (6) and headlight/taillight switches.

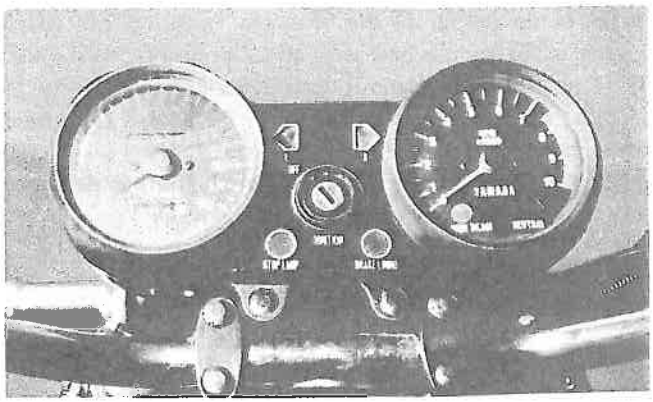
3rd position: Only the parking light is activated.



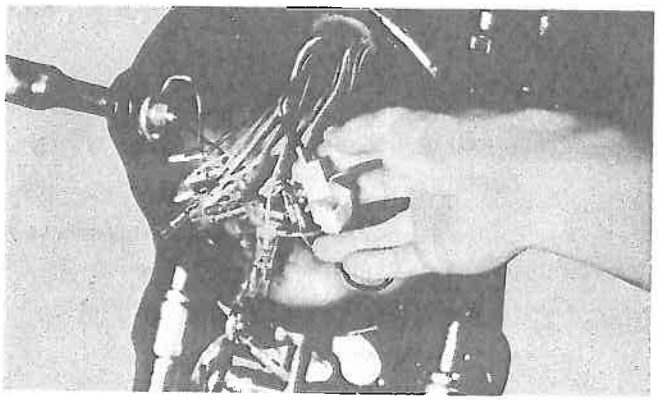
Main switch positions

B. Location and replacement

1. The switch is mounted on the tachometer/speedometer bracket. Remove both Phillips-head screws.



2. Remove the headlight. Two Phillips-head screws at the bottom of the shell hold it in place. Reach inside the headlight shell and disconnect the main switch multiple connector. The main switch can now be removed from the machine.



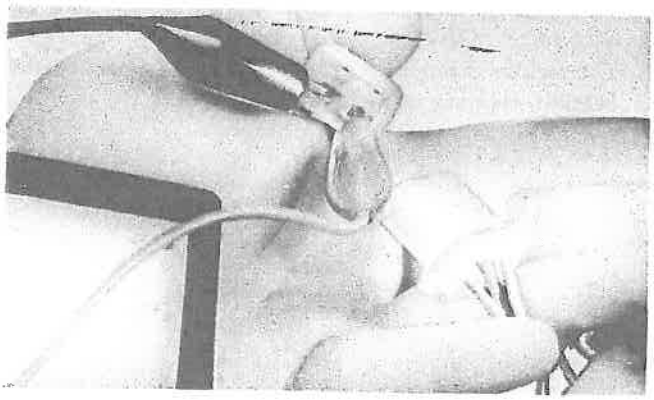
C. Troubleshooting

1. If voltage from the battery (or alternator) reaches the main switch (through the red wire), but, the same voltage does not pass through the switch, then it should be checked.
2. Use a pocket tester or electro-tester with the meter set to register continuity (Ohms x 1). The switch does not have to be removed from the machine but its multiple connector in the headlight must be disconnected. Make all continuity checks at this main switch multiple connector.

3. Four wires hook into the multiple connector, red, blue, brown, and red/yellow. Hook one lead of the tester to the red wire and use the other as a probe. First, check that there is no continuity between the red wire and the switch housing.

4. Turn the switch to the "Day-Night" position, Probe with the unattached meter lead. Touch the brown wire end and then the red/yellow wire end.
Continuity must exist.

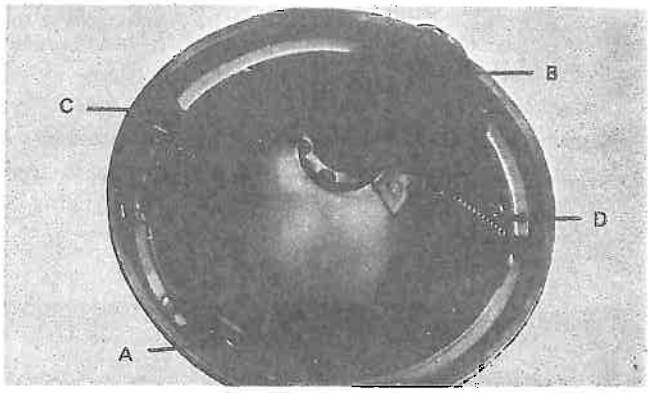
5. Turn the switch to the "Parking" position and touch the probe to the blue wire end. Continuity must exist.
6. If any of the previous tests reveals no continuity to exist check all main switch wires. If these wires appear to be in satisfactory condition (not broken or shorted to the frame), then the main switch itself is defective and must be replaced.



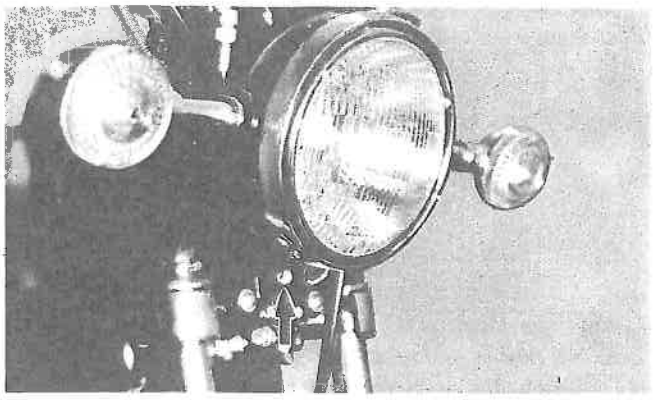
6-9. LIGHTING CIRCUIT

A. Headlight

1. The headlight is a semi-sealed unit with a non-replaceable filament. If the headlight burns out, replace the entire headlight bulb unit.
2. Replacement:
   Remove screws "A", "B" and "C" ("C" is the side adjustment screw). Unhook spring "D" and pull the defective unit out of its shell. Slip a new unit into position and install parts "A", "B", "C" and "D".

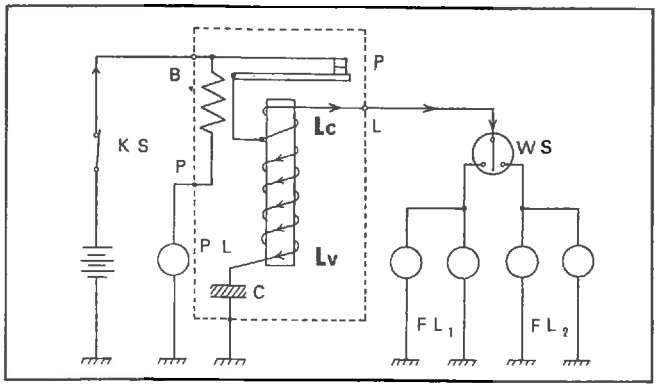


3. Adjustment:
   Screw "A" controls side-to-side headlight movement. Screw it in or out until the headlight beam is centered.
4. Headlight up and down movement is controlled by bolt "B". Loosen this bolt and tilt the headlight into position, then retighten the bolt.

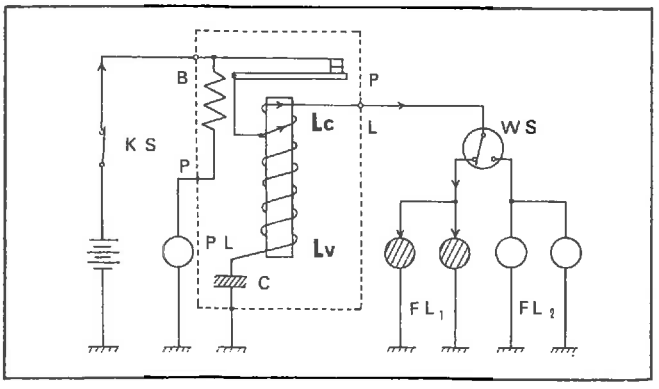


B. Turn signals

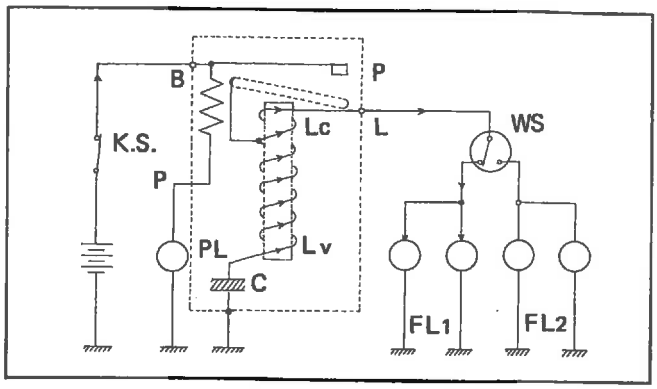
1. Voltage flows from battery to the relay condenser. The condenser becomes fully charged (including wire to flasher switch) and all voltage flow stops in the relay.



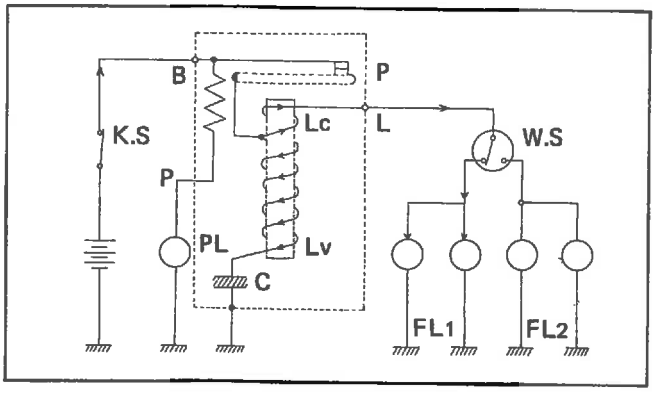
2. When the realy switch is activated, voltage flows from the battery through the "Lc" winding and causes the flasher to light.



3. At the same time that voltage lights the flasher, the "Lc" winding around the metal core creates an electro-magnet that pulls the contact points apart. Voltage flow stops and the flasher lights go out. Magnetism to hold the points apart is momentarily maintained because the stored electrical charge in the condenser discharges back through "Lv" and "Lc" winding. The stored condenser amperage, however, is no sufficient to light the flasher lights (due to their being a high resistance load), so both flasher lights do not light again.



As soon as the condenser becomes sufficiently discharged, magnetism ceases and the point spring pulls one point into the other. Voltage once again flows to the flasher lights, causing them to light. At the same time some voltage charges the condenser. The process continues to repeat itself until the switch is turned off.



4. Improper Operation
   a) No flasher action at all:
      Check for a broken or shorted wire in the turn signal circuit.
   b) Too slow or too fast flasher action:
      A burned out flasher bulb will slow the flasher action. Check the condition of all flasher bulbs. If flashing action is too slow, and all bulbs are good, the flasher relay (condenser inside) is defective. Replace the relay.

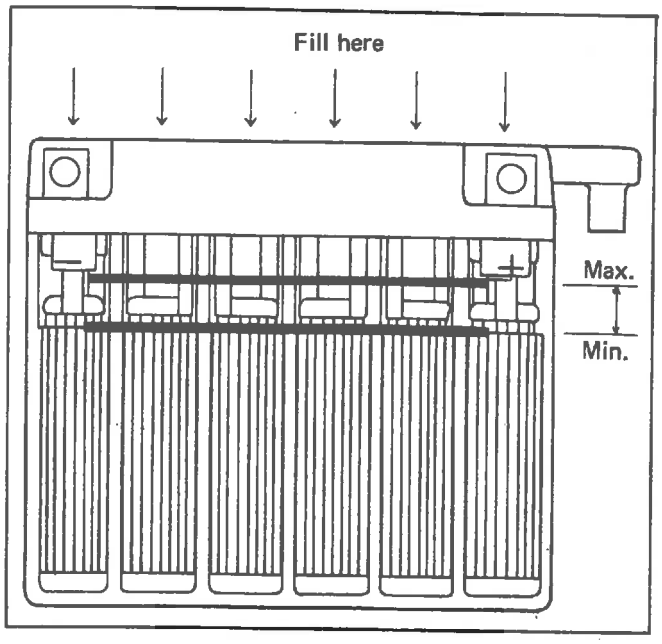
6-10. BATTERY

A. Servicing a new battery

1. Check the housing for cracks or other damage. Fill the battery with electrolyte and let set for an hour. This allows the acid to soak into the plates. With the caps off, hook up a trickle charger to the battery and charge it at 1 amp/hour rate or less. Check the specific gravity. A fully charged battery should have a rating of 1.260 ~ 1.280. If the electrolyte has dropped below minimum level after charging, add electrolyte (rating of 1.260 ~ 1.280).

B. Battery maintenance

1. Periodic inspection can determine the condition of the battery housing and the condition of the internal parts. Check for cracks or holes in the housing. Check for broken plates, sulfation, low fluid level and corroded terminals.
2. The battery housing is marked with a minimum and maximum fluid level. If any cell fluid level drops below the minimum level, fill with distilled water to correct height. Check once a month or more often in hot weather. Do not use tap water.



C. Charging

1. Remove the battery and check the specific gravity of the battery fluid. A fully charged battery reads between 1.260 ~ 1.280. If the rating is less than 1.260, the battery needs charging.
2. Fill the battery to the proper level with distilled water. Leave the fill caps off until battery charging has finished. Use a battery charger that has a maximum output of 1 amp. The XS650 battery uses a 12 amp/hour battery. DO NOT exceed a one amp input as excessive heat may be generated within the battery.

Note:

Battery fluid level sometimes drops during charging. Refill if necessary, using distilled water.

D. Troubleshooting

1. Excessive fluid evaporation from cells: Normal battery operation requires fluid to be added to the cells approximately once a month. If distilled water must be added every week or two, the battery is possibly being overcharged. Check voltage input from the alternator.
2. Low fluid level in one cell: If one cell continuously loses more fluid than others, check for a shorted cell. A shorted cell creates abnormal fluid evaporation. Check with a hydrometer for excessive difference in specific gravities between the cells.
3. Won't hold a charge:
   1) First check the alternator output to eliminate the possibility of a low charging rate. Next, check for loose terminal connections (creating high resistance), or a build up of material in the bottom of the housing that could short the plates. Nothing can be done about loose terminals themselves except to replace the battery.
   Sediment at the bottom of the housing can sometimes be removed by flushing the battery out several times with distilled water if the cell is discharge; flush with electrolyte if fully charged. Dry the battery off and recharge for a few hours. If enough loose sediment is flushed out, the battery could hold a charge. If the battery still cannot hold a full charge, replace it.

4. Sulfation: Sulfation, in the form of a white, scaly material, gradually forms on the plates and at the bottom of the housing. It is created over a period of time as the sulfuric acid combines with the lead plates to produce lead sulfate (white particles of sulfation). It is a product of age and use. The battery usually needs to be replaced when sulfation reaches the point of shorting out the plates.
5. Make sure that the wires are hooked to the proper battery terminals. The red wire must be hooked to the "positive" terminal, the black lead must be hooked to the "negative" terminal. If the wires are reversed, the battery will quickly loose its charge. Very likely the battery will be destroyed if the reversed hook-up is left connected for any length of time.

E. Storage

1. Whether it is a new battery or one that has been in service, preparation for storage of either one is almost identical. When new, the battery is dry charged (no electrolyte). Keep it away from moisture and heat. A stored dry-charged battery can last several months without losing a great deal of its charge.
2. A used battery should be filled to the maximum level with distilled water, given a complete charge and stored in a cool area (coldness slows the process of battery discharge). It should be given a booster charge every two months. When preparing to place a stored battery back into service, check for sufficient electrolyte and fully charge the battery.