

MARINE

INTEGRAL ELECTRONIC IGNITION SYSTEM



prestolite.

1

Prestolite Presents



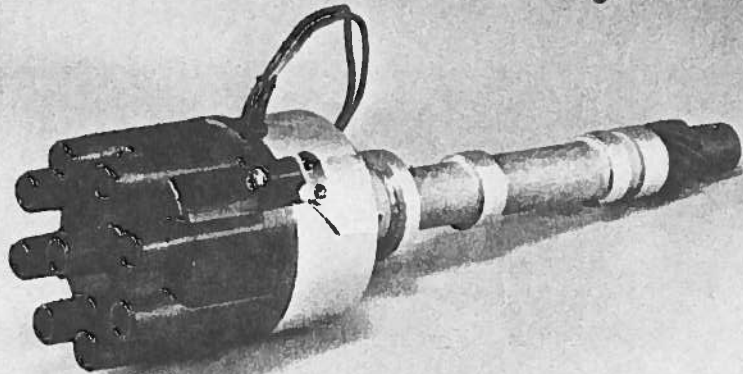
prestolite

PRESENTS

2

Electronic Ignition for Marine Engines.

Electronic Ignition for Marine Engines



3

The electronic ignition system maintains a tuned engine condition longer since there are no points or condenser. Breaker point erosion and rubbing block wear is eliminated. Wear on the distributor shaft and shaft bearings is greatly reduced. Dwell is controlled by the electronics and sensor air gap. Total electronic switching offers improved starting. The system is easy to troubleshoot requiring no elaborate test equipment or procedures.

- Maintains tuned condition
- Shaft bearing wear due to breaker point forces is eliminated
- Dwell is controlled by electronics and sensor air gap
- Starting is improved
- Easy to troubleshoot (no elaborate test equipment needed)

4

The electronics are fully protected with a moisture resistant material and are designed to resist shock and vibration. Protection against reverse polarity and overvoltage is built into the system.

- Shock and moisture resistant
- Reverse polarity protected
- Operates at temperature extremes

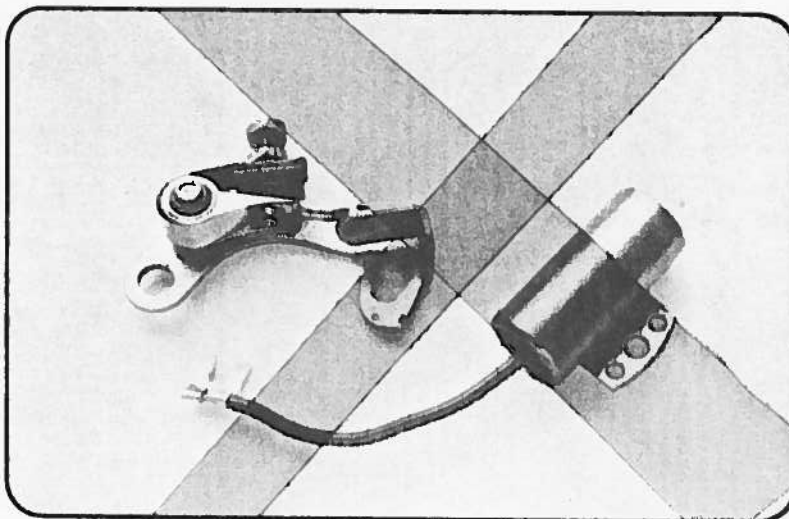
5

This system will trigger at any speed above zero R.P.M. Each cylinder will fire at the proper time because of close tolerances in the trigger wheel design. Elimination of points and condensers and their inherent problems such as rubbing block wear, plus the longevity of solid state circuitry offers much less downtime and more economical operation.

- Fires at very low cranking speeds
- Extremely accurate firing
- Economical operation
- Less downtime

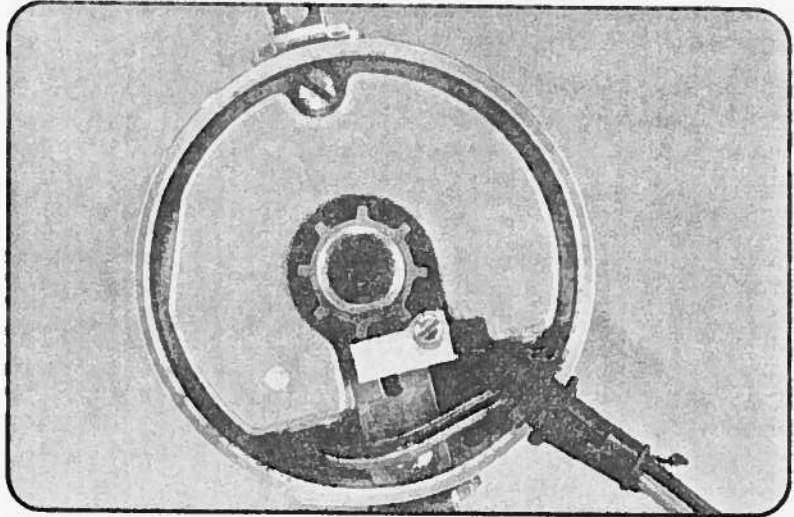
6

The electronic system provides better overall performance because there are no mechanical parts to deteriorate, so the engine stays "in tune" indefinitely.



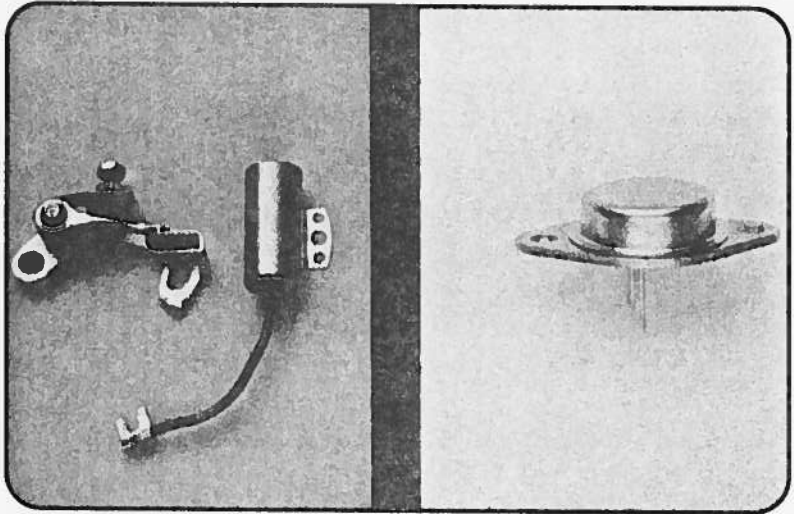
7

A sensor and trigger wheel device replaces the points and condenser in the distributor and control the precise timing needed to fire the spark plugs. The electronic ignition unit controls timing and dwell by accurately making and breaking the ignition coil primary circuit.



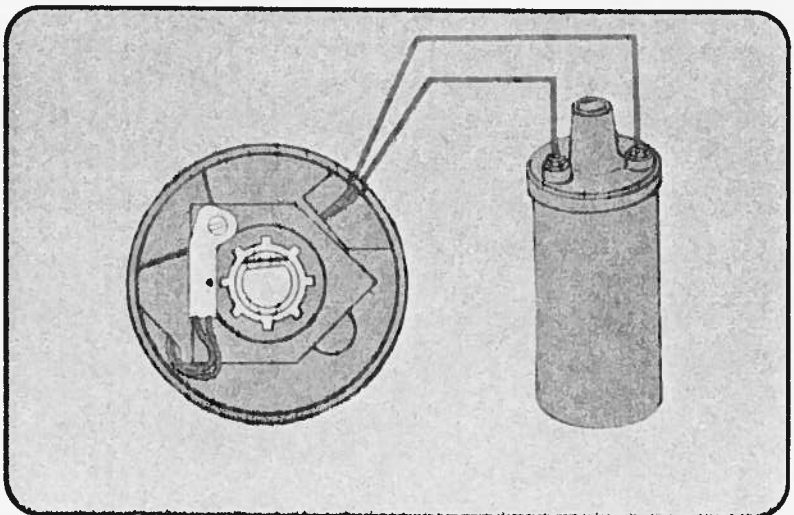
8

The industry has previously used a mechanical switch to make and break the ignition coil primary circuit (breaker points and condenser). Electronic systems accomplish this same duty by means of an electrical switch "transistor".



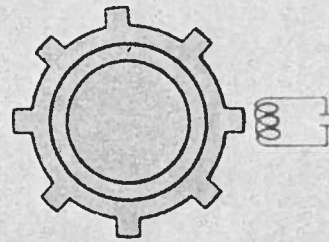
9

The Prestolite electronic ignition system is "integrated", in that the electronics are housed inside the distributor. Only two connections are made to the coil. The electronic control module contained in the distributor is connected to the battery via the coil positive terminal and grounded through the distributor base.

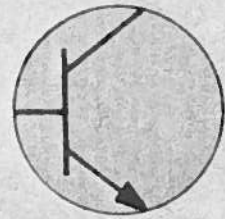


10

The Prestolite design is known as a "tuned" system. It uses an oscillator as its sensor. Acting as a "metal detector," it senses the trigger wheel teeth turning with the distributor shaft. The presence of metal (each tooth) causes a change to occur in the oscillator which in turn commands the control unit transistor switch to turn off.



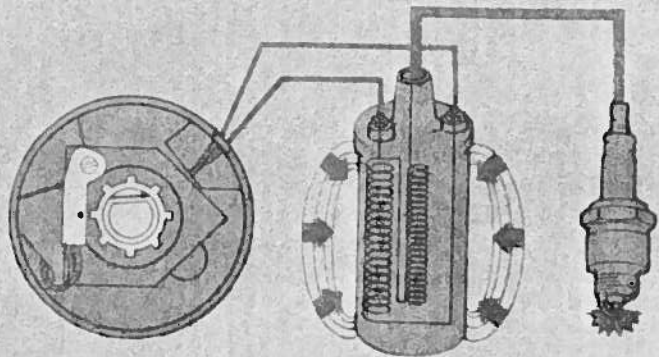
Metal
Detected



Transistor
Turns
Off

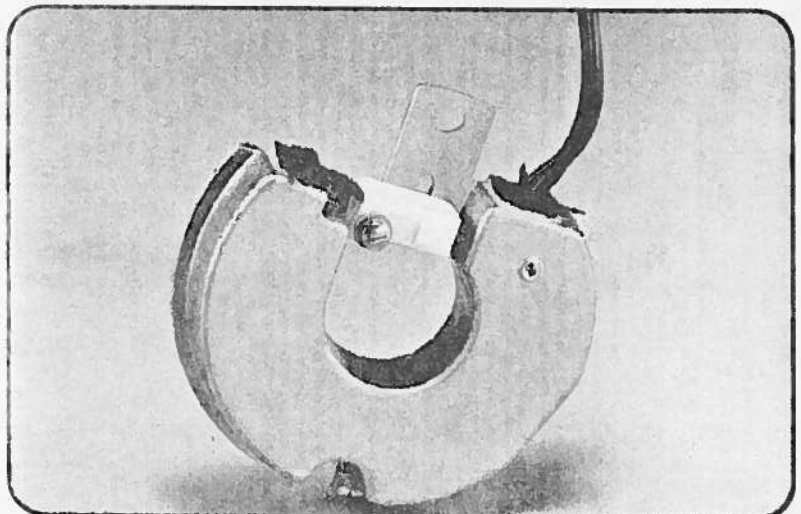
11

This off condition causes the primary current to stop flowing and the magnetic field, which built up during the on time, will collapse across the secondary coil winding causing a high voltage to fire the spark plug.



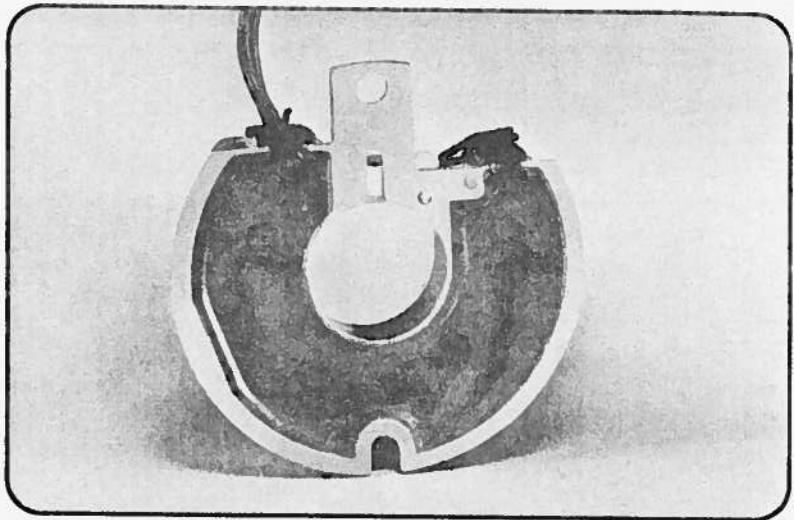
12

The sensor is a coil of very fine wire molded into a plastic housing. This plastic housing is mounted on the base plate and connected directly to the circuit board. The sensor is not replaceable.



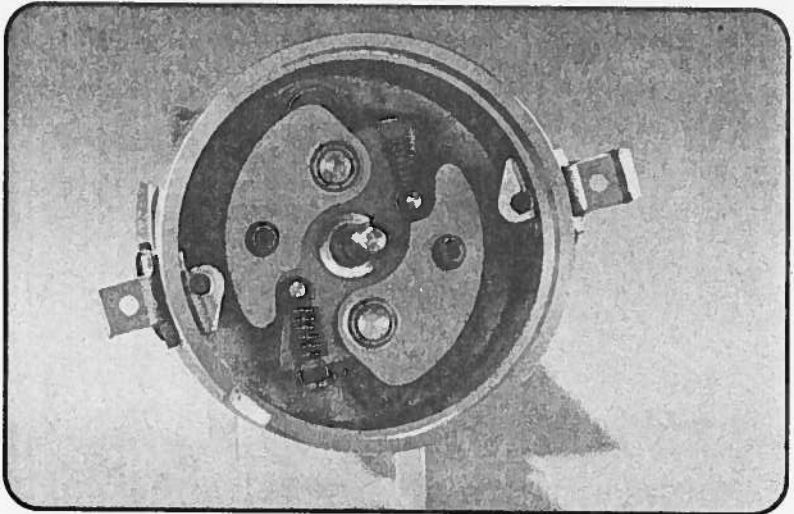
13

The electronic control system is a completely self-contained solid state device which is encapsulated with a potting compound to provide a vibration and moisture proof barrier. It is not repairable and, if necessary, must be replaced as a complete assembly.



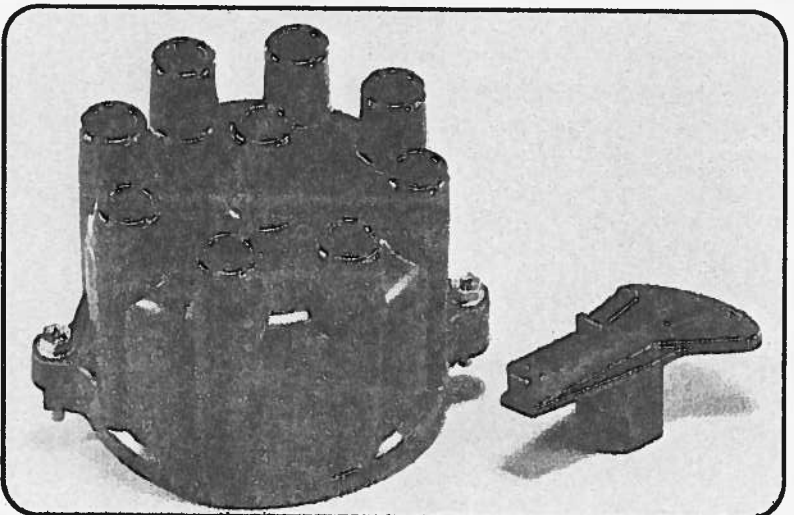
14

The distributor is of conventional design using a centrifugal advance mechanism to control timing.



15

The distributor cap and rotor are of a superior design to give excellent dielectric strength and tracking resistance.



16

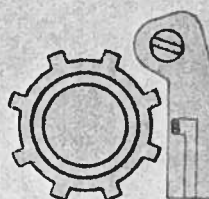
The ignition coil is of a special design for use with this system. A low resistance primary winding achieves high output for starting. A ballast resistor is not used as primary current is regulated in the electronics.



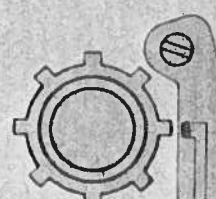
17

As mentioned before, this system operates as a metal detecting system. The detected metal is each tooth of the trigger wheel when it is in close proximity to the sensor coil. The system is not speed sensitive, that is, it is not necessary to "generate" an electrical current by turning the distributor shaft, and will operate at any speed above zero RPM.

NON SPEED SENSITIVE



ON



OFF

18

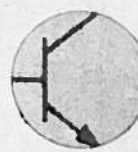
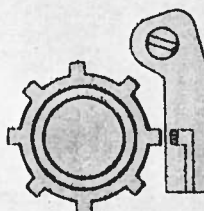
When a tooth of the trigger wheel is near the sensor, metal is detected, the oscillator is at a low level, the transistor is off, no primary current flows. This condition can be compared to "points open".

METAL
DETECTED

OSCILLATOR
LOW

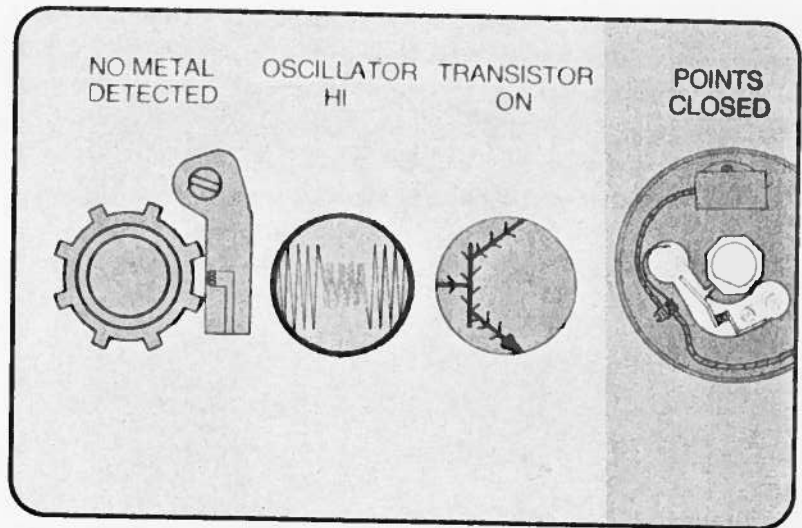
TRANSISTOR
OFF

POINTS
OPEN



19

When the trigger wheel is away from the sensor, metal is not detected, the oscillator is at a high level, the transistor is on, current flows in the primary winding. This condition can be compared to "points closed".



20

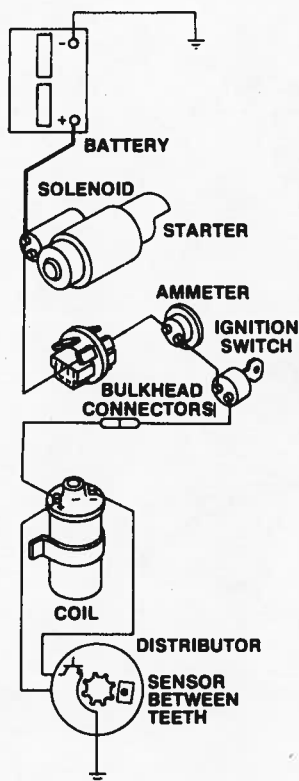
If a problem develops in this system it is an easy matter to troubleshoot.

TROUBLESHOOTING

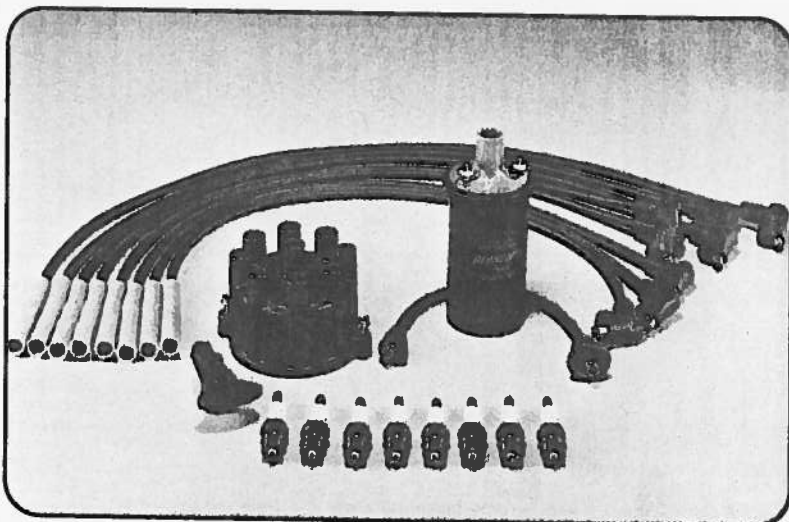
The complete ignition system is divided into two parts or sections commonly known as primary and secondary. The primary section is the low voltage section and is composed of the

battery, the ignition switch, the ignition coil primary winding, distributor electronics and associated wiring. Check primary wires for tight connections and proper polarity.

PRIMARY IGNITION SYSTEM



The secondary section is the high voltage section and is composed of the ignition coil secondary winding, the distributor cap, the rotor, the spark plug cables and the spark plugs.

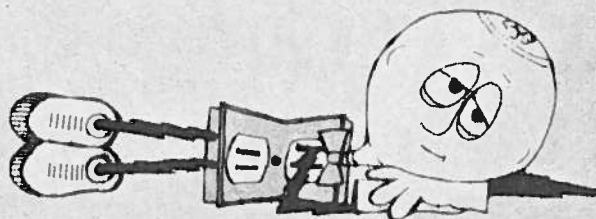


23

Electricity is "lazy" and will always seek the easiest path (lowest resistance) to complete its circuit.

It is very important that the secondary section be checked before troubleshooting the electronic section. Secondary system service is just as necessary as it has been in the past, but is very often neglected.

ELECTRICITY IS LAZY



24

Ignition systems sometimes develop more than one problem. Be sure to complete the entire troubleshooting procedure before returning boat to service.

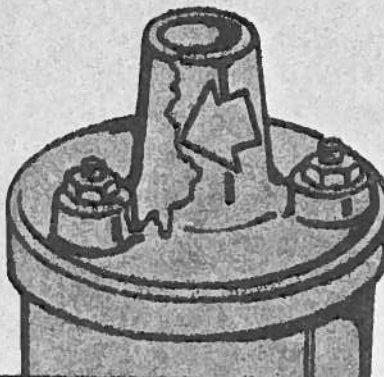
BE SURE TO COMPLETE THE ENTIRE TROUBLESHOOTING PROCEDURE

25

Let's first review secondary system service.

Check the coil tower for tracking. Check primary wires for tight connections and proper polarity, make sure the tower is clean and dry. Check coil nipple for proper sealing and insulating qualities. If flashover occurs here, the engine probably won't start.

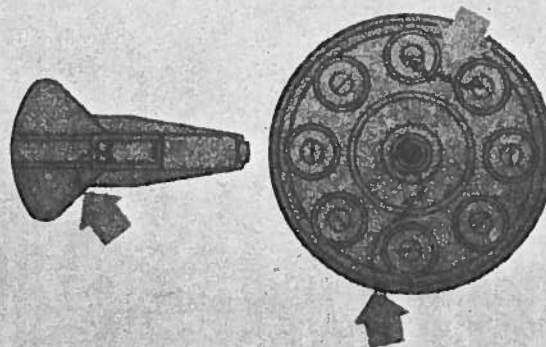
SECONDARY SYSTEM SERVICE



26

Check the distributor cap for tracking and dirt inside and outside. Moisture and dirt make a good path for flashover. It is very important that the cap be clean. Once a track has started, the cap must be replaced. Check the rotor also for the same thing.

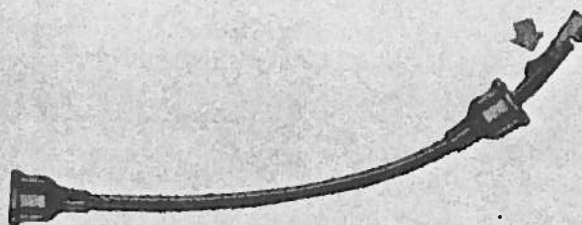
SECONDARY SYSTEM SERVICE



27

Check the coil to cap cable for proper resistance and excessive fold over of the conductor where it enters the coil tower. A high voltage leak at this point will cause a no start condition. An engine may run with poor insulation, but will refuse to start in a damp environment.

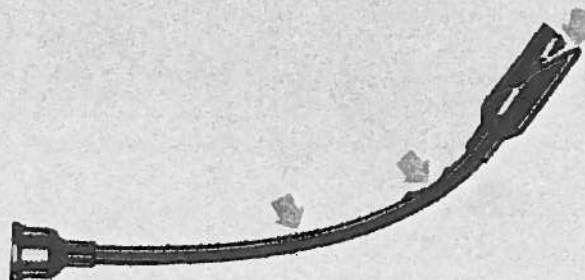
SECONDARY SYSTEM SERVICE



28

Check spark plug cables for burning, cracks and deterioration, and check for torn or cracked spark plug and distributor cap boots. Test all cables for proper resistance with an ohmmeter. Refer to the appropriate service manual for system specifications.

SECONDARY SYSTEM SERVICE



29

Check spark plugs for fouling, check gap, check for cracked insulators. Wipe insulators clean before installing boots.

SECONDARY SYSTEM SERVICE



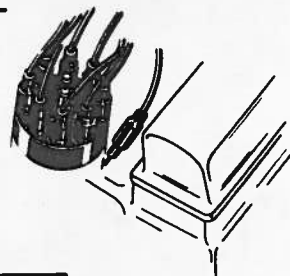
30

If the engine cranks but will not start, remove the center cap cable from the distributor cap and install an extension in the terminal. Hold the cable end approximately 1/2-inch from the engine block or connect a test plug between the cable and engine block, then have some

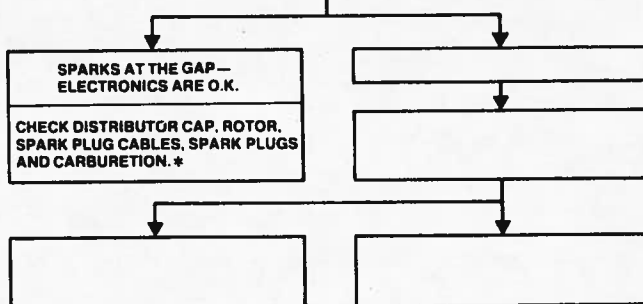
one crank the engine with the starter. Check for good spark. If a good spark occurs, the electronic system is O.K. Check the distributor cap, rotor, spark plugs, cables and carburetion.

ENGINE CRANKS—WILL NOT START

Disconnect high tension cable from center lower terminal of distributor. Insert extension adapter into boot and engage in cable terminal. Create about 1/2" gap between extension adapter and engine block.



Have an assistant crank engine

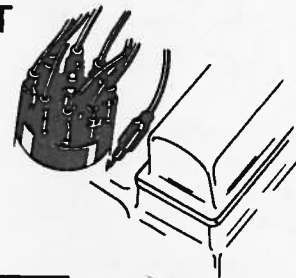


If no spark occurred, remove the distributor cap, rotor, and align a trigger wheel tooth with the center of the sensor and check sensor air gap, which should be .008". Note that the sensor will operate from a very small gap to

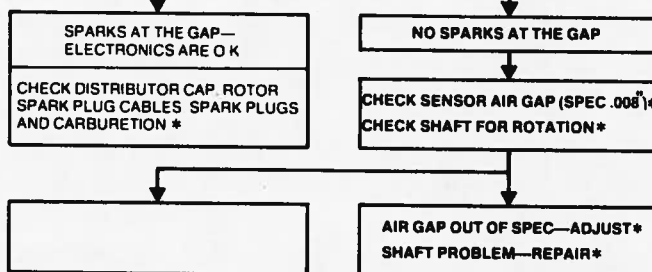
quite a large gap. If the gap is out of spec, reset to .008" and repeat the spark test. Be sure that the distributor shaft turns and is not broken or bent.

ENGINE CRANKS—WILL NOT START

Disconnect high tension cable from center tower terminal of distributor. Insert extension adapter into boot and engage in cable terminal. Create about 1/2" gap between extension adapter and engine block.



Have an assistant crank engine

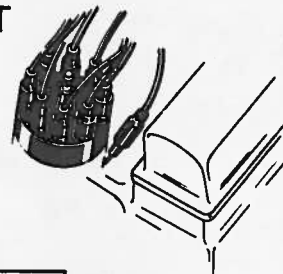


* Even if a problem is located, perform a voltage drop test.

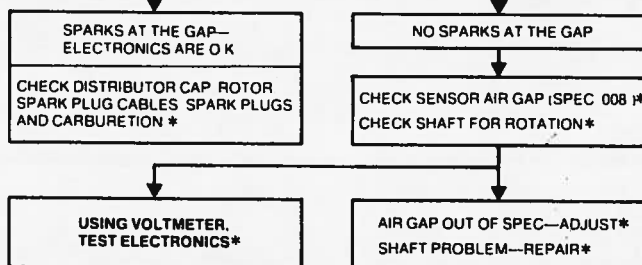
If the problem has not been located, it will be necessary to perform primary system voltme-ter tests.

ENGINE CRANKS—WILL NOT START

Disconnect high tension cable from center tower terminal of distributor. Insert extension adapter into boot and engage in cable terminal. Create about 1/2" gap between extension adapter and engine block.



Have an assistant crank engine



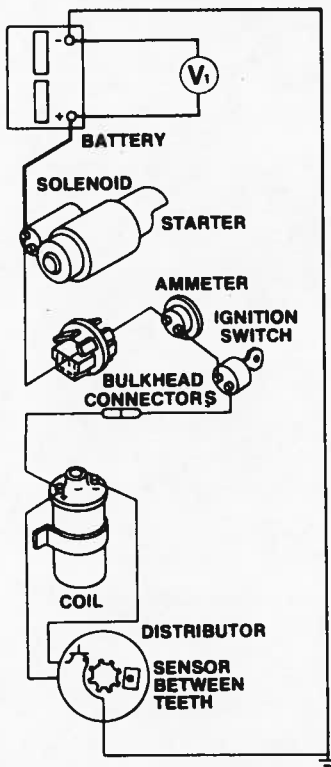
* Even if a problem is located, perform a voltage drop test.

Even if a problem is found, perform a voltage drop test. This test will be discussed later.

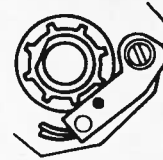
**BE SURE TO
COMPLETE
THE ENTIRE
TROUBLESHOOTING
PROCEDURE**

First position the trigger wheel so that the sensor is between 2 teeth. This is comparable to "points closed". Turn on the ignition switch. Primary current should flow. Connect a voltmeter across the battery terminals. Let's call this (V-1). (V-1) should read between 12 and 13 volts. If the battery is low, charge it.

VOLTMETER TEST



Position Sensor between 2 Teeth
(Primary circuit is on when sensor is between teeth)
Turn Ignition Switch "On."



V₁

CHECK BATTERY VOLTAGE

12-13

O.K.

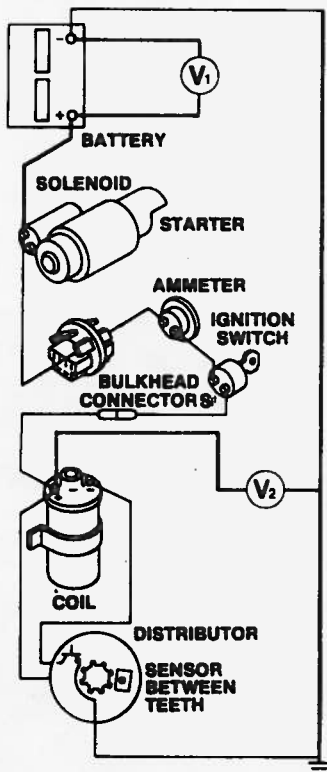
LOW

Fault → Charge Battery

Now, connect the voltmeter between the coil positive terminal and ground. Let's call this (V-2). (V-2) should read within one volt of that which you read at the battery. Normally, the

reading will be about 1/2-volt lower. If (V-2) reads low, a fault exists. The voltage drop test (V-4) and (V-5) will help you find it. Perform a voltage drop test. Refer to items 44 through 48.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V₁

12-13 O.K.

LOW

Fault → Charge Battery

V₂

CHECK VOLTAGE AT COIL POSITIVE

12-13

(Within 1 volt of battery) O.K.

LOW

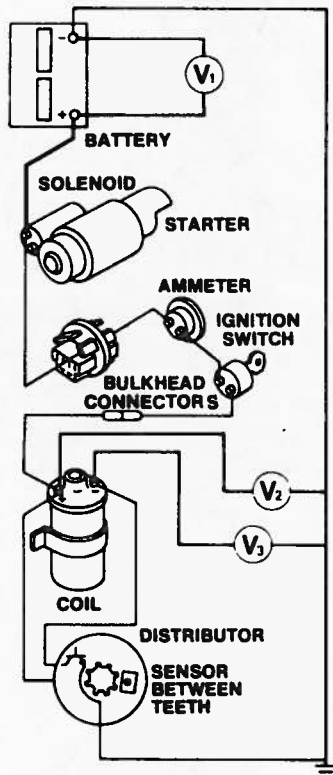
Fault →

Perform Voltage Drop Test

V₄

Now connect voltmeter between the coil negative terminal and ground. Let's call this (V-3). (V-3) should read somewhere between 4 and 8 volts.

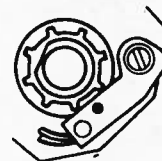
VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test V ₄

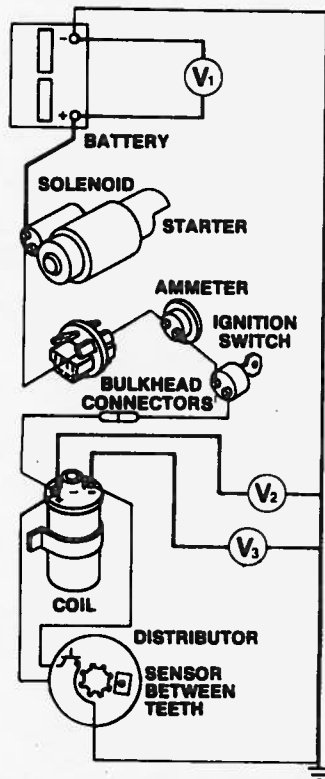
CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →
----------------	-----	--------

If (V-3) indicates 4-8 volts, this is normal. If the voltage is higher than 8 volts, a fault exists. (See Item 42). Now place a screwdriver in front of the sensor face. A spark should occur with (V-3) now indicating 12-13 volts. If not, either the coil or the electronics are faulty. Test the

coil or substitute a good coil. Repeat screwdriver test. If still no spark occurs, replace the electronics. When installing the new electronics, it will be necessary to adjust sensor to trigger wheel air gap to .008.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

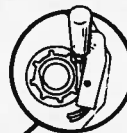
V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test V ₄

CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →
----------------	-----	--------

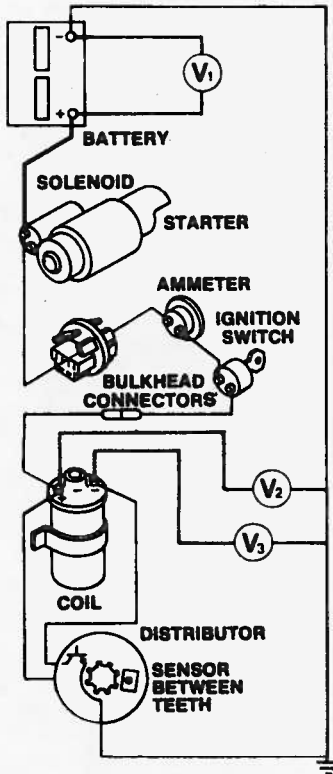


Place Screwdriver on Sensor Face

12-13V
Test Coil
If Good Replace
Electronics

If (V-3) does not change when the screwdriver is placed in front of the sensor or indicates less than 12 volts, the electronics are faulty and must be replaced.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test V ₄

CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →
----------------	-----	--------

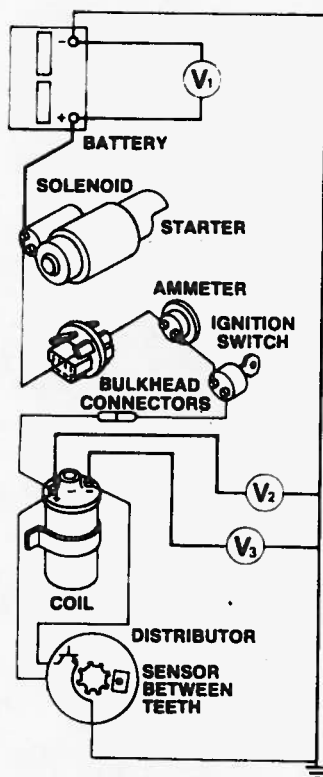
Place Screwdriver on Sensor Face

12-13V
Test Coil
If Good Replace
Electronics

Less than 12V
Replace
Electronics

If (V-3) did not indicate 4 to 8 volts (without the screwdriver), a fault exists and must be corrected. Let us consider a (V-3) reading of less than four volts, which in all probability will be zero.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test (V ₄)

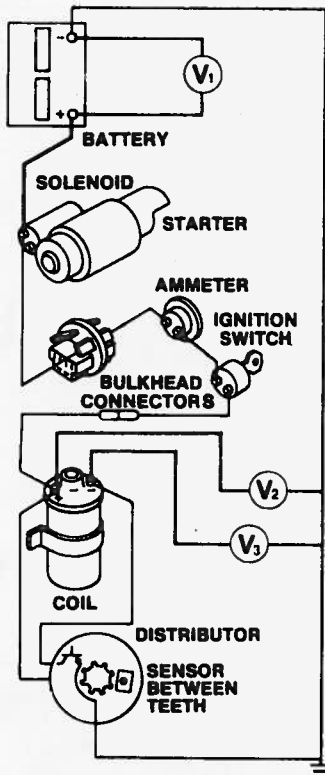
CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →
		Place Screwdriver on Sensor Face
		12-13V Test Coil If Good Replace Electronics
		Less than 12V Replace Electronics

Less than 4 Fault →

If (V-3) reads less than 4 volts, remove the wire from the coil negative terminal and reconnect (V-3) to coil negative.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V₁ 12-13 O.K.
LOW Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V₂ 12-13 (Within 1 volt of battery) O.K.
LOW Fault → Perform Voltage Drop Test V₄

CHECK VOLTAGE AT COIL NEGATIVE

V₃ 4-8 O.K. → Place Screwdriver on Sensor Face

12-13V Test Coil If Good Replace Electronics
Less than 12V Replace Electronics

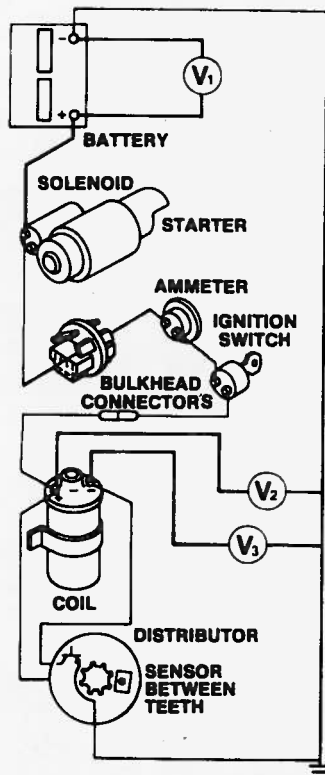
Less than 4 Fault →

**Remove Black
Wire from Coil
Reconnect V3**

If (V-3) now reads 12 to 13 volts, it is an indication that the coil primary winding has continuity and the electronics are shorted. Replace the distributor electronics. If (V-3)

reading has not changed, it indicates a faulty coil, the primary winding is open. Replace the coil.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test V ₄

CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →	Place Screwdriver on Sensor Face	12-13V Test Coil If Good Replace Electronics
	Less than 4	Fault →	Remove Black Wire from Coil Reconnect V ₃	Less than 12V Replace Electronics

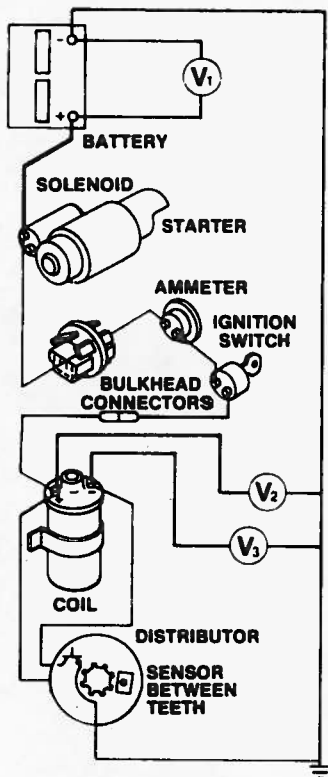
12-13V
Replace
Electronics

No Change
Replace Coil

The other condition which could exist is that (V-3) would indicate more than 8 volts, which in all probability would be 12-13V; the same as (V-2). This would indicate an open ground

circuit (See Item 48), open transistor, or shorted coil primary. However, check the distributor for a good ground. If it is OK, replace the electronics.

VOLTMETER TEST



Position Sensor between 2 Teeth

(Primary circuit is on when sensor is between teeth)

Turn Ignition Switch "On."



CHECK BATTERY VOLTAGE

V ₁	12-13	O.K.
	LOW	Fault → Charge Battery

CHECK VOLTAGE AT COIL POSITIVE

V ₂	12-13	(Within 1 volt of battery) O.K.
	LOW	Fault → Perform Voltage Drop Test (V ₄)

CHECK VOLTAGE AT COIL NEGATIVE

V ₃	4-8	O.K. →	Place Screwdriver on Sensor Face	12-13V Test Coil If Good Replace Electronics
	Less than 4	Fault →	Remove Black Wire from Coil Reconnect V3	Less than 12V Replace Electronics
	More than 8	Fault →	Check Distributor for Ground — If good, Replace Electronics	12-13V Replace Electronics
				No Change Replace Coil

43

Remember, most no start problems will be the result of one faulty component. However, ignition systems sometimes develop more than one problem. Be sure to complete the entire troubleshooting procedure before returning the boat to service.

**BE SURE TO
COMPLETE
THE ENTIRE
TROUBLESHOOTING
PROCEDURE**

44

One part of the troubleshooting procedure, which was mentioned earlier, is the voltage drop test. Let's call this (V-4) and (V-5).

This test requires the voltmeter (V-4) to be connected between the battery positive post and the coil positive terminal for the battery feed circuit.

For the battery return circuit, (V-5) is connected between the module case and the battery negative post.

**VOLTAGE DROP TEST
AIDS MECHANIC
IN LOCATING
POOR CIRCUIT
CONNECTIONS**

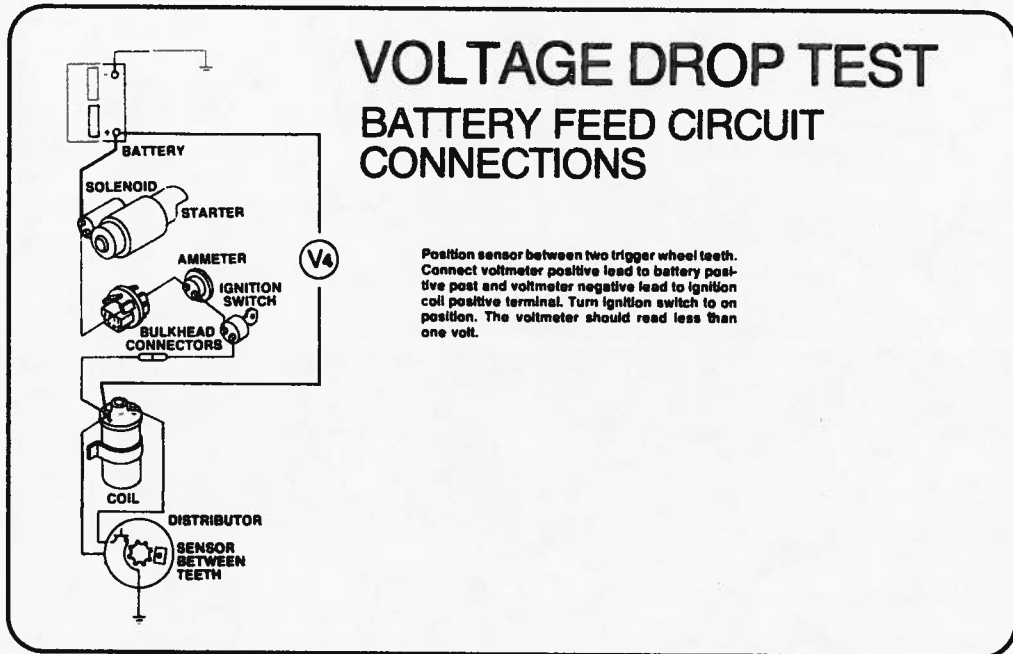
45

Any poor connection in this circuit will cause resistance to current flow and a resulting drop in voltage to the coil, along with intermittent engine misfire, cut outs, backfires, etc.

**POOR CONNECTIONS
CAUSE
INTERMITTENT
OPERATION
AND
FAILURE**

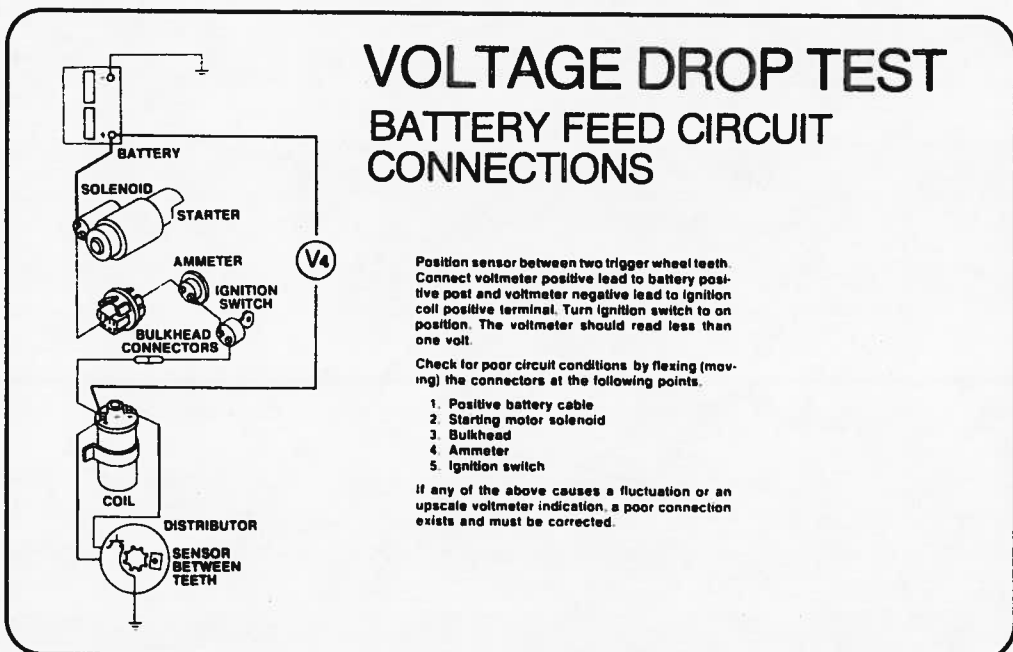
Position the sensor between two trigger wheel teeth. Connect (V-4's) positive lead to the battery positive post and (V-4's) negative lead to the coil positive terminal. With the ignition

switch "on" (V-4) should read less than one volt, normally about 1/2 volt. If the reading is O.K., don't stop but complete the test.



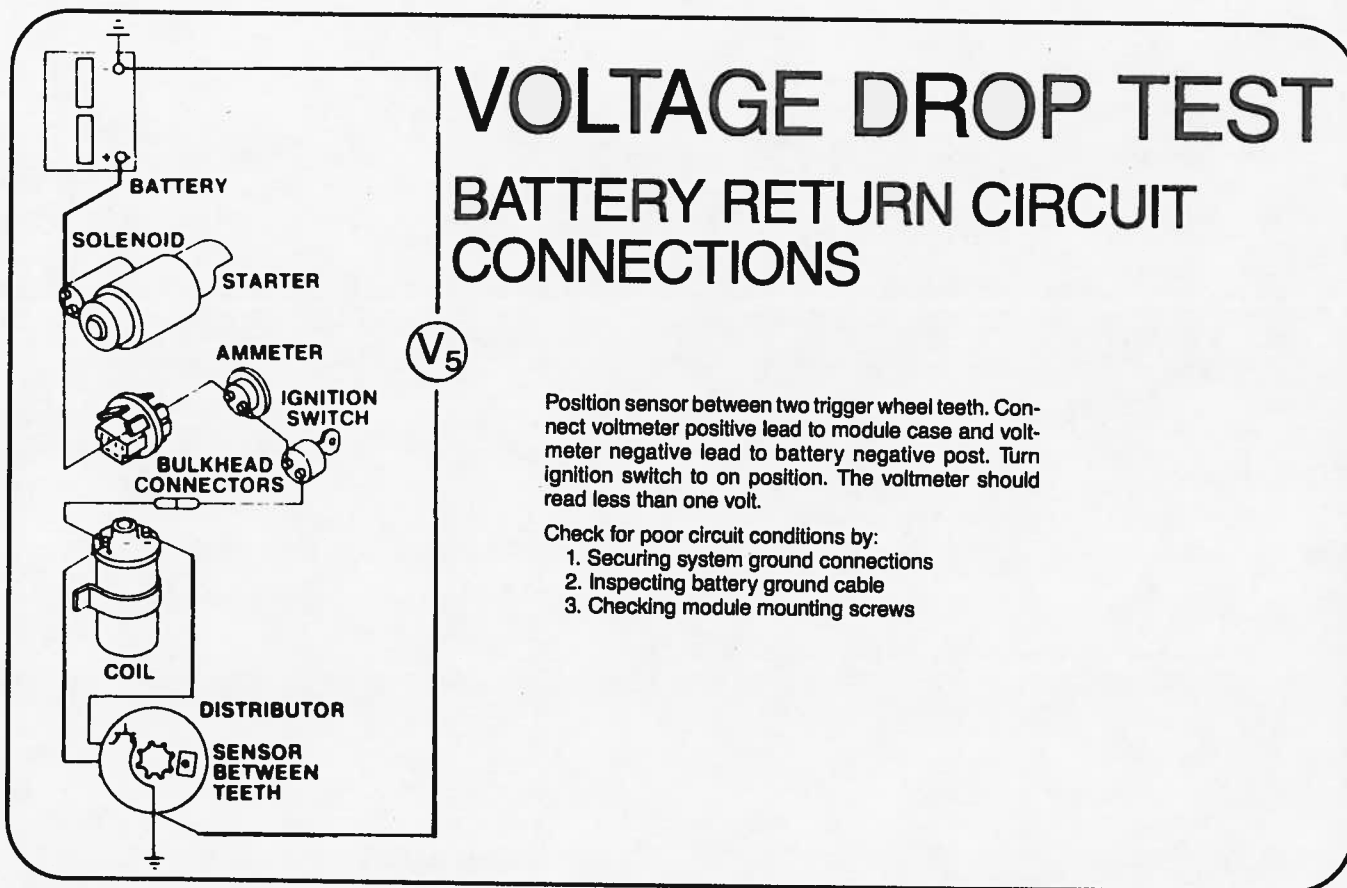
Check for poor circuit conditions by flexing, that is, wiggling the connections at the battery cables, starter solenoid, bulk head connectors, ammeter terminals, and ignition switch. Have an assistant watch (V-4) as you are

testing. A fluctuation or upscale indication of (V-4) indicates that you have located a poor connection and must make necessary repairs. Poor connections cause heat and get worse until there is no connection at all.



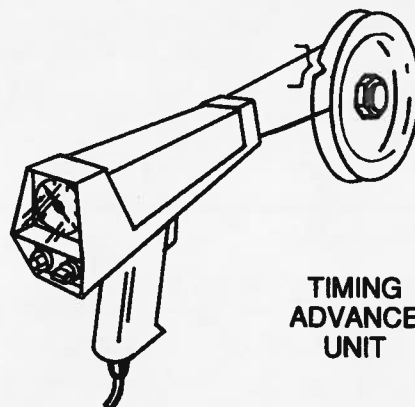
Connect (V-5's) positive lead to the module case and the negative lead to the battery negative post. With the ignition switch "on" (V-5) should read less than one volt, normally about 1/2 volt. If the reading is above one volt,

tighten the system ground connections, inspect the battery ground cable, and check to see that the module mounting screws are secure. Repeat the test. Replace the battery ground cable if necessary.



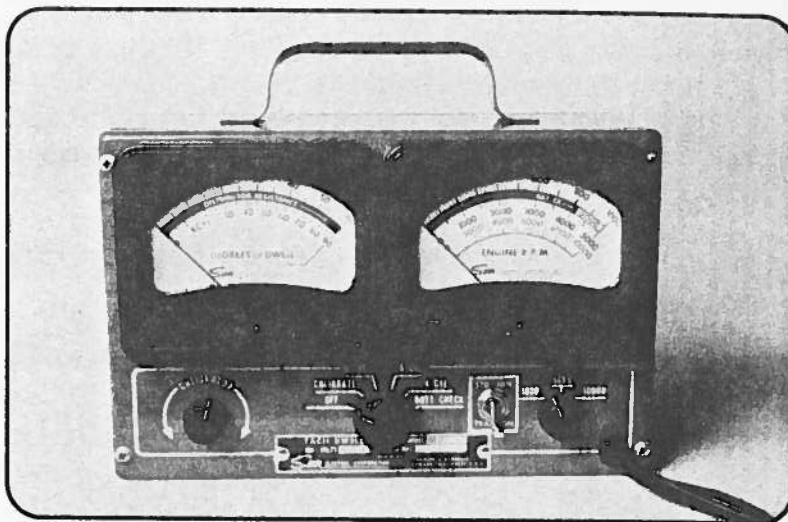
Check the distributor advance mechanism along with basic ignition timing. Be sure to operate the engine at correct idle speed to be sure of an accurate basic timing adjustment.

DISTRIBUTOR ADVANCE TEST



50

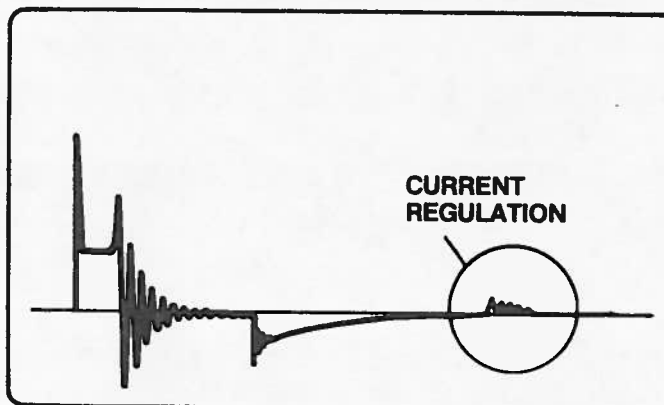
If the sensor air gap is adjusted properly, "dwell" will be "in spec." Checking dwell should not be required, however, if a dwell check is desired, it will be necessary to use a meter modified specifically for electronic ignition such as a Sun TDT-11 with an electronic ignition modification incorporated, or equivalent such as Sun SP-4102.



51

Most automotive "scope" analyzers will work well with this system. The pattern observed will be the same as that observed for breaker point type systems, with the exception being a slight hump somewhere in the dwell section. This is normal and is an indication of primary current regulation. Some early analyzers must be modified in order for the cylinder shorting test section of the analyzer to function properly.

TYPICAL SCOPE PATTERN



52

If these procedures have been followed and corrections properly made, the ignition system will function as designed.

**IF THESE PROCEDURES
HAVE BEEN FOLLOWED
AND CORRECTIONS MADE
THE IGNITION SYSTEM
WILL FUNCTION
PROPERLY**

**★★★ TECHNICAL INFORMATION IS AVAILABLE ★★★
FROM YOUR PRESTOLITE REPRESENTATIVE**

NOTES

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook paper. There is no handwriting or other markings on the page.

Prestolite Electric Incorporated
Four SeaGate
Toledo, Ohio 43691-0904
1-419-249-7600