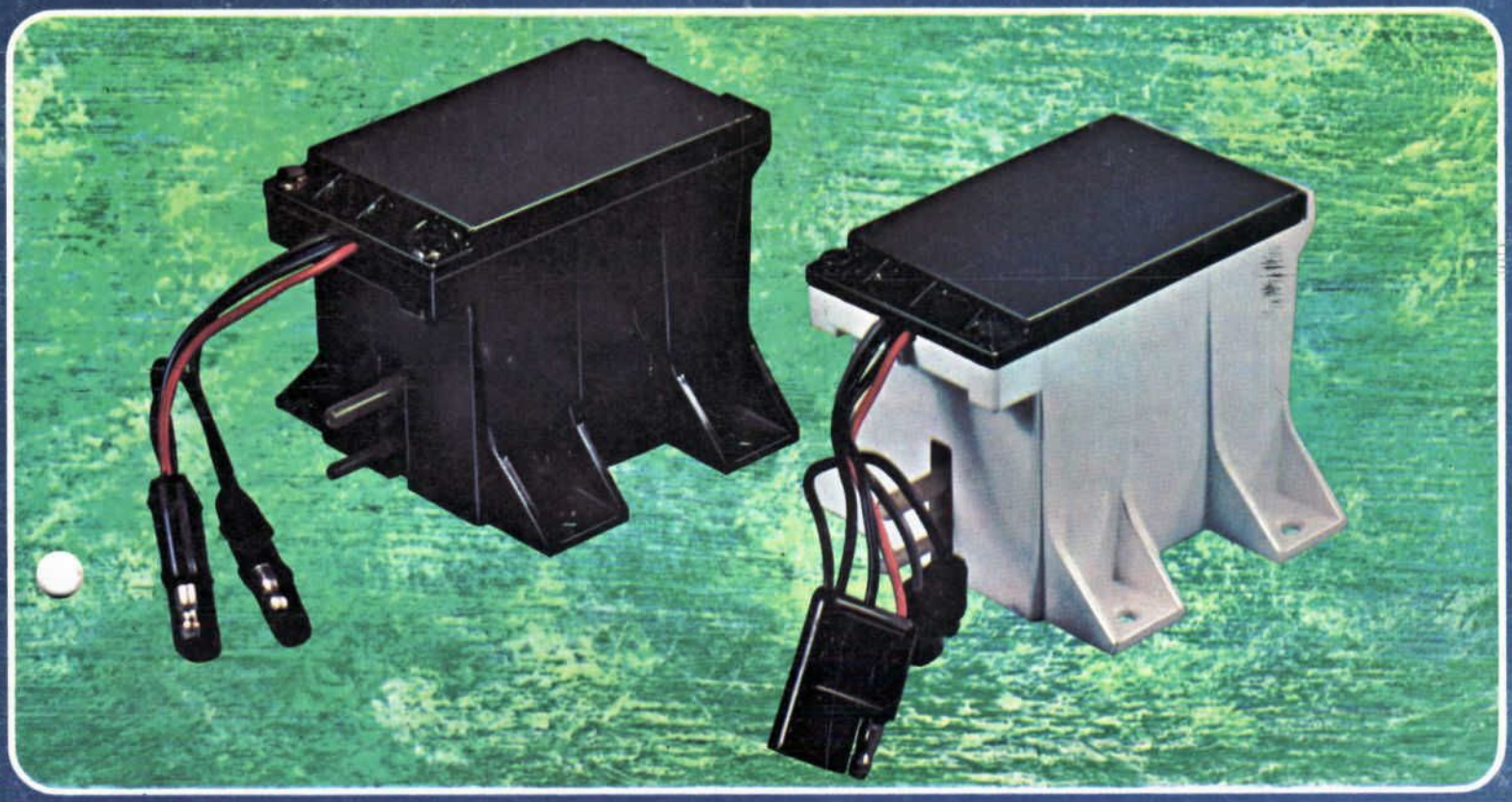
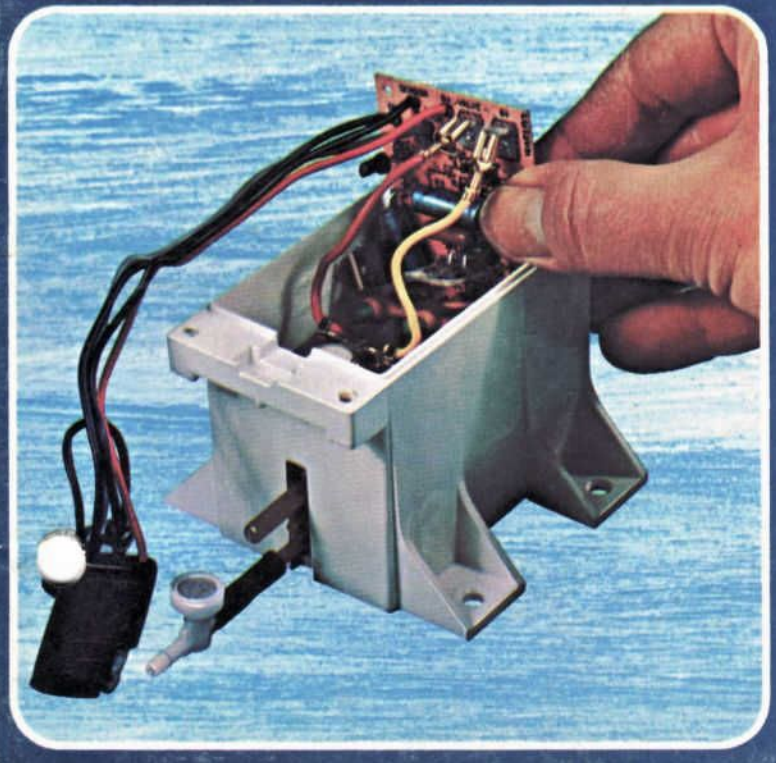
SHOP TIPS

Autolite Ford

VOL. 8, NO. 12 AUGUST, 1970





Distributor Modulator System

SEE CENTER INSERT FOR TIMELY PROMOTIONS

DISTRIBUTOR

Technical parts and service information published by the Autolite-Ford Parts Division and distributed by Ford and Lincoln-Mercury dealers to assist servicemen in Service Stations, Independent Garages and Fleets.

IN THIS ISSUE

Be sure and file this and future bulletins for ready reference. If you have any suggestions for additional information that you would like to see included in this publication, please write to: Autolite-Ford Parts Division, Merchandising Services Dept., P.O. Box 3000, Livonia, Michigan 48151.

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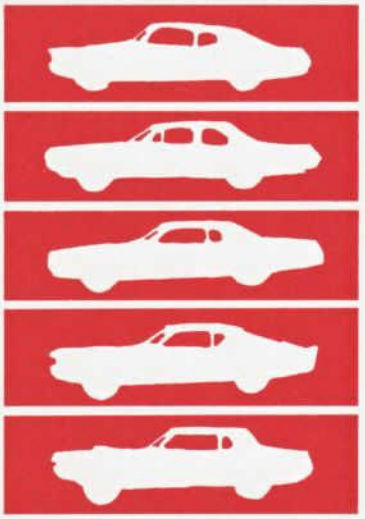
Autolite Ford

VOL. 70 MSD 55 LITHO IN U.S.A.

VANISHING VEHICLE EMISSIONS



It would take all FIVE cars in the 1970 model year as shown at the left to equal the smog-producing hydrocarbon output of the single 1960 car shown below. Carbon monoxide emissions have been reduced by about 65 percent during the same period.

1970 1960

Figure 1—The Great Strides in the Fight for Cleaner Air

BACKGROUND INFORMATION ... EMISSION CONTROL

Ford engineers have been actively engaged in a large-scale research program since the early 1950's to develop effective controls for reduction in the amount of air pollutants resulting from the combustion process within an internal combustion engine.

Today's new Ford-built cars offer testimony to the success of their efforts.

Reduction of hydrocarbon emissions, which averaged 567 grams per day (per car) in 1960, have been reduced by about two-thirds on Ford, Mercury and Lincoln cars for 1970, and a full 80 percent reduction will be achieved with the 1971 models. New 1970 models sold on the California market already meet the 1971 standards.

At the same time, emissions of carbon monoxide have been cut by about 65 percent.

Yet, Ford engineers have directed even greater efforts towards developing an engine that is virtually emission-free within the 1970-80 decade.

One of their latest engineering advances in the battle against air pollution is the *distributor modulator system*, sometimes referred to as the Dist-O-Vac system. This new system, introduced in some of the 1970 Ford-built passenger cars and light truck lines, functions to assist in a more complete burning of the air-fuel mixture in the engine combustion chambers.

Basically, it accomplishes this goal by controlling the distributor spark advance in a very sophisticated manner.

This issue of *Shop Tips* is published to familiarize service repairmen with the details of this Dist-O-Vac system and its operation, as well as methods to follow for troubleshooting the components.

MODULATOR SYSTEM

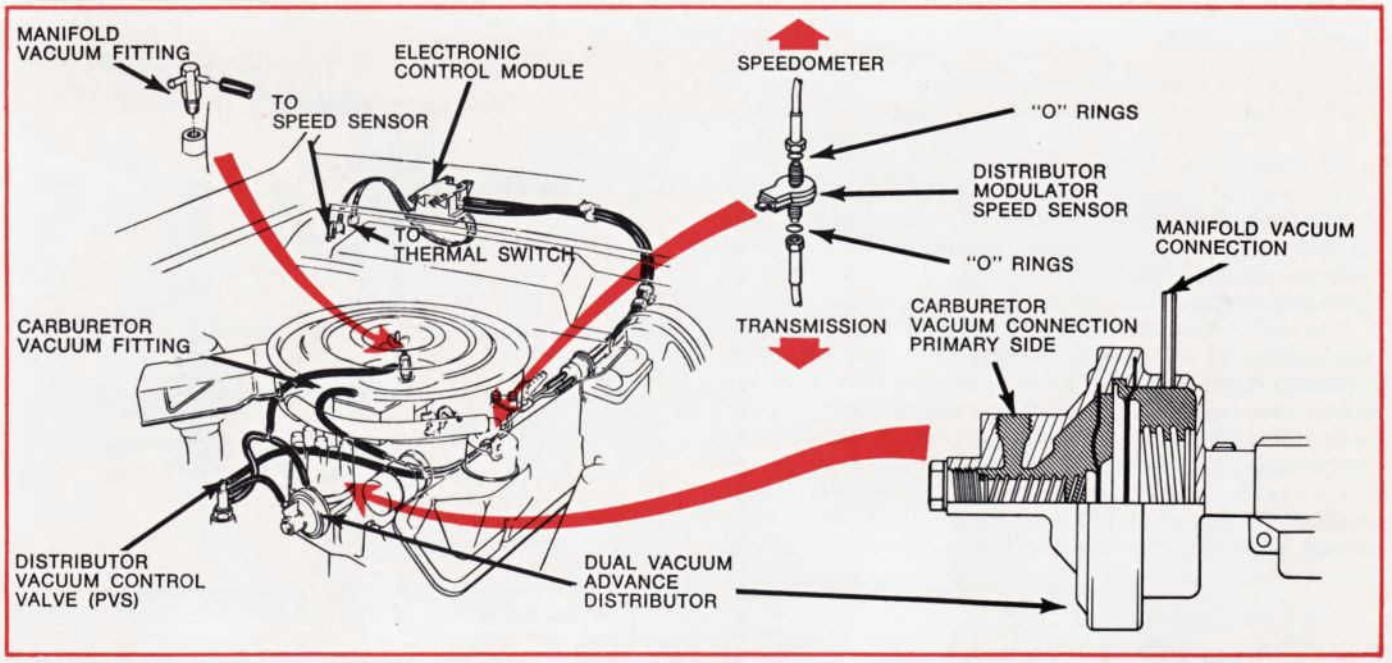


Figure 2—A Typical Distributor Modulator Installation in a V-8 Equipped Ford Vehicle

DIST-O-VAC SYSTEM UNITS

There are only three units that directly make up this system. They are the *speed sensor,* the *thermal switch,* and the *electronic control module.* Inside the module, which is a plastic box assembly, are two small subassemblies called the *electronic control amplifier* and the three-way *solenoid valve.* The solenoid valve routes vacuum to the distributor.

There are six different electronic control modules used with the modulator system that are available for service. Identification can be made through the color of the plastic box and the plastic cover. Both the *black* box module and the *white* box module are available with a *white . . . black . . .* or *blue* cover, making a total of six different units. Part numbers are molded on the covers for positive application. See Dist-O-Vac Application Chart on page 13 for additional details.

This emission control system also requires a dual-diaphragm vacuum advance type of distributor that has both an advance and retard diaphragm.

On some installations of the Dist-O-Vac system, a distributor vacuum control valve is also needed. This coolant temperature sensing valve is often referred to as the PVS valve or *P*orted *V*acuum *S*witch.

During normal operating temperature of the engine the PVS valve connects two ports . . . normal vacuum at the carburetor and to the distributor dual vacuum advance unit.

However, if the engine coolant temperature should rise above the normal operating range, the valve closes the normal source of vacuum port and connects the vacuum to an alternate vacuum source.

When this occurs the ignition timing advances and the engine curb idle speed increases about 100 rpm. This higher idle speed continues until the coolant temperature range returns to normal.

Although each of the components that make up the modulator system are serviced *only as complete assemblies,* we have included in this issue of *Shop Tips* a complete description and operation of each component.

We believe it is vitally necessary to do this so that you are better prepared to follow troubleshooting procedures and understand any problem that may develop within the system and its effect on engine performance.

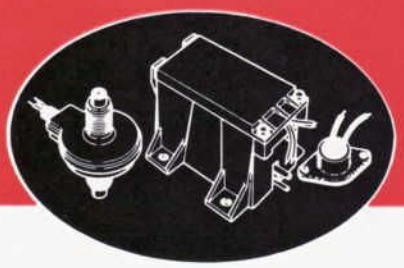
NOTE: A new type of electronic module assembly which is directly interchangeable with those now being used in production is now released for service.

Outwardly, it closely resembles the earlier type except for the following differences:

- There are three ventilation slots in the module cover and one in the main housing.
- The position of the larger plastic vacuum port leading to the PVS valve has been switched with the smaller port to which the carburetor spark port hose attaches.
- The two plastic ports are placed wider apart than before.

This revised module assures distributor advance vacuum should failure occur in the electronic portion. Formerly, in previous models, if the electronic portion failed, the engine would become sluggish and rough due to no vacuum applied to the distributor vacuum advance (primary) side.

Troubleshooting and service procedures for the new unit are identical with those established for prior electronic units.



DISTRIBUTOR

THE PURPOSE AND FUNCTION OF EACH UNIT

THERMAL SWITCH

The thermal switch is a small self-contained unit (Figure 3) that may be found at either the right or left door pillar post on passenger cars, or in the left door pillar post on light-duty trucks.

This switch is controlled by outside (ambient) air temperatures acting on a bimetallic element contained within the assembly. When outside air temperature changes to a marked degree (not engine coolant or engine compartment temperature), this switch opens or closes an electrical circuit to the electronic control amplifier.

For example, if the temperature of outside air is in a range of 58 to 50 degrees F. or *lower,* the switch is *closed,* while outside air temperature *above* 58 to 68 degrees F. causes the switch to *open.*

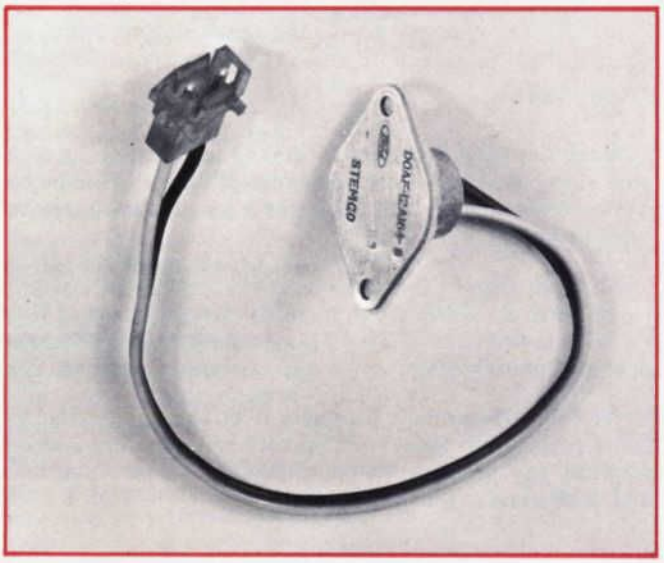


Figure 3—The Thermal Switch That Senses Outside Air Temperature

SPEED SENSOR

The speed sensor is mounted between a two-section speedometer cable and cable housing. See Figure 4 for details. The drive is from the transmission output shaft to the speed sensor and from the speed sensor to the speedometer at the instrument panel.

If the speed sensor must be removed for any reason and then reinstalled, always remember that the sintered bronze bushing (as noted in Figure 5) must face towards the transmission. In this position the bushing will absorb most of the drive shocks that can occur in the speedometer driven cable as it rotates, thus protecting the life of the sensor's internal parts.

The speed sensor is non-repairable and contains a rotating magnet and a stationary winding. This stationary field winding is insulated from ground.

As the magnet rotates with the speedometer cable, it causes a very small voltage to develop in the field windings. This voltage increases (ever so slightly) in direct proportion to the rotating speed of the magnet and directly depends upon the vehicle speed. In effect it operates in much the same manner as an alternating current alternator.

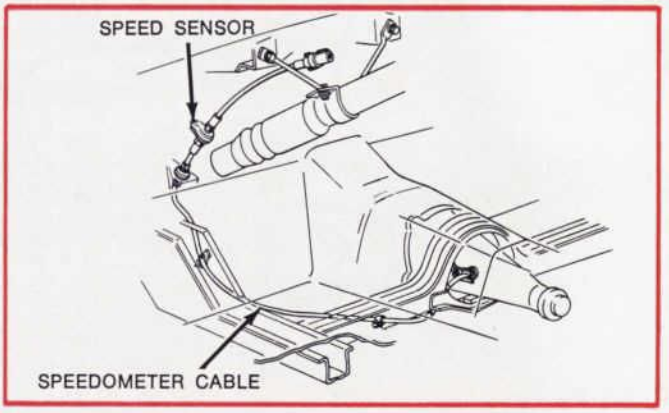


Figure 4—Typical Location of the Speed Sensor Connected into the Speedometer Cable

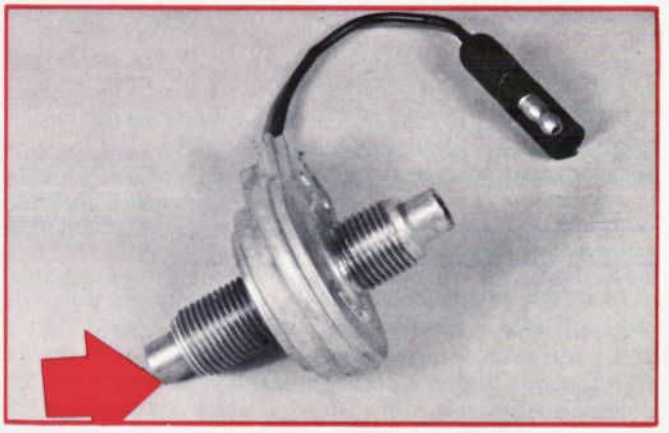


Figure 5—The Speed Sensor and Sintered Bronze Bushing

There are two different distributor modulator speed sensors available. Both have the same basic part number but the last letters in the number are different because of wiring length which varies due to vehicle application. See the Dist-O-Vac Application Chart on page 13.

On cars that are also equipped with an electronic speed control accessory item, there is a short coupling adapter that is needed to connect the speed control sensor with the distributor modulator speed sensor as shown in Figure 6.

If for any reason the speed control sensor is removed and then replaced, always remember that the speed control sensor must be reinstalled to the adapter *first.* Then connect to the distributor modulator speed sensor for final hookup. Remember too, the "O" rings must be installed on sensor bosses before installing cable nuts on sensor. Also, make sure the adapter is installed so that the brass collar is facing towards the accessory speed control sensor.

MODULATOR SYSTEM

Continued

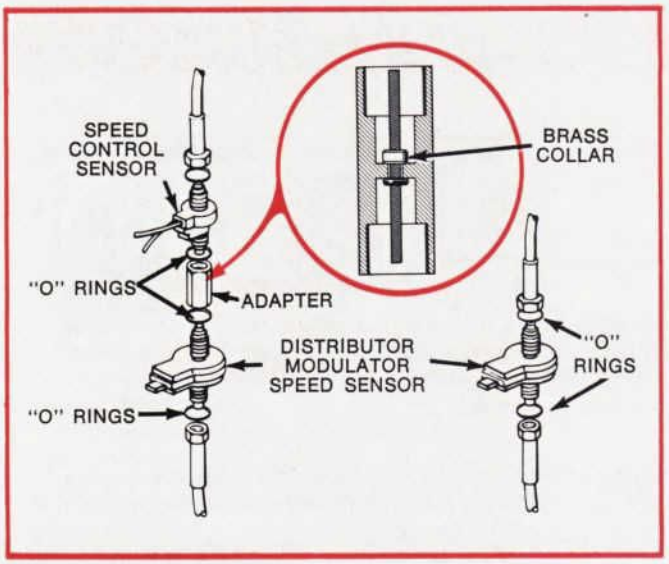


Figure 6—Exploded View of the Speed Control Sensor and its Relationship with the Adapter and Distributor Modulator Speed Sensor. Note Brass Collar and "O" Ring Locations

ELECTRONIC CONTROL AMPLIFIER

Inside the electronic control module plastic box assembly is a printed circuit board with its electronic control amplifier. See Figure 7. It can be compared to a switchboard.

This amplifier receives two signals. One is the weak input voltage signal developed by the speed sensor and the other is the signal from the thermal switch. As we mentioned earlier, when outside air temperature is below the 58 to 50 degree F. range, the thermal switch is closed (circuit grounded) and regardless of car speed (or speed sensor voltage) the electronic control amplifier will not trigger the three-way solenoid valve. However, above the 58 to 68 degrees F. range, the thermal switch is open (circuit not grounded) and the speed sensor completely takes over to control and trigger the three-way solenoid valve.

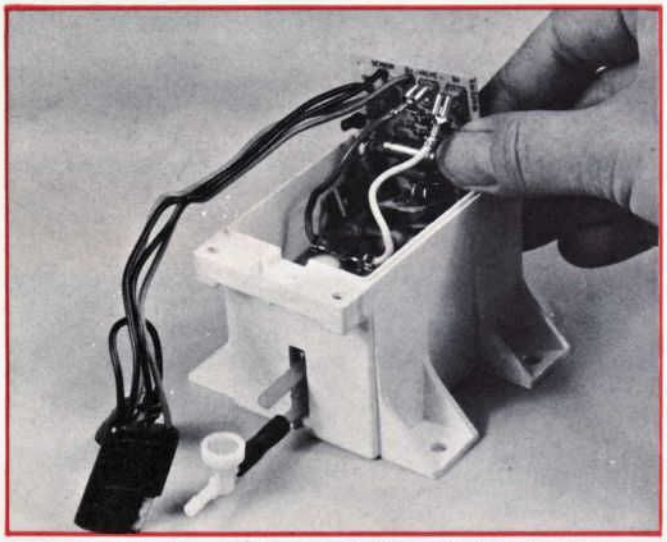


Figure 7—The Electronic Control Module with the Printed Circuit Board and Control Amplifier Revealed

SOLENOID VALVE

Located underneath the printed circuit board in the electronic control module plastic box assembly is the three-way solenoid valve.

This valve controls vacuum applied to the *primary side* of the dual-diaphragm type of distributor vacuum advance. When the thermal switch is closed (grounded), or the speed sensor does not send out a strong enough voltage signal, the amplifier will not activate the solenoid valve and the smaller hose connection leading to the carburetor spark port is in the *closed position* as shown in Figure 8A.

At the same time the upper (larger) hose connection leading to the primary side of the distributor vacuum advance is vented to atmosphere at the top of the solenoid valve. When the solenoid valve is triggered by a signal from the speed sensor, the *valve opens* a vacuum hose connection from the carburetor spark port as shown in Figure 8B.

The *vent* then *closes* and vacuum is applied to the primary side of the distributor vacuum advance mechanism. As a result, the spark is advanced.

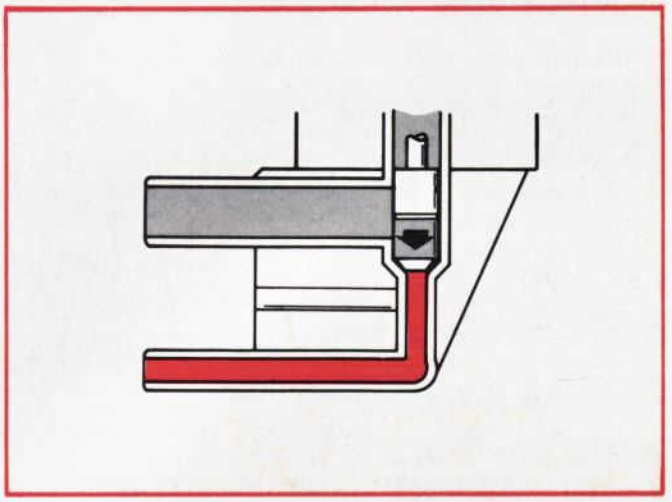


Figure 8A—Solenoid Valve Closed to Carburetor Spark Port

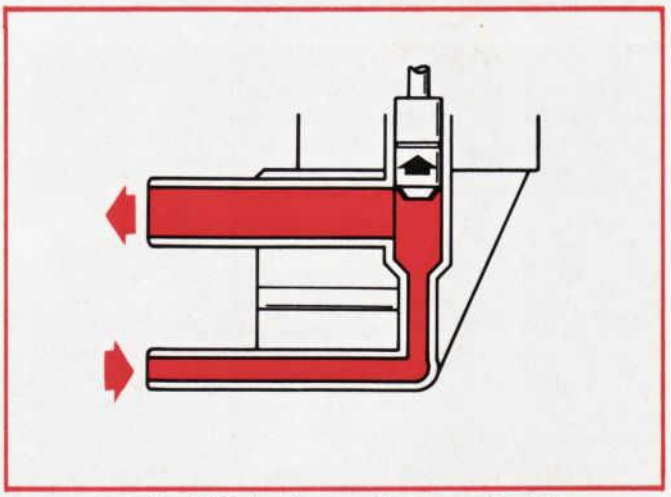
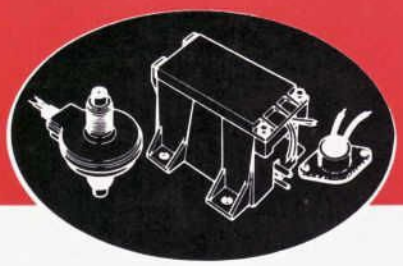


Figure 8B—Solenoid Valve Open to Carburetor Spark Port



DISTRIBUTOR

HOW THE DIST-O-VAC SYSTEM WORKS

To begin with, current is supplied to the electronic control module when the driver turns the ignition switch to the ON position.

When this occurs, current triggers the solenoid valve to shut off carburetor vacuum to the primary side of the distributor dual-diaphragm mechanism. See Figure 9.

As the driver accelerates his car and picks up speed, the speed sensor develops a voltage frequency that is proportional to the vehicle speed. This weak voltage is sent to the electronic control amplifier. Then, as car speed reaches the approximate operating limits of either 23 or 28 mph, (depends upon engine application) the control amplifier is triggered by the signal from the speed sensor. The solenoid valve then opens. When this occurs, both the distributor and carburetor vacuum passages are interconnected, thus vacuum is applied to the primary side of the distributor vacuum advance mechanism and the spark advances. See Figure 10.

When the driver begins to slow down and car speed reaches approximately 18 mph (or less), the speed sensor signal to the amplifier is not strong enough for the amplifier to maintain the control valve in its open position. Thus, the amplifier responds by closing the solenoid valve. With no vacuum applied to the primary side of the distributor vacuum advance mechanism, the spark is retarded.

However, you must remember that this spark retard will only occur below 18 mph (or less) when the outside air temperature is 58 to 68 degrees F. *or higher.* As mentioned earlier, at that temperature the thermal switch is *open* (circuit not grounded) and the speed sensor is the unit that signals the amplifier to control spark advance or retard.

However, if outside air temperature is within a range of 58 to 50 degrees F. *or lower,* the thermal switch *closes,* (circuit grounded) and in doing so overrides the signal from the speed sensor. As a result and regardless of vehicle speed on acceleration or deceleration, carburetor vacuum is applied to the primary side of the distributor vacuum advance mechanism.

In effect then, you can say that spark advance by the distributor modulator is cancelled out and the distributor then operates through the conventional vacuum control system. See Figure 11.

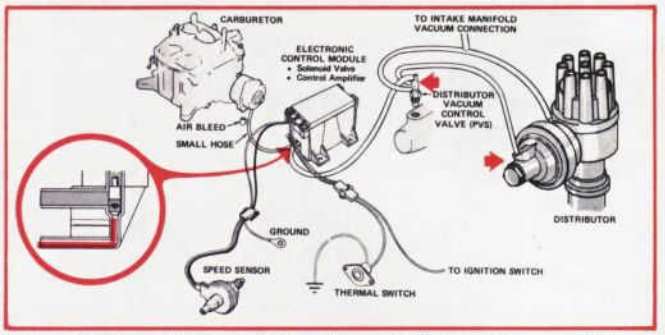


Figure 9—Overall View of Distributor Modulator System with Ignition Key Turned ON and Solenoid Valve in the OFF Position

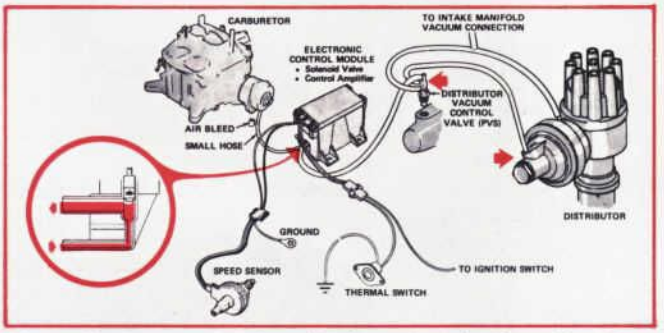


Figure 10—Position of Solenoid Valve at Speeds Above 28 mph

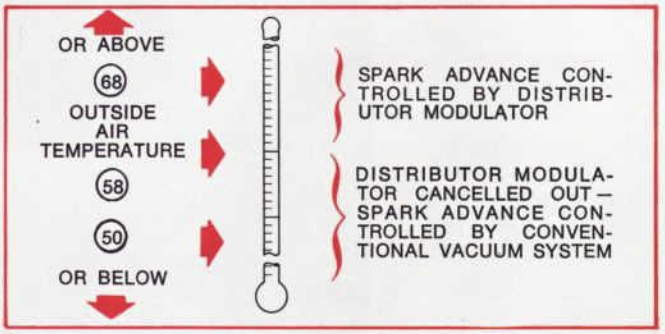
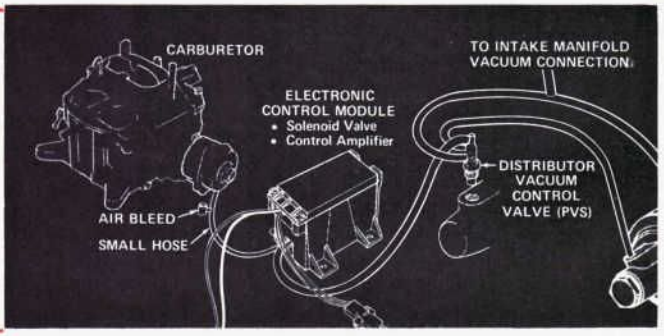


Figure 11—Thermometer Showing Ranges of Modulator Operation Dependent Upon Outside Air Temperature

Figure 12—Location of the Air Bleed Device

An air bleed is installed in the vacuum hose attached to the carburetor spark port to provide a positive air flow in the direction of the carburetor. This device purges the hose of vacuum and thus prevents the possibility of drawing raw gas through the hose and into the distributor diaphragm.



MODULATOR SYSTEM

Continued

TROUBLESHOOTING SYSTEM PROBLEMS

When the distributor modulator system is not working properly the result can be normal road load vacuum not reaching the distributor. As a result, this condition can be easily mistaken as a problem within the distributor since a broken or ruptured vacuum advance diaphragm produces a similar condition of poor engine performance.

Also, such complaints as engine hesitation, stumble, surge or sluggishness, or even excessive fuel consumption usually indicate a problem in the carburetor or the ignition distributor. *However, these same conditions can be caused by an improperly operating distributor modulator system.*

Whenever you have a problem of poor engine performance the first thing to do is determine if it is in the distributor modulator system or other operating units of the ignition or carburetion systems.

To do this, first bypass the distributor modulator and check out the ignition distributor. Connect a short piece of rubber hose to the carburetor spark port hose and the other end to the distributor vacuum hose as shown in Figure 13.

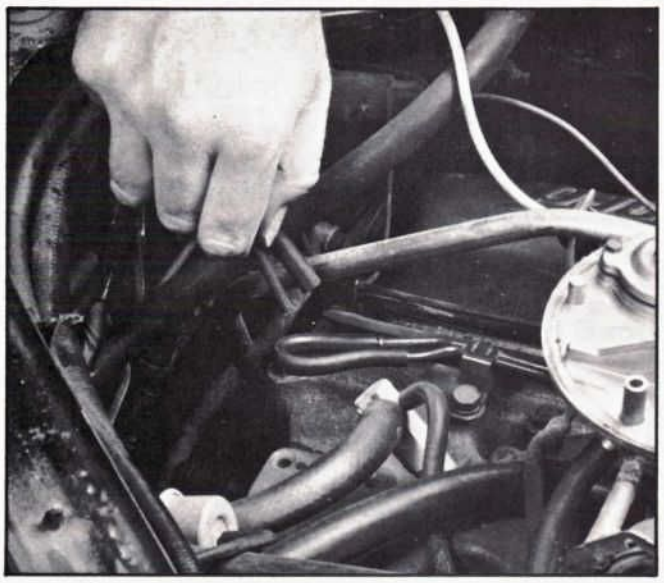


Figure 13—Installing the Short Bypass Hose for Test Purposes

When this is completed, check out the distributor vacuum advance on an analyzer by following the manufacturer's instructions for his particular equipment. If the distributor operates as called for in the specifications, then the problem is likely in the modulator system.

As your first step in troubleshooting the distributor modulator system, connect a vacuum gauge to the carburetor spark port.

With the engine running at a fast idle speed (1500 rpm) check the gauge reading and make a mental note of the results. See Figure 14. Reconnect the vacuum hose to the carburetor spark port.

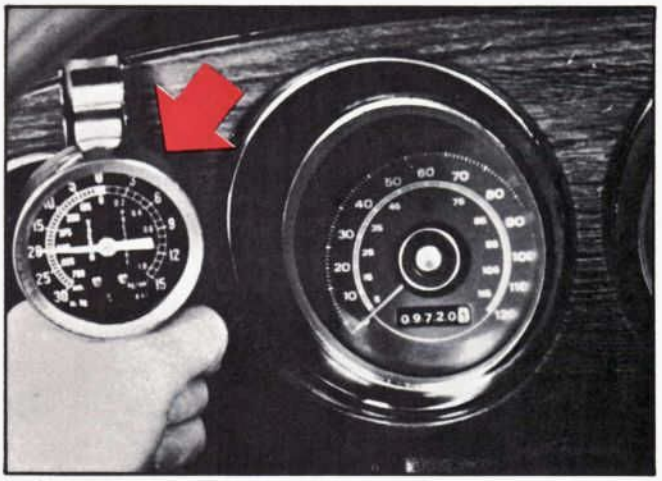


Figure 14—Checking Vacuum at Engine Fast Idle Speed

Now, once again bypass the distributor modulator hoses at the rear of the engine as shown in Figure 13. Hook up a vacuum gauge to the primary side of the distributor. See Figure 15. Then, once again with the engine running at a fast idle speed, note the vacuum gauge reading.

If you find that the vacuum reading is ZERO or considerably LESS than the vacuum reading at the carburetor spark port, visually inspect for pinched or leaking hoses in the engine compartment. Repair or replace as needed. However, if the vacuum readings at the distributor and at the carburetor are about the same, this indicates that the trouble is somewhere else in the system and further checks and tests are necessary.

Remove the bypass hose that you installed and reconnect both the distributor modulator hoses.

Keep the vacuum gauge connected to the distributor primary hose tubing for the following test.

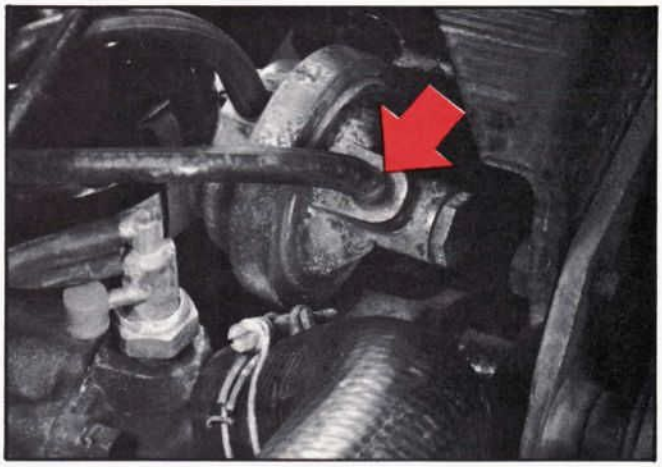
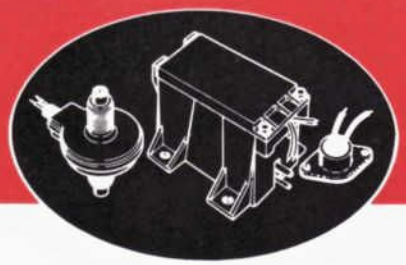


Figure 15—Connecting Point for Vacuum Gauge Hookup to Primary Side of Distributor Vacuum Advance



DISTRIBUTOR MODULATOR SYSTEM

Continued

Raise the rear wheels of the car (or light truck) and loosen the thermal switch from the pillar post. Run the engine at normal idle speed until normal operating temperature is reached.

Then, hold the thermal switch in the palm of your hand long enough to warm it above 68 degrees F. See Figure 16.

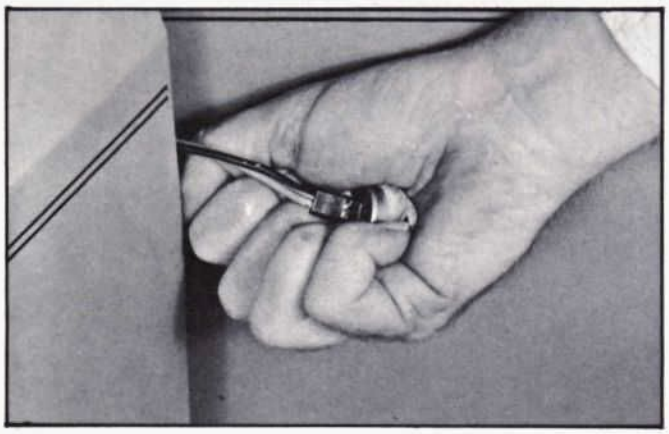


Figure 16—Warming the Thermal Switch by Hand

Place the transmission in Drive range and slowly accelerate the engine to 35 mph.

If the gauge shows NO VACUUM at any speed, the problem may be in the electrical or the vacuum hose connections or in the electronic control module. See Figure 17. But, if vacuum cuts in at the start of acceleration or before 20 mph is reached, the problem would *NOT* be in the vacuum hoses or speed sensor.

First check to see that all of the electrical and vacuum hose connections inside the passenger compartment are properly attached to the control module.

If the connections (both electrical and vacuum) are OK, then install a new electronic control module assembly. Do not attempt to repair this unit.

Recheck the vacuum to make sure the problem has been solved.

However, if the vacuum gauge still does not indicate a vacuum reading, the speed sensor is at fault and must be replaced. Recheck the vacuum, and if it cuts in between 20 and 30 mph the system is operating properly.

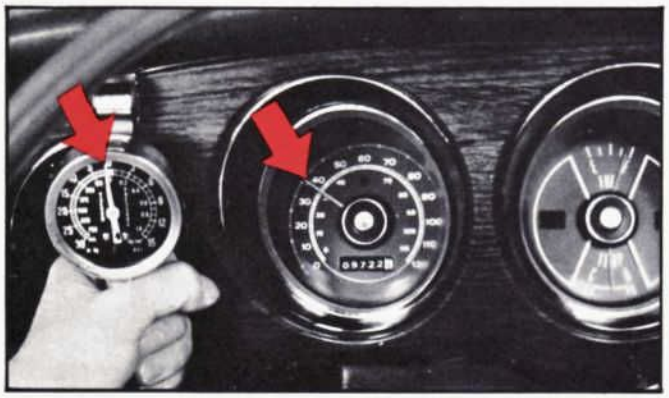


Figure 17—Checking Vacuum Reading Cut-In Point

After you have made sure that the electrical connections of the electronic control module are OK, recheck the vacuum with the thermal switch disconnected at the multiple plug. If no vacuum registers during this test, install a new thermal switch. See Figure 18.

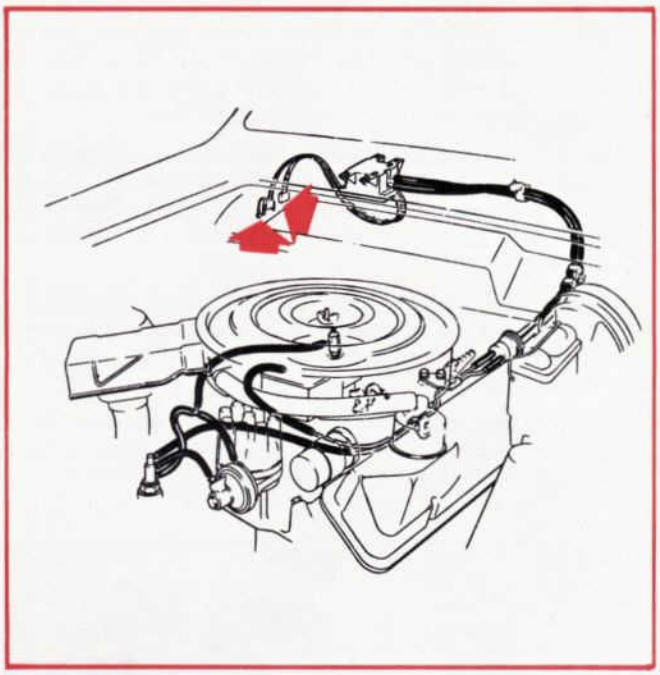


Figure 18—Check Points for Making Vacuum Test

However, if there is normal vacuum with the thermal switch disconnected, then replace the electronic control module.

After you have made the repairs as needed, recheck the vacuum to be sure that it cuts in between 20 and 30 mph. See Figure 19.

The procedures described are those that can best pinpoint the problem with the least amount of effort. By following them in a step-by-step manner, as outlined, you will eliminate possible error in your diagnosis. It is also suggested that you follow the Troubleshooting Chart on page 12.

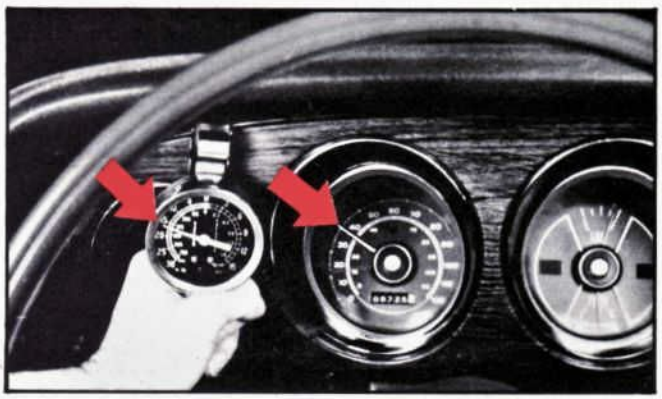


Figure 19—Gauge and Speedometer Readings when System Checks Out OK

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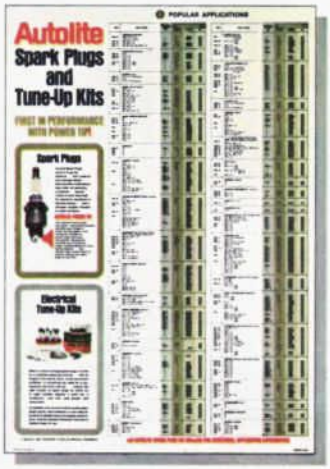

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FC-1000 (C8PZ-9030-A)	Gasoline Cap
EC-1000 (C8PZ-6766-A)	Oil Breather Cap
RT-1000 (C8PZ-8575-A)	180 Degree Thermostat
RT-1001 (C8PZ-8575-B)	190 Degree Thermostat
RG-12 (C8PZ-8255-A)	Water Outlet Gasket

VISIT OUR PARTS COUNTER AND STOCK UP NOW!

UNIQUE V-BELT AND HOSE SALES NUMBERING SYSTEM!

SIMPLIFIES STOCKING, SELECTING & SELLING!

Just a glance at a belt sleeve or hose label and you know immediately the size of the part and/or its intended use. Autolite's new V-Belt and Hose numbering system makes your job easier and more efficient. The Autolite V-Belt numbering system is explained in detail on the back of every Pacesetter and Hi-Trac Belt sleeve. A complete explanation of the new numbering system is available in the Autolite V-Belt and Hose Catalog.

PREMIUM QUALITY — Autolite V-Belts and Hose feature premium construction design and are made of the finest quality materials available. Broad line product coverage is provided for all Ford-built vehicles and all other popular domestic and foreign passenger cars and domestic light trucks.

CATALOG AND WALL CHART — To assist you, a new 595-page catalog (GSR-200) has been prepared with complete application and product information on the entire Autolite V-Belt and Hose line. Plus, a colorful wall chart (GSR-203) is available with application information on popular passenger cars for V-belts and flexible and molded radiator hose.

NEW PACEMAKER TEAR TAB REDEMPTION PROGRAM

makes the industry's best incentive program . . . PACEMAKER '70 . . . even better!

Sell Autolite performance-proven V-Belts and Radiator Hose and earn exciting Pacemaker Prize Points. All Autolite V-Belts and Radiator Hose feature either a sleeve tear tab or hose label tear tab. Any combination of ten sleeve tear tabs and hose label tear tabs have the equivalent value of one Pacemaker Prize Point. Combine these tabs with the other Pacemaker Prize Points you earn. Choose from more than 1800 nationally-known brand-name items pictured in the Pacemaker Awards Catalog.

ASK AT OUR PARTS COUNTER FOR COMPLETE DETAILS TODAY!

No problem...!

It's "No problem!" to keep promises and protect customer satisfaction with Authorized Remanufactured Ford Parts . . . you know every unit is ready to install fast and is right for the job.

You're sure because every replacement part meets Ford engineering standards . . . is tested for original part performance and is backed up with a warranty honored coast to coast.

All this protects you against comeback jobs and assures satisfied customers.

To get "No problem" remanufactured Ford parts, just give us a call.

NATIONAL WARRANTY

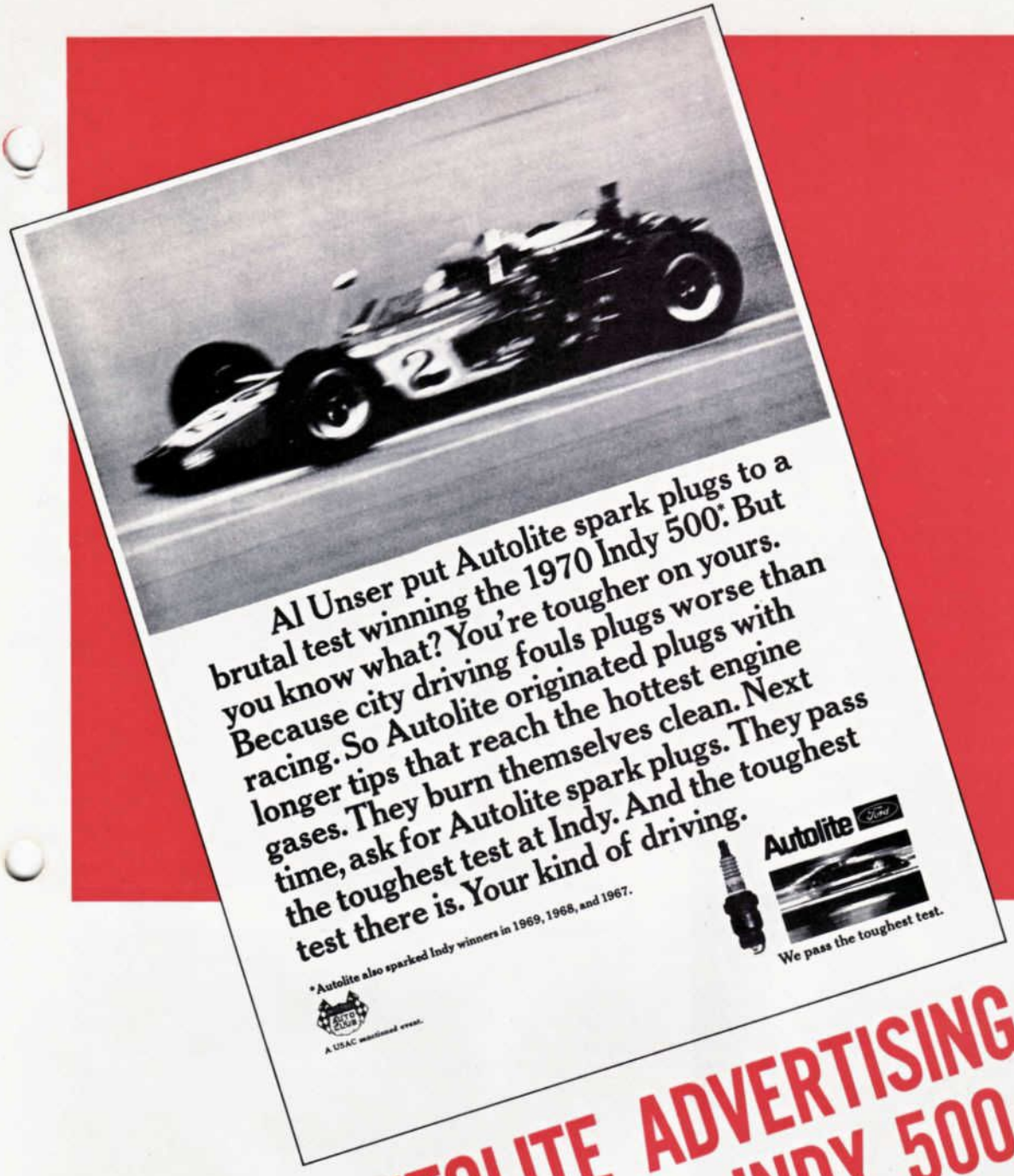
Every Remanufactured Ford Part is warranted nationally by the Remanufacturer to be free of defects in materials and workmanship for 90 days or 4000 miles from date of installation, whichever occurs first. Complete OHV engine assemblies are warranted for 12 months or 12,000 miles on passenger vehicles, and 6 months or 12,000 miles on trucks, whichever occurs first. This Warranty includes parts replacement plus related labor.

Ford and Lincoln-Mercury dealers will honor this warranty anywhere in the country.

Remanufactured

Ford

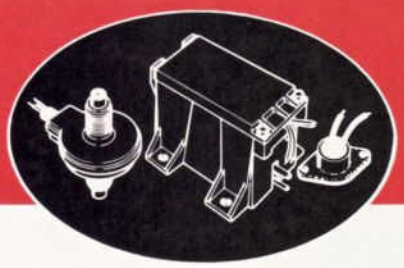
Engines · Parts



AUTOLITE ADVERTISING PROMOTES INDY 500 VICTORY

The 1970 Autolite Indy 500 victory continues to be promoted and advertised in major consumer publications during August and September. To date consumers have seen Autolite Indy 500 victory nationally advertised on ABC's "The FBI" and in *Sports Illustrated*. During August, Autolite "win" advertising will appear in *Hot Rod*, *Road & Track*, *Sports Car Graphic* and *Popular Mechanics*; and in the September issues of *Car Craft*, *Car & Driver*, *Motor Trend*, *Popular Science* and *Mechanix Illustrated*.

This special advertising campaign featuring a victory at the world's most famous race of its kind–the Indy 500–is designed to assist you in increasing *your* sales of all Autolite products.



DISTRIBUTOR

TROUBLESHOOTING EACH UNIT

At times it is worthwhile to test the separate units that make up the complete distributor modulator system. If you are not sure whether one of the units is damaged, or before installation of a replacement unit, you may want to test its operation before installation.

POWER SUPPLY TEST

To make this test, turn the ignition switch to the ON position and check the voltage at the RED wire leading to the electronic control module. A ZERO reading indicates an open circuit which may be traced to a blown fuse or loose, disconnected or broken wiring from the ignition switch circuit.

If you find that the power supply is correct (system voltage) the voltmeter will indicate normal battery voltage. See Figure 20.

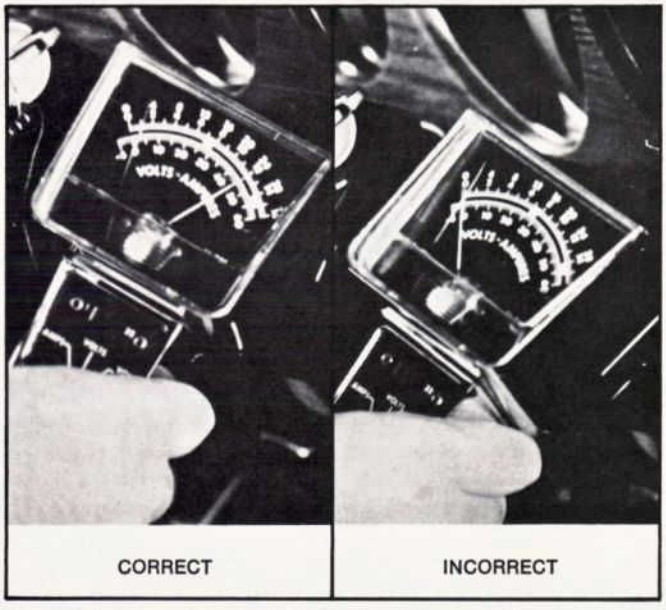


Figure 20—Power Supply Test Showing Correct and Incorrect Voltage Readings

THERMAL SWITCH TEST

You will need an ohmmeter to make this test, which can be made on the car or if you prefer, on the bench. First, disconnect the multiple plug electrical connection leading to the thermal switch. Connect the ohmmeter to the gray (or white) wire leading from the switch and to the ground wire (black). Hold the switch in the palm of your hand and allow enough time to warm this unit. See Figure 21.

If the meter indicates a reading with the switch warmed (58 to 68 degrees F. or higher), it means that the switch is CLOSED and so it must be replaced with a new one. As we mentioned earlier, the switch should be OPEN when temperatures are higher than the range listed above. No reading indicates the switch is OK.

Figure 21—Testing the Thermal Switch with an Ohmmeter. No Reading Means the Switch is OK

To be able to check the thermal switch operation at a lower temperature range, chill the switch by using ice in a small pail as shown in Figure 22, or use cold water. At temperatures within a range of 58 to 50 degrees F. or LOWER, the switch should be CLOSED and will indicate a reading on the ohmmeter scale. If there is NO reading (at those temperatures) it means the switch is OPEN and the switch will have to be replaced.

Figure 22—Testing the Thermal Switch to See if it Closes When Chilled

MODULATOR SYSTEM
Continued

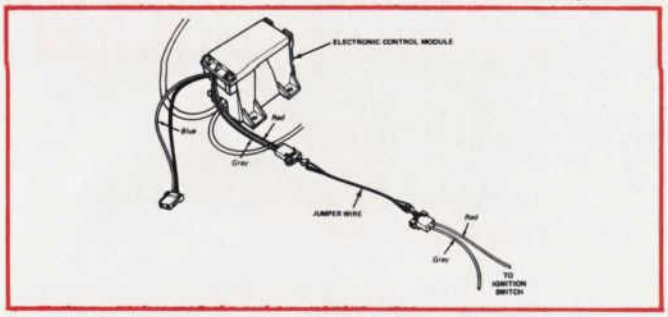


Figure 23—Using a Jumper Wire to Make the Electronic Control Modulator Test

ELECTRONIC CONTROL MODULE TEST

To make this test, first disconnect the multiple connector leading from the module and using a jumper wire, connect the two RED wires as shown in Figure 23. Now, connect a vacuum gauge to the carburetor spark port connection. See Figure 24.

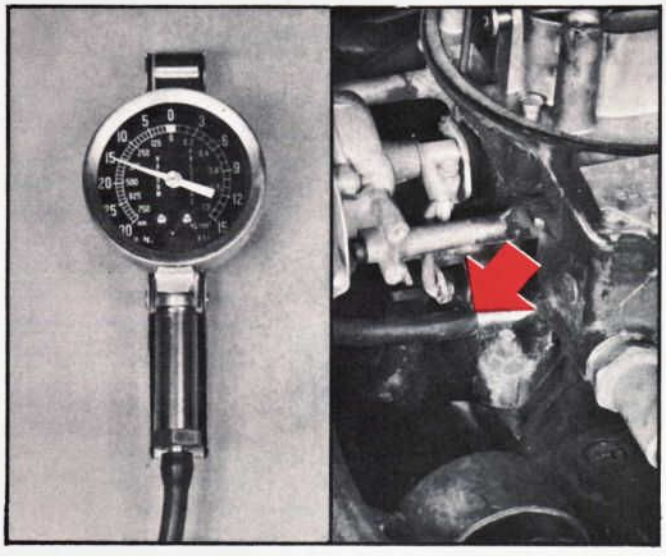


Figure 24—Checking Vacuum at the Carburetor Spark Port

Operate the engine at a fast idle speed and note the vacuum gauge reading. When this is completed, reconnect the vacuum hose.

Next, attach the vacuum gauge to the vacuum hose tube at the PVS valve or at the primary side of the distributor vacuum advance mechanism as shown by stub arrows in Figure 25. Then, connect another jumper wire to a clean ground and also to the GRAY or WHITE wire at the thermal switch connecting plug as indicated in Figure 26.

Run the engine at a fast idle speed and while doing so, note the vacuum gauge reading. This vacuum gauge reading should be the same or only slightly lower than the vacuum reading taken earlier at the carburetor spark port.

Replace the electronic control module if the vacuum readings DO NOT meet the conditions outlined when you have the thermal switch open or grounded through the use of jumper wires.

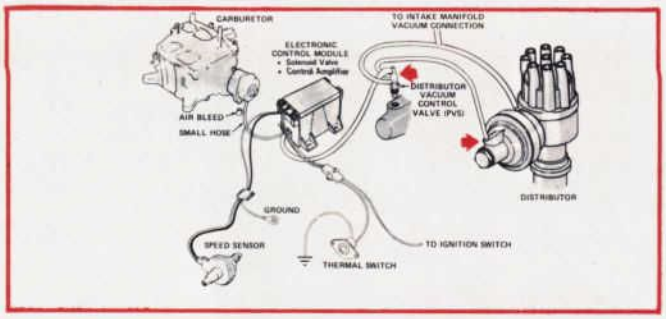


Figure 25—Vacuum Gauge Hookup Points for Making Vacuum Comparison Test of Electronic Modulator Unit

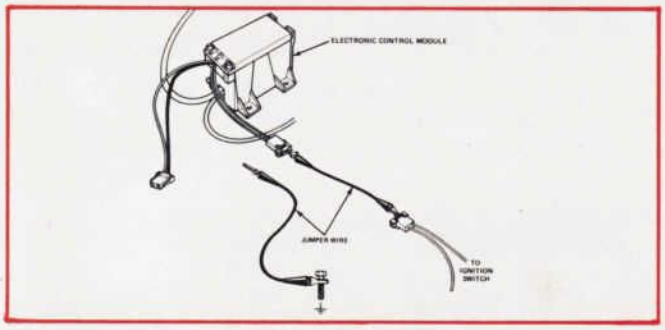


Figure 26—Using Two Jumper Wires for Test Purposes

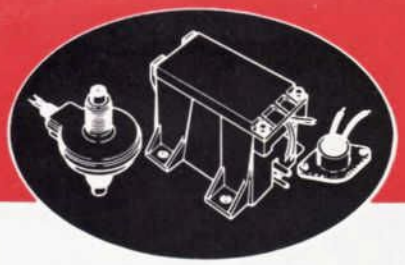
SPEED SENSOR TEST

Check the speed sensor for circuit continuity at the multiple plug as shown in Figure 27.

Using an ohmmeter, you should get a reading of 40-60 ohms with the sensor at room temperature.

Also check resistance between the BLACK wire and the speed sensor housing. The meter should show NO READING since it should be an open circuit condition. No continuity is permitted. If resistance readings are NOT correct, replace this unit.

Figure 27—Checking Speed Sensor Continuity Using an Ohmmeter



DISTRIBUTOR

DISTRIBUTOR MODULATOR SYSTEM TROUBLESHOOTING CHART

1 Run engine at 1500 rpm and check for vacuum at carburetor spark port with vacuum gauge. Note vacuum reading and reconnect vacuum hose to spark port.

2 Bypass Distributor Modulator hoses at rear of engine and connect vacuum gauge to distributor vacuum advance, primary side. Note vacuum reading.

If vacuum in Step 2 is approximately same as Step 1 then remove bypass hose and reconnect vacuum hoses from firewall to rear of engine.

Run engine until warm and at normal idle. Ensure that Thermal Switch is above 65°F.

Raise rear wheels.

Slowly accelerate to 35 mph.

NO VACUUM AT ANY SPEED. Check electrical and hose connection inside vehicle leading to modulator box.

Connections OK

Replace Distributor Modulator assembly and recheck vacuum

No vacuum

Replace speed sensor.

Connections not OK

Repair as required

VACUUM OCCURS BETWEEN 20-30 mph.

OK

If vacuum in Step 2 is not apparent or is considerably less than Step 1 check for pinched hoses or leaks on engine.

Repair as required.

VACUUM OCCURS BEFORE 20 MPH OR AT START OF ACCELERATION. Check electrical connections inside vehicle leading to plastic modulator box.

Disconnect Thermal Switch and recheck vacuum.

Vacuum

Replace Modulator assembly.

No vacuum

Replace Thermal Switch.

MODULATOR SYSTEM

Continued

DIST-O-VAC APPLICATION CHART

CARS AND TRUCKS	ENGINE WITH AUTO. TRANS.	ELECTRONIC (2) CONTROL MODULE			THERMAL SWITCH	SPEED SENSOR
		PART NUMBER	Color Code			
			Box	Cover		
FORD	240-1V	D0AZ-9E718-A	Black	White	D0AZ-12A164-E	D0AZ-9E731-B
FORD METEOR (1)	302-2V	D0AZ-9E718-G	White	White	D0AZ-12A164-E	D0AZ-9E731-B
FORD, MERCURY METEOR	390-2V	D0AZ-9E718-A	Black	White	D0AZ-12A164-E	D0AZ-9E731-B
MUSTANG COUGAR	351-4V(3)	D0AZ-9E718-C	Black	Blue	D0AZ-12A164-B	D0AZ-9E731-A
TORINO MONTEGO RANCHERO	351-4V(3)	D0AZ-9E718-B	Black	Black	D0AZ-12A164-E	D0AZ-9E731-A
ECONOLINE (E-100, E-200 and E-300 Bus Only)	302-2V	D0AZ-9E718-B	Black	Black	D0AZ-12A164-E	D0AZ-9E731-A
Truck F-100 (4 x 2)					D0AZ-12A164-E	

1 Air Conditioning Only
2 Electronic Control Modules Include Vent Bleed Assembly D0AE-12A168-B
3 Cleveland Built Engines

DIST-O-VAC OPERATING LIMITS

	Engine With Automatic Transmission	Vacuum Advance Cut-In Speed on Acceleration	Vacuum Advance Cut-Out Speed on Deceleration
DISTRIBUTOR MODULATOR SYSTEM OPERATING LIMITS	240-1V 302-2V (Econoline Only) 351-4V (Cleveland Engine) 390-2V	23 ± about 2 mph	All Engines Approximately 18 mph

DIST-O-VAC UNIT SPECIFICATIONS

THERMAL SWITCH*

Open.....58-68° F. (Max.)

Close.....58-50° F. (Min.)

*Outside or Ambient Air Temperature

SPEED SENSOR

Resistance**.....40-60 ohms

Coil Resistance to Case.....Open Circuit

Speedometer Cable Nut Torque...18-25 In.-Lbs.

**At Room Temperature

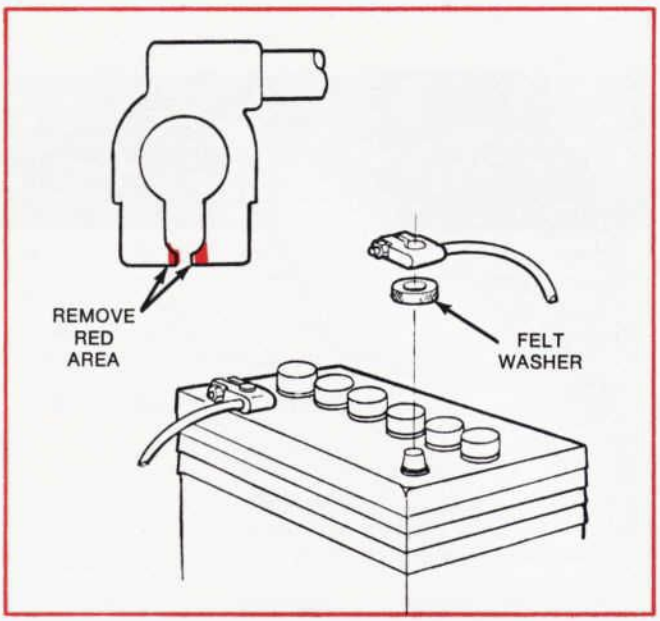
TECHNICAL

CABLE CLAMP CONNECTIONS AT THE BATTERY POST

One of the major causes of rapid and repeated cable clamp and battery post corrosion is a small leakage of battery electrolyte around the terminal post. Although the oxide formation is often dark gray in color and appears to be harmless, it is *non-conductive*, thus preventing the passage of electrical current. This harmless looking condition often results in a no-start problem. As a result, it is important that the inner surfaces of the cable clamp and the outside surfaces of the battery terminal post be cleaned with a wire brush or sandpaper until they are "new metal" bright.

Use of a felt washer (Part No. C1AZ-10A717-A) placed over the battery terminal posts before installing the cable clamps will help to prevent oxide formation. Note illustration. Saturate the felt washers with engine oil and make sure the cable clamp is flush with the top of the terminal post.

CAUTION: Some 1967 and 1968 vehicles may have stop blocks on the clamps. You can improve the connection if these blocks are removed with a hacksaw as shown.



SPECIAL ATTENTION . . . ALL MECHANICS

It is extremely important to realize that engines, transmissions and steering assemblies manufactured overseas are sized in *metric dimensions*. As a result, these components on Ford of Germany and Ford of Britain vehicles also use metric sized bolts, nuts, studs, screws and fasteners.

If for example, a U.S. standard sized nut is installed on a metric sized bolt it will loosen and may well fall out of the assembly or cause parts to separate. Remember that the length or the inner or outer diameter of a U.S. standard sized bolt or nut looks very similar to those of metric sized dimensions.

CORRECTION AND CLARIFICATION . . . TO TRAILER TOWING ARTICLE

(JUNE 1970 EDITION OF SHOP TIPS)

- *Page 3, column one under Trailer Classifications*—The note that indicated a Class I trailer becomes a Class III trailer when it has more than 25 square feet of frontal area is not correct and does not apply.
- *Page 3, column two under the Two Types of Trailer Hitches*—Delete:"THE TWO TYPES OF TRAILER HITCHES" and entire paragraph thereunder—replace with, "SOME POINTERS ON TRAILER HITCHES." "Ford-built cars have built-in ability to haul most light trailers with no special equipment other than a proper hitch and a hook-up for lights. Clamp-on "bumper" trailer hitches, which attach to the bumper face bar at the two jack points, rather than at the center, are generally satisfactory. Included in this category are the hitches, such as those furnished by many trailer rental companies."
- *Page 4, column one under NOTE*—The statement that "Ford recommends the use of frame hitches only" is to be deleted in its entirety.

STARTING PROCEDURES

Emission requirements, such as the elimination of the external fuel bowl vent from carburetors, have made proper starting technique more important than before. Frequently, the complaint can be corrected through demonstration of the proper starting technique.

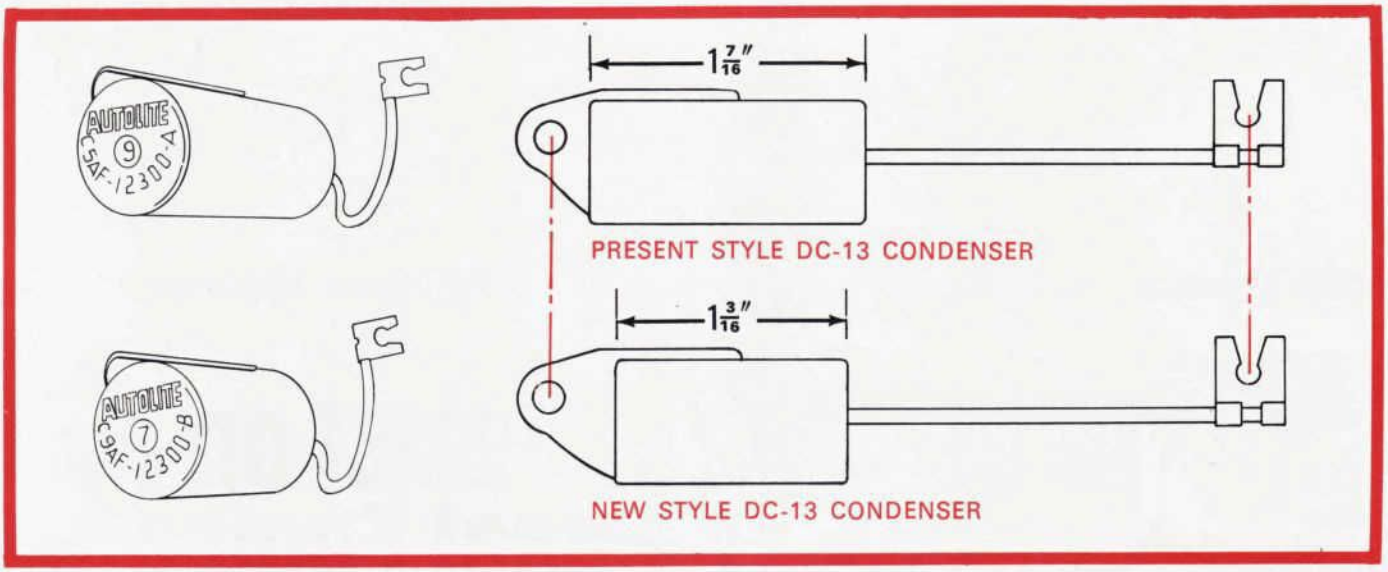
Hot Start Technique (Engine Warm)

- TURN KEY TO "ON" POSITION. (It is important to do this FIRST.)
- PRESS ACCELERATOR PEDAL ¼ to ½ WAY DOWN AND HOLD. (**CAUTION:** DO NOT PUMP THE PEDAL)
- TURN KEY TO "START"

NOTE: IF ENGINE FAILS TO START USING ABOVE PROCEDURES—

- PRESS THE PEDAL ALL THE WAY TO THE FLOOR AND **HOLD.**

SERVICE BRIEFS



A NEW STYLE DC-13 CONDENSER IS BEING PACKAGED IN FORD APPLICATION TUNE-UP KITS.

The new style condenser, identified by C9AF-12300-B on the end of the assembly (see above illustration) has the same capacitance and the same overall length as the present type DC-13.

Note, however, that the new style has a shorter body and incorporates a longer lead wire. From a service standpoint, this makes installation easier since it takes up less space inside the distributor housing. The new style condenser change in Ford Application Tune-Up Kits will not affect the kit applications in any way.

OPERATION OF AUTOLITE CONDENSERS

When distributor points open through the mechanical action of the cam, the condenser quickly absorbs the electrical charge from the primary winding of the coil. This allows the magnetic field to collapse rapidly, thus preventing arcing across the distributor point contacts.

Consequently, Autolite condensers are designed to absorb the high induced voltage without becoming shorted or open-circuited which would stop operation of the entire ignition system.

Any variations in the rated capacitance value of a condenser will lead to point set pitting and early point set failure and naturally result in poor engine performance.

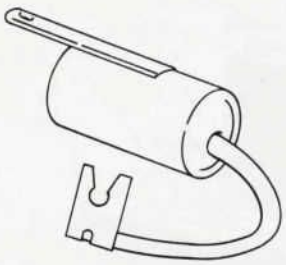
For maximum electrical efficiency, Autolite condensers are precisely balanced with the other electrical parts in the ignition system and their capacitance value is rigidly controlled.

CONDENSER INFORMATION TIPS

In a 12-volt battery system, the *movable* point will become pitted if an *under-capacity* condenser is installed while the *stationary point* will become pitted if an *over-capacity* condenser is installed. However, just the opposite is true in a 6-volt battery system. Therefore, the pitting of the *movable* point indicates an *over-capacity* condenser and pitting of the stationary point indicates an *under-capacity* condenser.

Capacity is measured in microfarads and can be checked on most of the nationally known tune-up test equipment.

AUTOLITE CONDENSERS OFFER QUALITY ADVANTAGES



- Controlled manufacturing process hermetically seals out moisture, dust and corrosion
- Permanently welded internal connectors
- Internal components firmly anchored to prevent movement and resulting short circuits
- High dielectric insulation holds voltage surges without breakdown
- Insulated, stranded copper leads with the connector lug clamped and soldered to the lead
- Matched capacitance offers longer point life and better engine performance

COMPLIMENTS OF

YOUR SOURCE FOR GENUINE FORD AND AUTOLITE ORIGINAL EQUIPMENT PARTS

TO BE SURE . . . insist on Ford Original Equipment Engine Parts!

Ford replacement engine parts—rings, bearings, rocker arm assemblies and others—are all part of a "matched set" . . . designed, engineered and precision-built for Ford vehicles. They are of the highest original-equipment quality to fit right, wear longer and provide like-new dependability. This all adds up to greater customer satisfaction and fewer comebacks for you.

So, to be *sure* on all Ford engine part replacements, install Ford original-equipment parts. Just like the ones that came from the factory. Let us serve your *other* Ford parts needs, too. You can get everything you need in one stop. Save time. Speed up customer service. And win a lot of friends because you *did your very best!*

CALL US TODAY . . .

We're headquarters for all your Ford and Autolite parts!