SHOP TIPS

Autolite Ford

VOL. 9, NO. 7 MARCH, 1971

Pollution Control ... Part 2

SEE CENTER INSERT FOR TIMELY PROMOTIONS

CONTROLLING

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 to file this and future issues for ready reference. If you have any suggestions for articles 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.

The information in this publication was gathered from materials released by the National Service Department of Autolite-Ford, Ford and Lincoln-Mercury Divisions, as well as other vehicle and parts manufacturers. The descriptions and specifications contained in this issue were in effect at the time it was approved for printing. Our policy is one of continuous improvement and we reserve the right to change specifications or design without notice and without incurring obligation.

Autolite Ford

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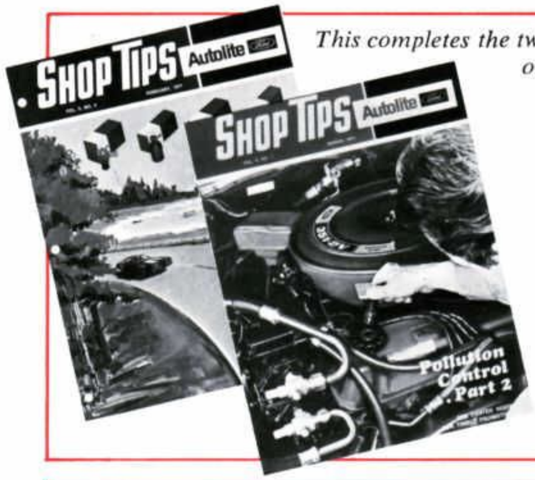


This completes the two-part series on controlling pollution.

INTRODUCTION

This issue contains service procedures for keeping pollution control devices on the automobile in proper working order. As a person who makes your living at correcting mechanical problems, you can well realize why it is important to keep such devices in good repair. You know how important a tune-up is and how it can affect the overall performance of an engine. Fouled spark plugs or worn ignition points not only reduce fuel economy and engine power, but allow a greater percentage of unburned fuel vapors to reach the exhaust system. If the car is equipped with pollution control devices that are not working properly or are disconnected, these vapors will reach the atmosphere as air pollutants.

Fortunately, the average driver is beginning to realize that he has pollution control devices on his car, and he is becoming more receptive to the idea that if he keeps his car in good repair it will perform better and he will be doing his part to reduce pollution.

Unfortunately, there are many drivers who do not go along with the average motorist, and their cars usually are driven until they stop in the street before they get attention. These are the people you, as a service technician, have to do a selling job on to make them aware of what they can do to fight pollution.

First, emission control devices cannot do their job if other systems on the car are in need of repair. Emission control devices cannot do their job properly if the exhaust system or cooling system is not working properly or if the engine has worn parts. This is especially true with cars that are a few years old or have not been maintained regularly. So, you will have to fix a problem before you begin any work on an emission control device.

You may run into a customer who asks if emission control devices really do reduce air polluting contaminants. Show the customer the charts in the last month's issue and explain what effect pollution control devices have had already on reducing the amount of pollutants that reach the atmosphere from automobiles. Remind every customer that he has the power to do his share in making the car he drives as pollution free as is mechanically possible. Cleaner air is a large return on a small investment in pollution control device maintenance.

POLLUTION

SERVICE PROCEDURES

ANALYZING EXHAUST EMISSIONS

In the 'old' days, before anyone really thought about exhaust vapors being a source for air polluting contaminants, mechanics used an exhaust gas analyzer to check air/fuel ratios during the engine tune-up process. These ratio meters relied upon a rich fuel mixture for air/fuel ratio detection.

As newer emission control devices were developed, the air/fuel ratio detection meters were no longer accurate because the new emission controlled engines ran on leaner air/fuel mixtures and an accurate ratio reading could not be obtained. This need led to the development of an exhaust emission analyzer that measures the amount of carbon monoxide (CO) and unburned hydrocarbons (HC) in the exhaust vapors. Figure 1.

Figure 1–Exhaust Emission Analyzer

USING THE EXHAUST EMISSION ANALYZER

The typical analyzer uses a pick-up probe that collects data after it is inserted into the tail pipe of the running car. To insure accurate readings, the exhaust system should be leak-free and the probe should be inserted into the tail pipe a minimum of 18 inches. Turn on the analyzer and let the instrument warm up to normal operating temperature so the meters are stable before you take a reading.

With the engine running at curb idle and the air cleaner installed, place the "COMPOSITE-INDIVIDUAL" switch in the "COMPOSITE" position and wait for the carbon monoxide meter to stabilize.

After the carbon monoxide meter has stabilized, hold the "COMPOSITE-INDIVIDUAL" switch in the "INDIVIDUAL" position and record the reading of both meters—after they have stabilized. Release the switch.

TEST CONCLUSIONS

1. If the carbon monoxide meter registered in the *GREEN* portion of the scale, or within specifications, and the combustion meter registered *RED* or *YELLOW*, the carburetor air/fuel mixture and idle speed are correct; however, the vehicle's combustion system requires attention. Check the spark plugs, points, timing, compression, etc. After finding the problem and correcting trouble, repeat the test. The combustion meter should register in the *GREEN*, or within specifications.

2. If the carbon monoxide meter registers *RED* on the scale, or above specifications, and the combustion meter registers *GREEN* on the scale, or within specifications, the air/fuel mixture is too rich. To correct the problem, a carburetor adjustment may be required. Place the analyzer switch in the "COMPOSITE" position and adjust the idle mixture and/or idle speed adjusting screws on the carburetor. If the meter does not register in the *GREEN* portion of the scale after adjusting the idle mixture and/or idle speed, check for other causes of a rich carburetion condition. A sticking choke, dirty air cleaner, dirty PCV valve, etc., are possible sources of trouble. Repeat the test after making corrections.

3. If both meters register in the *RED* or *YELLOW* portion of the scale or above specifications, the carburetion and combustion systems may need a major overhaul to bring exhaust emissions down to an acceptable level.

NOTE: Always correct the combustion problem first.

IGNITION AND COMBUSTION TESTS

Ignition timing is an adjustment necessary to bring the instant firing of the spark plug into its correct time relationship with the position of the piston. Igniting the fuel at the right instant, under all load and speed conditions, is a determining factor in the performance and economy of the automobile engine. Now, with the introduction of the emission control systems, timing, advance and retard have become even more important. As an example: if the engine timing is advanced 5 degrees beyond specifications the hydrocarbon emissions will increase 60 parts per million in the exhaust vapors.

Accurate engine timing requires the use of a strobe-flash timing light. The flash of the strobe light is simultaneous with the firing of the number one spark plug. Correct engine timing is indicated by the alignment of the engine timing pointer and a specified engine timing mark.

Equipment manufacturers have developed a timing light with a meter that checks the advance or retard in degrees, thus enabling the service technician to test the total timing mechanism with the distributor on the engine.

Due to the more sophisticated timing requirements, there have to be additional control valves to control vacuum to the distributor under all speed and load conditions.

The operating principles of these valves have been discussed previously but, of course, we must be able to service them in the event of a malfunction. Most vehicle manufacturers use either one or both of these valves.

NOTE: When setting initial timing be sure to disconnect the hoses from the vacuum advance and plug the hoses. A golf tee or any similar object may be used as the tool to do this job.

SERVICING THE DISTRIBUTOR VACUUM CONTROL VALVE

The distributor vacuum control valve is also referred to as a temperature-sensing valve.

1. Before you begin the test, make sure all vacuum hoses are installed and routed properly.
2. Attach a tachometer to the engine.
3. Start the engine and allow it to warm up to normal operating temperature. Check the choke plate and make sure it is in the vertical position. *THE ENGINE MUST NOT BE OVERHEATED.*
4. Note the engine idle rpm with the transmission in neutral and the carburetor throttle in the curb idle position.
5. Disconnect the vacuum hose from the intake manifold at the temperature-sensing valve and plug or clamp the hose.
6. Note the engine idle rpm with the hose disconnected. If there is no change in idle speed, the valve is acceptable to this point. If there is a drop in idle speed of 100 rpm or more, the valve should be replaced.
7. Verify that the correct radiator cap is installed and that the all-season cooling mixture is up to manufacturer's specifications.
8. Cover the radiator sufficiently to bring on a high temperature condition. Run the engine until the red (high-temperature) light comes on indicating an above normal temperature.

If the engine idle speed by this time has increased 100 rpm or more, the temperature-sensing valve is satisfactory. If the idle speed does not increase sufficiently, replace the valve.

CAUTION:
Do not permit the engine to operate in an overheated condition any longer than necessary to determine that the valve is good or bad.

DISTRIBUTOR VACUUM CONTROL VALVE TEST WITH VACUUM GAUGE

Using the above procedure, substitute a vacuum gauge for the tachometer. See Figure 2. Note the vacuum gauge reading with the gauge connected to the distributor outlet on the temperature-sensing valve.

1. With engine temperature normal, the gauge should read near zero inches of vacuum (venturi vacuum) with the other hoses connected.
2. Repeat steps #7 and #8 of test to bring engine to a high temperature.
3. With the engine overheated, the vacuum gauge should read sixteen (16) inches of vacuum or more (manifold vacuum).

The valve should be replaced if the gauge readings are not satisfactory.

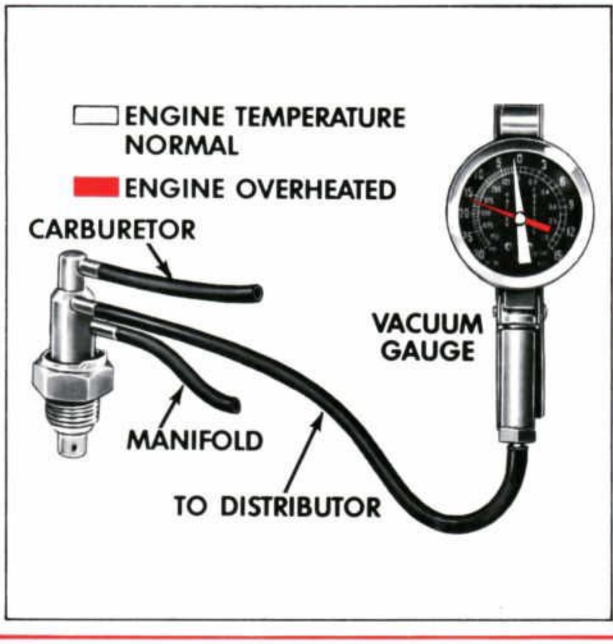


Figure 2—Testing Vacuum Control Valve With Vacuum Gauge

DISTRIBUTOR VACUUM ADVANCE CONTROL VALVE TEST

The distributor vacuum advance control valve also referred to as the distributor vacuum deceleration valve, is one of the methods used to control timing during enigne deceleration. The following testing procedure for the distributor vacuum advance control valve is for Ford-built vehicles only. See Figure 3.

1. Connect a tachometer to the engine and start the engine. Let the engine run until it reaches normal operating temperature.
2. Connect a vacuum gauge to the distributor vacuum line. The distributor vacuum line and the tee fitting should have approximately the same inside diameter or the reading on the gauge will not be accurate.

3. If the engine is equipped with a dashpot, tape the plunger in a depressed position so that it does not contact the throttle lever at idle speed. Use a clamp to close the vacuum line that connects the deceleration valve to the intake manifold.

4. Remove the distributor vacuum hose at the distributor and clamp the hose closed. With the engine running at the idle rpm specified by the manufacturer (transmission in neutral and parking brake on), set the ignition timing to the manufacturer's specifications.

5. If necessary, adjust idle speed and air/fuel ratio to the manufacturer's specifications and procedures. The distributor vacuum must be below six inches of mercury at idle speed.

6. Remove the clamps from the vacuum tubes and reconnect the vacuum line to the distributor. Remove the distributor vacuum advance control valve cover. Increase engine speed to 2,000 rpm in neutral and hold the speed approximately five seconds. Release the throttle and note the distributor vacuum reading. When the throttle is released, the distributor vacuum should increase to more than 16 inches of mercury and remain there for a minimum of one second. The distributor vacuum should fall below six inches of mercury within three seconds after the throttle is released.

7. It is normal during this period for a buzzing sound to be heard. If it takes less than one second or more than three seconds for the distributor vacuum to fall below six inches of mercury, adjust the valve. Turning the spring end adjusting screw counterclockwise will increase the time the distributor vacuum remains above six inches of mercury after the throttle is closed. One turn of the adjusting screw, Figure 3, will change the valve setting approximately one-half inch of mercury. If the valve cannot be adjusted to manufacturer's specifications, replace the valve.

8. Replace the valve cover. Remove the tape from the dashpot plunger and re-check the performance of the deceleration valve. If the distributor vacuum does not fall below six inches of mercury within four seconds after the throttle is closed, adjust the dashpot to manufacturer's specifications or replace the dashpot.

9. To check the distributor vacuum advance control valve for a possible diaphragm leak, connect a vacuum gauge into the vacuum hose connecting the valve to the intake manifold vacuum connection. Use a tee fitting with approximately the same inside diameter as the inside diameter of the vacuum hose (¼-inch I.D.). Clamp the vacuum hose connecting the valve to the distributor. Clamp the hose connection to the valve and the carburetor.

10. Start the engine and let it run at normal idle speed. Observe the vacuum reading. Place a clamp on the vacuum hose connecting the valve to the intake manifold between the valve and the vacuum gauge tee. Observe the vacuum reading. If the second reading indicates a higher vacuum reading than the first reading, replace the deceleration valve.

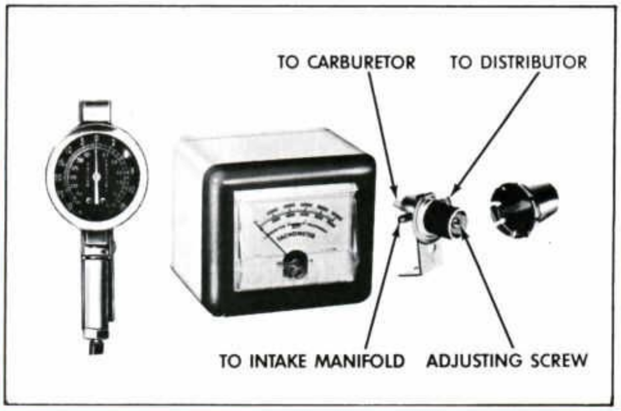


Figure 3—Vacuum Advance Control Valve (Deceleration Valve)

POSITIVE CRANKCASE VENTILATOR TEST

During the course of combustion, unburned gas vapors, soot and other contaminants slip by the piston rings and gather in the crankcase area. These blow-by vapors must be removed from the crankcase. This is accomplished with either a "closed" or "open" PCV system which recycles the blow-by vapors back through the intake manifold and into the air/fuel mixture.

1. Inspect the hoses, oil filler cap, oil dipstick and seal to make sure they are sealing properly.
2. Remove the oil filler cap and start the engine.
3. With the engine running at idle speed, place a PCV tester over the oil fill hole or tube. See Figure 4.
4. If testing with the Autolite (EV-44) tester, observe the position of the yellow ball—Green (good) indicates that the PCV system is functioning properly. Red (repair) indicates that the PCV system needs to be serviced.
5. Clean hoses, install new Autolite PCV Valve and retest.

Figure 4—PCV Valve Test

AIR INJECTION SYSTEM TEST

The air injection system has three component parts that need testing. The air supply pump, check valve, and air bypass valve can all be tested with a pressure gauge and an adaptor that is simple to fabricate. Although air injection system components may differ slightly between car makes and models, their main function and the procedure for testing is basically the same. The test procedures and instructions for fabricating the test adaptor are for Ford-built vehicles. Consult the appropriate vehicle shop manual for specific tests on other make vehicles.

FABRICATING THE TEST ADAPTOR

Obtain a ½-inch pipe tee, a 2-inch long piece of ½-inch galvanized pipe threaded on one end only, a ½-inch pipe plug, and a ½-inch reducer bushing or suitable gauge adaptor. See Figure 5.

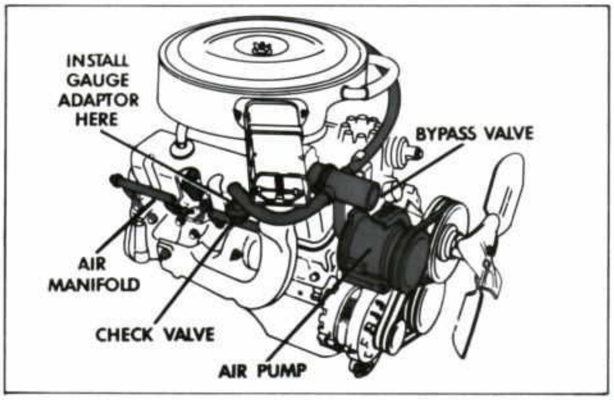


Figure 5—Test Gauge Adaptor

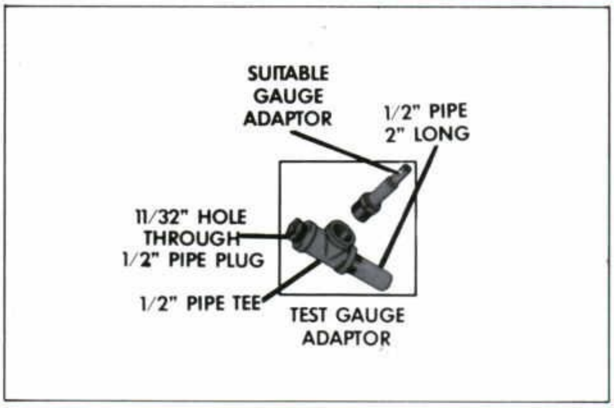


Figure 6—Thermactor System

1. Apply sealer on the 2-inch long piece of ½-inch pipe and install it on one end of the pipe tee. Apply sealer on the O.D. threads of the pipe plug and install it in the other end of the tee. Apply sealer on the O.D. threads of the ½-inch reducer bushing or adaptor for the pressure gauge and install it into the side opening of the tee.
2. Using an 11/32 (0.3437)-inch diameter drill, drill a hole through the center of the pipe plug. Clean out the chips produced by drilling.
3. Obtain a standard fuel pump tester or suitable pressure gauge. Make sure the gauge is accurate and readable in ¼ psi increments. Attach the gauge to the adaptor.

AIR SUPPLY PUMP TEST PROCEDURE

Start the engine and let it run until it reaches normal operating temperatures. Inspect all hoses and hose connections for leaks and correct as necessary prior to checking the air pump.

Check the air pump belt tension and adjust the belt to manufacturer's specifications. Disconnect the air supply hose(s) at the air manifold check valve(s). If there are two check valves, close off one hose by inserting a suitable plug in one end of the hose. Use a hose clamp and secure the plug so that it will not be blown out.

Insert the open pipe end of the test gauge adaptor in the other air supply hose. Clamp the hose securely to the adaptor to prevent it from blowing out. Position the adaptor and test gauge so that the air blast emitted through the drilled pipe plug will be harmlessly dissipated.

Install a tachometer on the engine. Start the engine and slowly increase the engine speed to 1,500 rpm. Observe the pressure produced at the test gauge. The air pressure should exceed one psi.

NOTE: If the air pump pressure is below the minimum of one psi, replace the air supply pump.

CHECK VALVE TEST PROCEDURE

THIS TEST CAN BE PERFORMED AT THE SAME TIME AS THE "AIR SUPPLY PUMP TEST."

Start the engine and let it run until it reaches normal operating temperatures. Inspect all hoses and hose connections for leaks and correct as necessary before testing the check valve.

Disconnect the air supply hose(s) at the check valve(s).

Visually inspect the position of the valve plate inside the valve body. It should be lightly positioned against the valve seat—away from the air manifold.

Insert a probe into the hose connection on the check valve and depress the valve plate. It should freely return to the original position, against the valve seat, when released.

If equipped with two check valve assemblies, check both valves for free operation.

Leave the hose(s) disconnected and start the engine. Slowly increase the engine speed to 1,500 rpm and watch for exhaust gas leakage at the check valve(s). There should not be any exhaust leakage. The valve may flutter or vibrate at idle speeds, but this is normal due to the exhaust pulsations in the manifold.

Replace the valve(s) if not functioning properly.

AIR BYPASS VALVE FUNCTIONAL TEST

Remove the air bypass valve-to-air manifold check valve hose at the bypass valve hose connection.

With the transmission in neutral and the parking brake on, start the engine and operate it at normal engine idle speed. Verify that air is flowing from the air bypass valve hose connection. See Figure 6. Air pressure should be noted as this is the normal delivery flow to the air manifold(s).

Pinch off the vacuum hose to the bypass valve for approximately five seconds to duplicate the air bypass cycle.

Release the pinched vacuum hose. Air flow through the air bypass valve should diminish or stop for a short period of time. The length of time required to resume normal flow cannot be specified since the time interval is dependent on engine vacuum and length of time the vacuum line is pinched off.

Evaluate the bypass valve for diaphragm leakage by performing the following check:

1. Remove the vacuum supply hose to the air bypass valve at the bypass valve connection.
2. Insert a tee connection in the vacuum supply hose.
3. Connect a vacuum gauge to one of the remaining hose connections on the tee; insert a short length of hose (about 3 inches long) on the remaining connection.
4. Insert a suitable plug in the open end of the short length of hose.
5. Start the engine and note the vacuum gauge reading.
6. Remove the plug from the short length of hose to the air bypass valve vacuum connection.

NOTE: If the indicated vacuum reading does not correspond with the previous reading after 60 seconds, replace the air bypass valve.

If a problem still exists after the above tests, it proves the air injection system is working properly and the engine may be in need of a tune-up.

Tune-up procedures should include the checking and adjusting of the following to manufacturer's specifications:

- Ignition timing (approximate figures will not be sufficient).
- Spark plugs, spark plug wires, distributor cap and distributor rotor.
- Carburetor float level.
- Carburetor main metering jets.
- Choke operation (staying closed too long or partially closed when hot).

Poor engine performance and idle can result from a vacuum leak at any of the numerous lines or gaskets in the intake system. A vacuum leak can be erroneously diagnosed as a malfunction of most any other system.

CARBURETOR ADJUSTMENTS

ROUTINE ADJUSTMENTS

Idle mixture adjustments must be made with the engine at operating temperatures and after all other adjustments have been made. If an exhaust analyzer is not available, a vacuum gauge and/or a tachometer can be used to adjust idle mixture *within the limits of the idle limiter device* used on any given carburetor. Idle adjustments within the limiters is subject to the same precautions as in previous years. The choke should be open, hot idle compensator valve closed, headlights on, automatic transmission in drive, emergency brake on, air cleaner installed, etc. If a satisfactory idle adjustment cannot be made within these limits, an exhaust emission analyzer must be used and the limiting device re-adjusted to obtain the specified (CO) carbon monoxide level.

MODIFYING CARBURETOR IDLE CONDITIONS WITH LIMITING CAPS

Remove the plastic limiter caps by cutting them with side-cutter pliers and a knife. See Figure 7. After the cut is made, carefully pry the limiter apart.

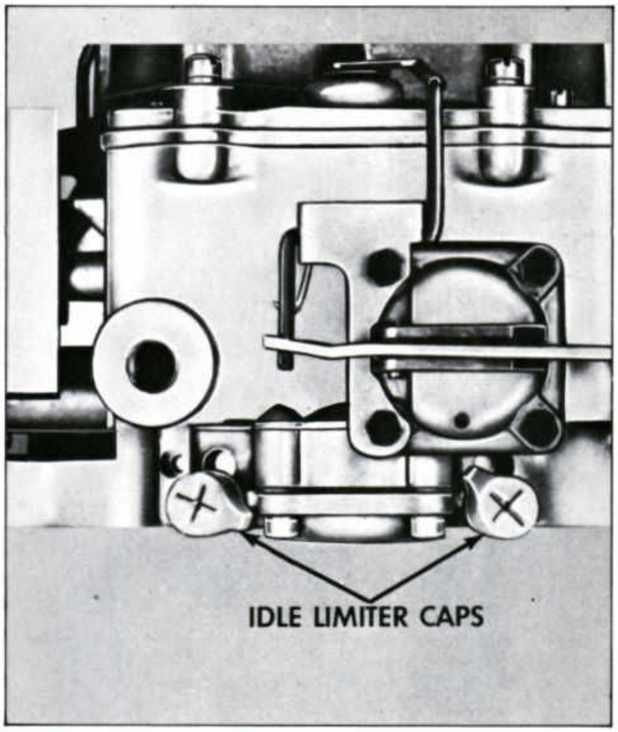


Figure 7—Idle Limiting Caps

ON SOME CARBURETORS, IT MAY BE NECESSARY TO REMOVE THE CARBURETOR TO REMOVE THE LIMITERS.

After the limiters are removed, set the carburetor to manufacturer's specifications using the exhaust emission analyzer.

When the idle is within specifications, install a blue plastic limiter cap. Use care when installing the cap and avoid turning the idle mixture screw with the cap. Position the cap so that it is in the maximum counterclockwise position with the tab of the limiter against the stop on the carburetor. The idle mixture adjusting screw will then be at the maximum allowable outward, or rich, setting.

To install the service limiter cap, use a straight forward pushing force with thumb pressure or a ⅜-inch socket wrench extension. Recheck the carbon monoxide level with the exhaust emission analyzer to make sure the limiter caps are properly installed.

MODIFYING CARBURETOR IDLE CONDITIONS WITH IDLE LIMITING NEEDLES

Remove the lead seal covering the idle limiting needle in the throttle body by carefully picking it out with a sharp-pointed tool. See Figure 8. If necessary, drill out the center of the lead seal with a ⅛-inch diameter drill in a pin vise. With the idle adjusting needle at the maximum rich setting, slowly back out the idle limiter, 1/16 turn at a time, until the specified carbon monoxide reading is obtained on the exhaust emission analyzer. After obtaining the specified reading, install a new lead seal over the idle limiter. Drive the lead seal into the hole with a small punch until the lead just contacts the head of the screw.

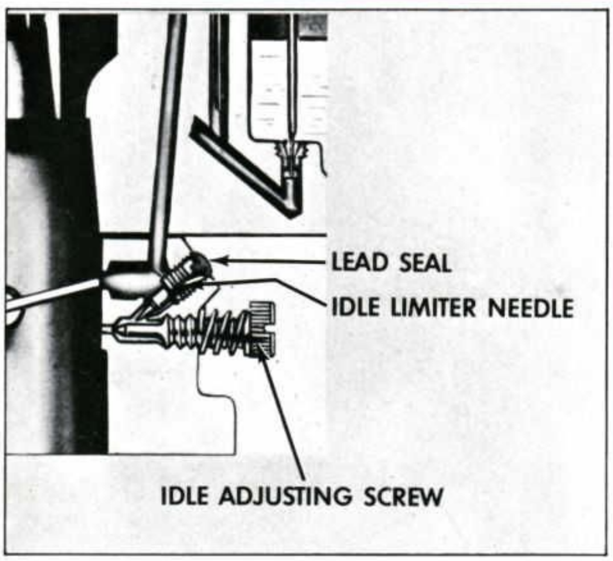


Figure 8—Idle Limiter, Seal and Adjusting Screw

After the idle limiter has been reset and the carbon monoxide level verified with the emission analyzer, stamp or scribe the letter "R" on the carburetor identification tag just above the name Autolite to indicate the carburetor has been reworked.

NOTE: Idle limiter modification should not be attempted without an exhaust analyzer and only after all other engine systems have been eliminated as the source of the problem.

OTHER IDLE LIMITERS

Some manufacturers use idle limiter screws that restrict the movement of the idle adjustment screw. On Chrysler Ball & Ball Carburetors, the idle adjustment screws have limited travel. Any attempt to remove the screw will result in damage to the screw and the carburetor will have to be replaced. Rochester Carburetors (General Motors) use an idle restriction in the idle passage. With this system, the idle adjusting needle can be turned any number of turns but the result is limited by the restricted passage.

AIR INTAKE SYSTEM SERVICE

The service of this system is not directly connected to the emission system and will not affect the vehicle's exhaust emission. However, the air intake system became necessary as a result of the leaner mixtures used to control the emission of hydrocarbons and carbon monoxide emissions. Any malfunction will affect driveability.

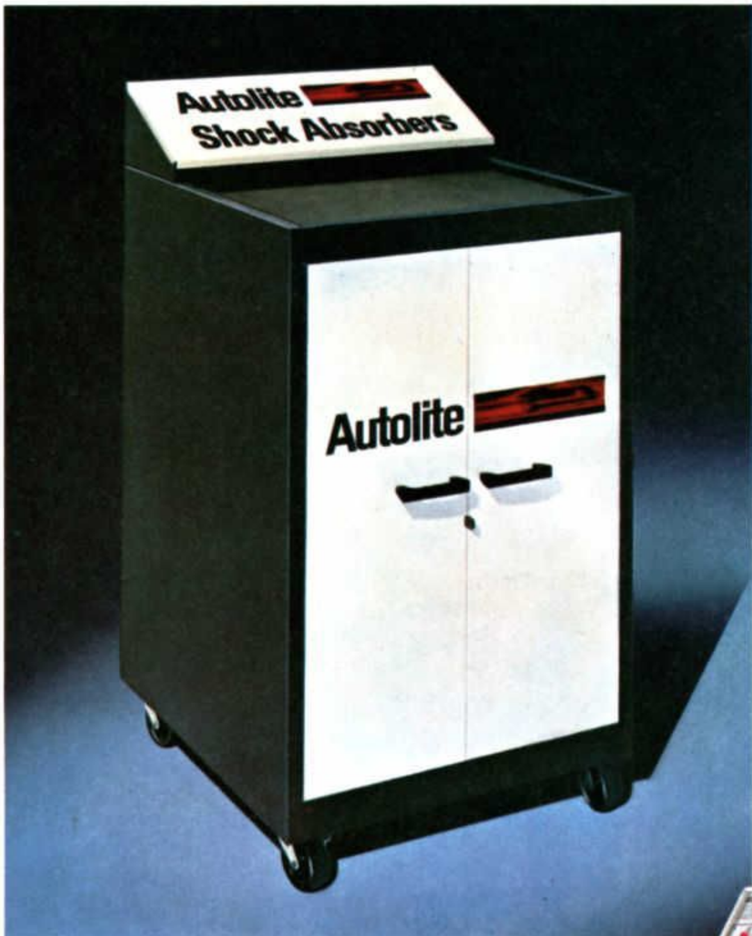
The following service procedures outlined refer to Ford-built vehicles and may vary slightly according to vehicle make and model. For other makes and models, refer to the appropriate service manual.

DUCT AND VALVE ASSEMBLY TEST—WITHOUT OVERRIDE

1. With the duct assembly installed on the vehicle, cold engine, and ambient temperature in the engine compartment less than 100 degrees F., the valve plate should be in the "heat-on" position. (Valve plate up.)
2. If the plate is not in the "heat-on" position, check for interference of the plate and duct which would cause the plate to hang up. If interference is present, correct by realigning the plate.
3. Remove the duct and valve assembly from the vehicle, and immerse it in water to a point where the thermostat capsule is completely covered with water.
4. Heat the water to 100 degrees F., allow five minutes to stabilize the temperature; the valve should be in the "heat-on" position.
5. Increase the water temperature to 135 degrees F. and stabilize the temperature. The valve should now be in the "heat-off" position and the valve plate should be down.

If the valve does not react to heat properly, and there is no interference noted between the plate and duct, the duct and valve assembly should be replaced. See Figure 9 on page 9.

Autolite SHOCK ABSORBER "SERVICE CABINET"



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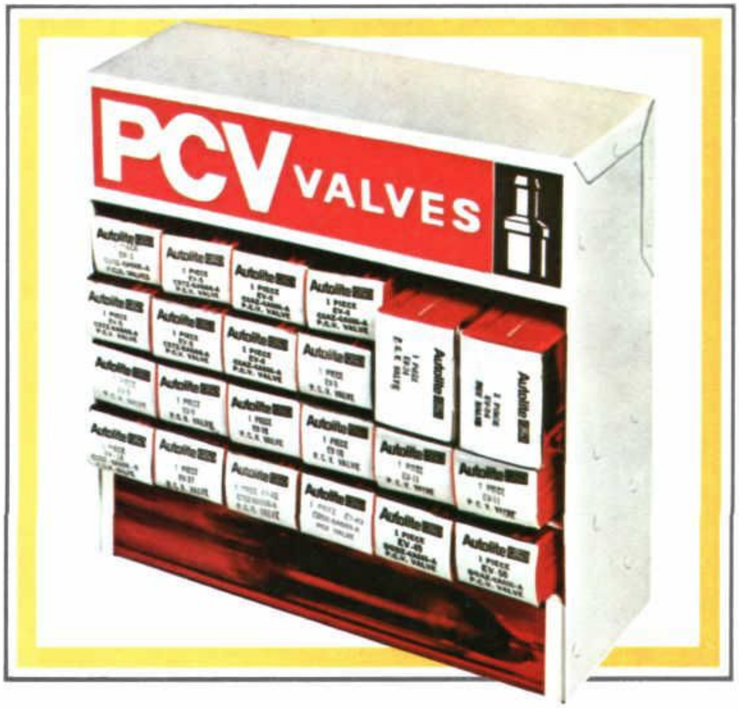

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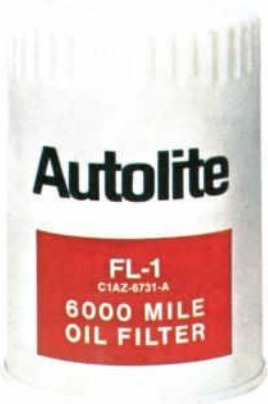

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CONTROLLING POLLUTION *Continued*

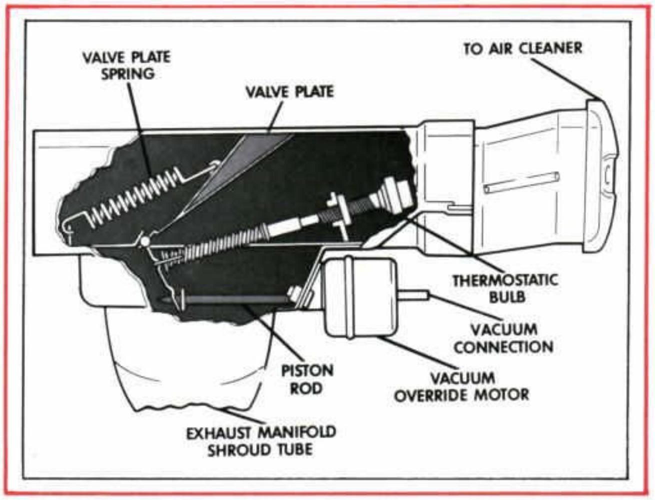

Figure 9—Air Intake System

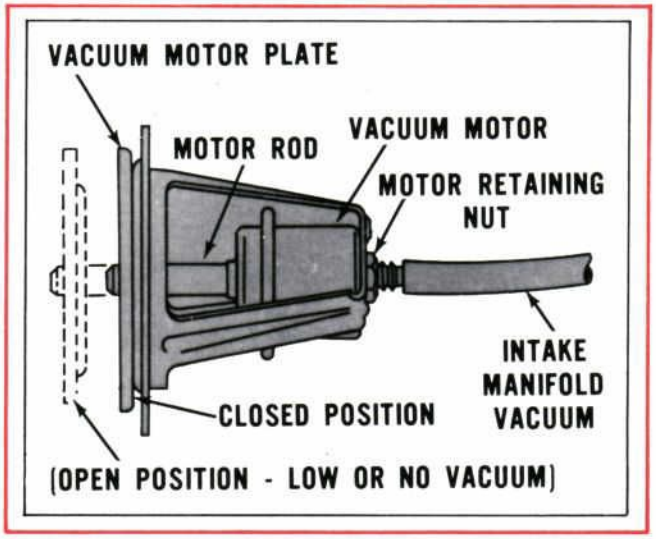

Figure 10—Air Valve and Vacuum Motor Assembly

DUCT AND VALVE ASSEMBLY TEST—WITH OVERRIDE

1. With the duct assembly installed on the vehicle, cold engine, and ambient temperature in the engine compartment less than 100 degrees F., the valve plate should be in approximately *one-half heat-on position.*
2. If the plate is not in the above position, check for possible interference of plate, duct, and/or vacuum motor which would cause the plate to hang up in its given travel. Correct by realigning the plate or vacuum motor as required.
3. Start the engine and observe the valve plate position while the engine is still cold. The correct position for the plate is in the full *heat-on* position. Align the plate or vacuum motor if interference is noted.
4. If the valve plate remains in the *one-half heat-on position,* remove the vacuum hose at the override vacuum motor and check for vacuum at the hose—minimum of 15 inches Hg. at idle.
5. If the vacuum is less than 15 inches of Hg., check for vacuum leaks in the hose and hose connection.
6. When the vacuum meets specifications, reconnect the hose to the override motor and observe the valve plate position again with the underhood temperature less than 100 degrees F.
7. If the plate still remains only in the *one-half heat-on position* and there is no interference between the valve plate, duct, or vacuum motor rod, the vacuum motor should be removed and connected to another vacuum source.
8. If the motor rod moves a minimum of one-half inch, the motor is functional and should be reassembled into the duct assembly. Checks for interference and misalignment and action of the thermostat bulb should be made. If the motor rod does not move a minimum of one-half inch, the vacuum motor is not functional and should be replaced. See Figure 10.

SERVICE PROCEDURES—EVAPORATIVE EMISSION SYSTEM

Other than obvious tank leaks or damaged parts, *diagnosis* of the evaporative emission system is limited to kinked lines or a 3-way vent control valve malfunction.

- A leak between passages in the vapor separator tank or a loose vent flange and pipe assembly will cause raw fuel to overflow from the carbon canister.

Component parts of the system are not subject to repair. Malfunctioning or damaged parts should be removed and replaced with new parts. See Figure 11.

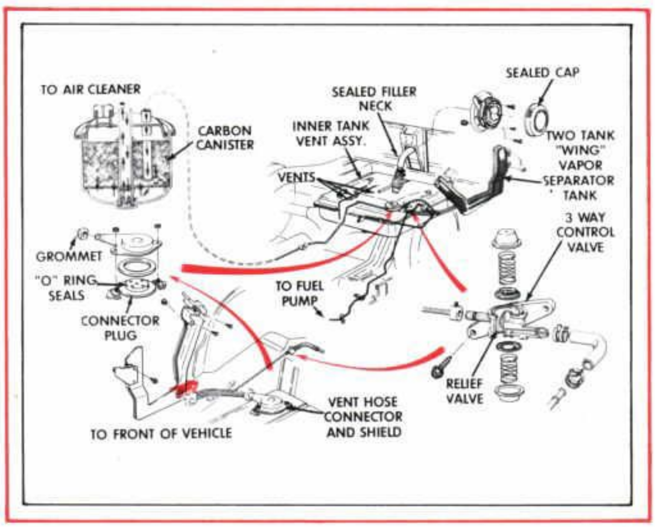

Figure 11—Evaporative Emission System

FUEL TANK (1970)

Should contamination ever be found in the fuel tank, the tank must be cleaned with a cold flush only. Heat, such as welding, soldering or steam will cause the polyethylene material to deteriorate.

THREE-WAY VENT CONTROL VALVE DIAGNOSIS (1970)

Intermittent Buzzing or Humming Sound

- The noise is caused by fuel vapor flow through the valve and occurs mainly during hot weather driving after vehicle motion has agitated the fuel tank.
- The noise can assume two different tonal qualities, depending on valve reaction to the vapor flow rate.
- When the above described noise occurs, no attempt should be made to repair or replace the valve . . . this condition is common to all early production units. Operation or function of the valve is *NOT IMPAIRED* when noises occur.

NOTE: A service replacement valve with a smaller vent hole (1/32-inch dia.) is available if customer objection to noise requires a valve replacement.

FUEL TANK DEFORMATION

- A defective or malfunctioning valve is indicated . . . provided vent lines are free of obstructions.
- Kinked or damaged vapor lines can cause tank deformation. Check the lines before replacing the valve.

RECOMMENDED SERVICE REPLACEMENT INTERVAL

- The three-way vent control valve should be replaced at 12,000 miles or 12 months, whichever occurs first.

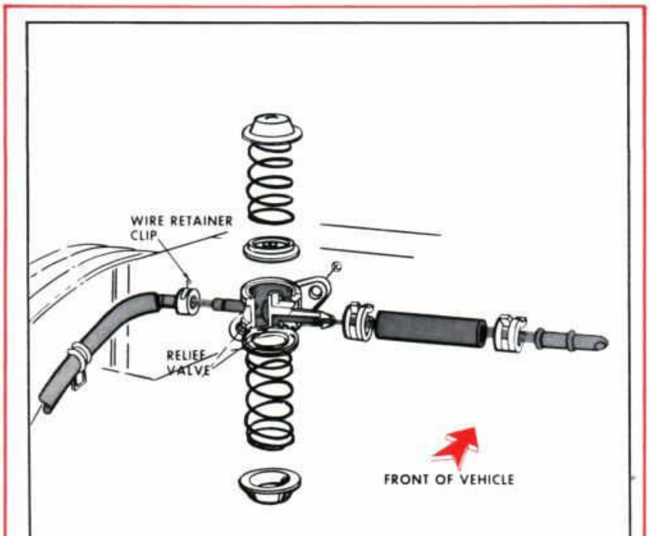

Figure 12–Three-way Vent Control Valve

1971 EMISSION SYSTEM REFINEMENTS

PCV SYSTEM DESIGN CHANGES

A new valve rocker arm cover is required with the oil fill cap and PCV valve locations are reversed. See Figure 13. It also necessitated a change in the internal baffles and the addition of a center baffle.

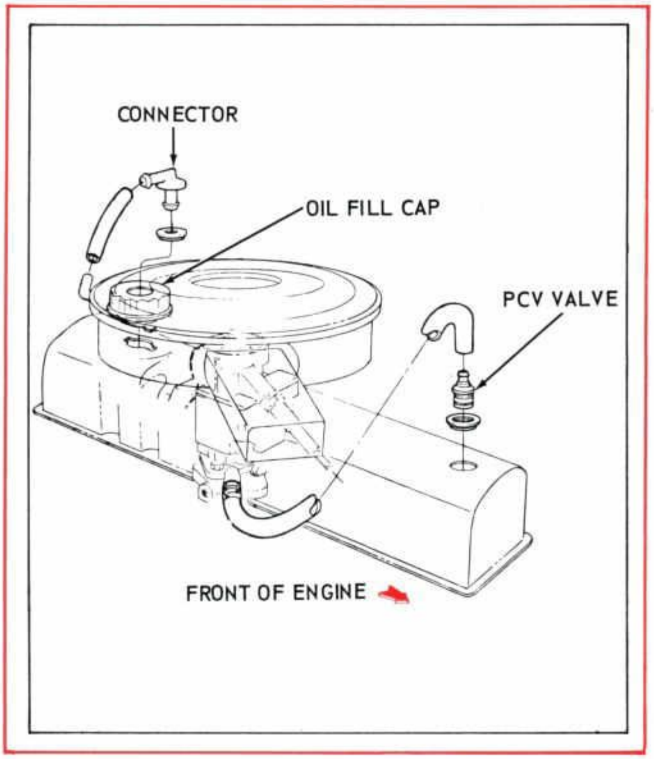

Figure 13–New PCV Valve Location

EVAPORATIVE EMISSION CONTROL SYSTEM

The fuel tank evaporative emission control system is used on all 1971 Ford-built passenger cars. The 1971 fuel evaporative emission control system is simplified over the 1970 system which was supplied only on cars offered for sale in California. The refined system is made up of three basic systems:

- Fill Control Vent System
- Pressure and Vacuum Relief System
- Vapor Vent and Storage System

The fill control vent system provides positive control of fuel height during fill operations by filler neck design and/or internal vent lines within the filler neck or fuel tank. See Figure 14. This vent system is designed to permit an approximate 10 to 12 percent volume void or space when the tank is filled to capacity. This space allows for heat expansion of the fuel, as well as aiding the function of the vapor vent system in the tank.

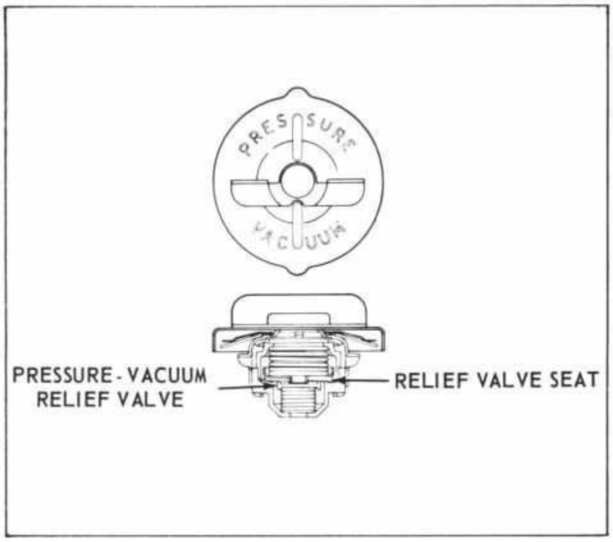

Figure 14—Fill Control Vent System

PRESSURE AND VACUUM RELIEF SYSTEM

The fill cap is a sealed cap with a built-in pressure and vacuum relief valve system. See Figure 15. The valve opens to relieve pressure when it exceeds ¾ - 1¼ psi. When vacuum buildup occurs in the tank, the valve opens to allow air into the system. Maximum vacuum at which the cap valve opens is ½ psi.

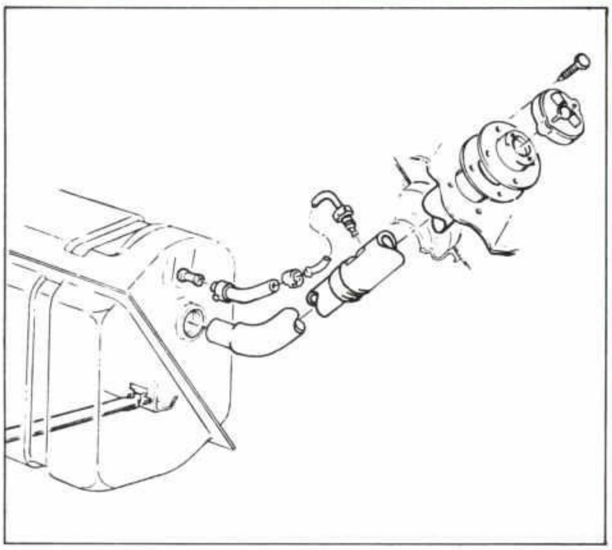

Figure 15—Fill Cap (Pressure-Vacuum Relief Design)

The fill cap functions as a check valve under normal operating conditions to allow air to enter the tank as gasoline is used while preventing fuel vapors from escaping through the cap. The fill cap is specifically designed to replace the three-way vent control valve that was previously used on the 1970 California units.

VAPOR VENT AND STORAGE SYSTEM

The vapor vent system consists of a vapor space above the gasoline surface in the fuel tank to allow adequate breathing space for the vapor separator assembly. Vertically mounted tanks utilize a vapor separator mounted centrally on the uppermost surface of the fuel tank. See Figure 16.

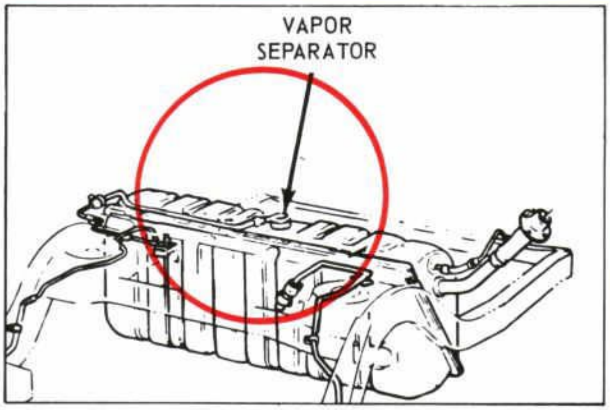

Figure 16—Vertically Mounted Fuel Tank

Most horizontally mounted fuel tanks use a raised mounting section for the vapor separator assembly that is centrally located on the upper surface of the tank. See Figure 17.

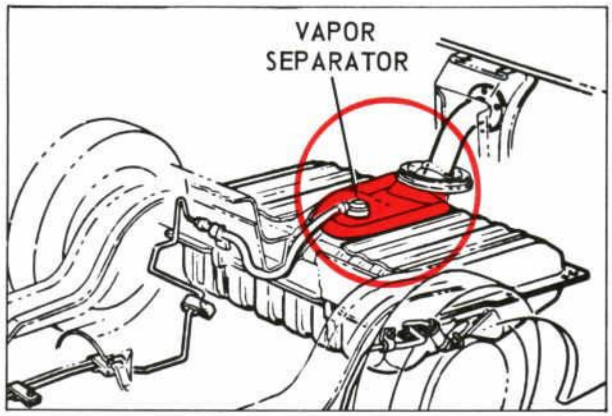

Figure 17—Horizontally Mounted Fuel Tank

The vapor separator uses an orifice and open cell foam to provide a multiple baffle to separate raw fuel and vapor. It minimizes the possibility of raw fuel entering the vapor line. The vapor separator assembly performs the same function previously handled by the vapor separator tank assembly in the 1970 system for California units.

The vapor separator is retained to the fuel tank by the same type of cam-lock ring used for the fuel sending unit. On some vehicles attachment is on the underside of tank. After assembly, be sure the gasket is in place and that the tabs are against the stop. See Figure 18 on page 12.

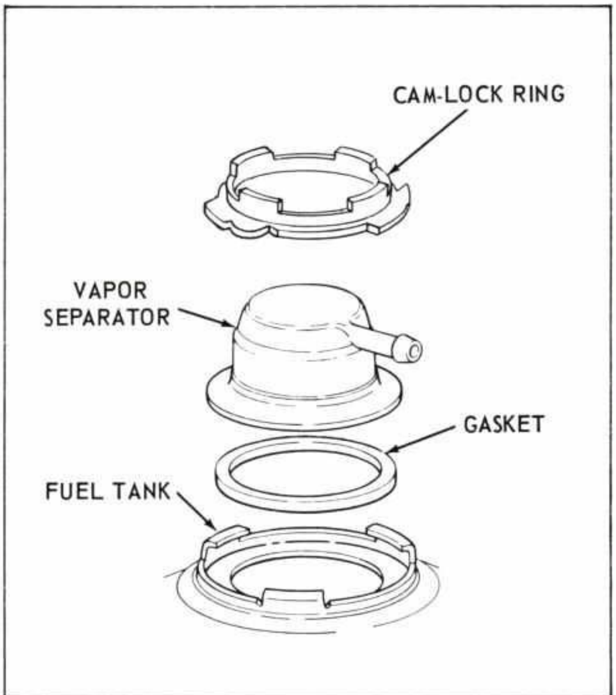

Figure 18–Vapor Separator Mounting

The fuel vapors trapped in the sealed fuel tank are vented through the orifice in the vapor separator. The vapors are then directed through a single vapor line and into the carbon canister in the engine compartment. The vapors are stored in the carbon canister until they are purged into the engine for consumption.

Diagnosis of the emission control system, other than tank or fuel line leaks and damaged parts, is limited to kinked lines or fill cap malfunction. Fill cap damage or contamination rendering the pressure-vacuum relief valve inoperative may result in deformation of the fuel tank. Make sure that the correct fill cap is used and that it is in working order.

Component parts of the fuel emission system, except the fuel tank and lines, are not subject to repair. Malfunctioning or damaged parts should be removed and replaced with new parts.

Removal of the vapor separator assembly from the fuel tank can be accomplished by using the same tool and procedure used for the removal of fuel sending units. There is one caution note you should be aware of. *On those applications where the vapor separator assembly is mounted on the underside of the fuel tank, all fuel must be drained from the fuel tank before removing the vapor separator*. The fuel tanks can be repaired and cleaned using the standard procedures because there is no polyethylene inner tanks as used on some 1970 applications.

Periodic maintenance at specific intervals is not necessary with this evaporative system. The carbon canister is good for the life of the vehicle; however, the canister must be replaced if subjected to crushing, oil contamination or water flooding.

THROTTLE SOLENOID POSITIONER

The manufacturer's specifications are given in the split rpm range.

- Example–800/500

1. Loosen locknut and turn the solenoid body in its threaded bracket until the high rpm is attained. Then, retighten the locknut.
2. With the engine still running, disconnect the solenoid lead wire, at the bullet connector *only*. Then, adjust the throttle stop screw until the lower rpm is attained.

THROTTLE MODULATOR

1. Connect an electric tachometer to the engine.
2. Raise the rear wheels of the vehicle and install support stands; start the engine, place the transmission selector in drive position and slowly accelerate to 30 mph.
3. At 30 mph, let the vehicle coast down to 15 mph. Observe engine speed on the tachometer during coast-down. Between 20 to 16 mph, a sudden drop in engine speed of at least 100 rpm should be apparent.

NOTE: If the unit checks out O.K., there is no need to proceed further; if not, proceed with the following checks:

4. Check the vacuum throttle positioner by connecting it to a vacuum source.
   - Replace, if unit is defective.
5. Check the red wire at the electronic module for battery voltage.
6. Check the speed sensor for continuity–it should be 40-60 ohms at room temperature.
7. Check the speed sensor with an ohmmeter to ensure that it is insulated from ground.

GLOSSARY OF EMISSION CONTROL SYSTEM TERMS

Advance—To move forward, such as ignition timing.

A.I.R.—An air injection type exhaust emission system. (Air Injection Reactor.) A product identification name of General Motors Corporation.

Air Cleaner—A device mounted on the carburetor, through which air must pass on its way into the carburetor air horn. It filters out dirt and dust particles and also silences the intake noise.

Air Guard—An air injection type exhaust emission system. A product identification name of American Motors Corporation.

Air Injection—A system, whereby pressurized air is transmitted to each exhaust port of the engine. The fresh charge of air mixes with hot exhaust gases and promotes more complete burning of hydrocarbons and carbon monoxide.

Air Pump—An engine belt-driven air pump, incorporating a rotor and three vanes. The vanes rotate freely about an off-center pivot pin, and follow the circular shaped pump bore. A basic component of all air injection type exhaust emission systems.

Belt Tension—Usually associated with the looseness or tightness of a drive belt. A loose belt may cause improper air pump operation; a tight belt places a severe strain on support bearings. Specified tension should be checked and adjusted according to manufacturer's specifications.

Blow-by—The name given to the high pressure gases that escape past the engine piston rings into the crankcase during both compression and power strokes.

Bypass Valve—A valve to control the air supply from the air pump. Normally closed, but opens on engine deceleration to divert air from cylinder head ports to the atmosphere.

C.A.P. (Clean Air Package)—An engine modification type exhaust emission system which relies on precision carburetion, breathing and ignition to burn fuel more efficiently. A product identification name adopted by Chrysler Corporation.

Carbon Monoxide—A colorless, odorless, poisonous gas; a by-product of incomplete combustion of carbon.

C.C.S. (Controlled Combustion System)—An engine modification type exhaust emission system similar to C.A.P. offered by Chrysler Corporation. A product identification name adopted by General Motors Corporation.

Check Valve—A one-way valve to prevent exhaust gas backflow into the air pump and air bypass valve in event of pump failure.

Closed System—Related to a crankcase emission system which obtains fresh air through the carburetor air cleaner and routes it through a tube to the oil filler cap.

Dashpot—A device whose function is to slow down the closing action of the carburetor throttle plates.

Deceleration Valve (Distributor Vacuum Advance Control Valve)—A device used in conjunction with the dual diaphragm vacuum advance unit to advance timing under deceleration conditions.

Diverter Valve—(Refer to bypass valve.) This provides same function as bypass valve. A product name of General Motors.

Duct and Valve Assembly—An assembly incorporated in air cleaner to regulate the temperature of carburetor intake air.

Emission—The act of emitting or releasing from an engine products of incomplete combustion—principally hydrocarbon and carbon monoxide.

Exhaust Gas Analyzer—An instrument for determining air/fuel mixture ratio of the carburetor.

Fast Idle Cam—The mechanism of the carburetor that holds the throttle valve slightly open when the engine is cold so that the engine will idle at a higher rpm when cold.

Grommet—A device, usually of hard rubber composition, to encircle or support a component. In emission systems, located in the valve cover assembly to support and help seal the crankcase emission control (regulator P.C.V.) valve.

Hot Idle Compensator—A thermostatically controlled carburetor valve that opens whenever inlet air temperatures are high.

Hydrocarbon—Any compound composed of carbon and hydrogen, such as petroleum products. Excessive amounts in the atmosphere are considered undesirable contaminants and a major contributor to air pollution.

Idle Limiter—A device to control maximum idle fuel richness of the carburetor. Also aids in preventing unauthorized persons from making overly rich idle adjustments. The limiters are of two distinct types: the external plastic limiter caps installed on the head of the idle mixture adjustment screws; or the internal needle-type located in the idle channel.

Idle Mixture Adjusting Screw—The adjusting screw that can be turned in or out to lean or enrich the idle mixture.

IMCO—An improved combustion type engine exhaust emission system. A product identification name of Ford Marketing Corporation. Similar to engine exhaust emission systems used on G.M., Chrysler and American Motors vehicles. (IMproved COmbustion.)

GLOSSARY OF EMISSION CONTROL SYSTEM TERMS (continued)

Malfunction—The act of performing improperly or incorrectly. The ultimate aim of diagnosis is specifically directed toward the isolation and correction of any given problem or undesirable condition.

Manifold—A tube or pipe for conveying liquids or gases. On injector emission control-equipped engines, an air manifold is utilized in addition to the engine intake and exhaust manifolds.

Manifold Control Valve—A thermostatically operated valve in the exhaust manifold for varying heat to intake manifold with engine temperature.

Modification—An alteration. To change from original, such as engine modifications—design change, component changes, etc.

MVPC—Motor Vehicle Pollution Control; name of official governing Board in California which administers provisions of legislation applicable to vehicle emission systems.

Nozzle—A restricted orifice or hole. The final outlet for air entering the exhaust manifold on injector emission systems.

O.E.M.—Original Equipment Manufacturer.

Oil Separator—A device for separating oil from air or oil from another liquid. Used on some applications of engine crankcase emission controls.

Open System—Descriptive term for crankcase emission control system which draws air through the oil fill opening.

P.C.V.—(Regulator crankcase emission control valve.) A valve which controls crankcase vapors that are discharged into the engine intake system and pass through the engine cylinders rather than being discharged into the air.

Pollution—To soil, stain or corrupt by contact. To render unfit for a specified use. (Contaminate level presently specified as less than 275 parts per million of hydrocarbon and less than 1.5% carbon monoxide by volume.) Further reduction is planned in vehicle emission levels by federal legislation.

Polyurethane—A synthetic substance used in filtration materials, normally associated with filtering to carburetor inlet air.

Ratio—The expression of the proportional mixture of two substances usually expressed as a numerical relationship, such as 2:1, 10:1, etc., . . . in emission systems, concern is with air/fuel mixtures.

Relief Valve—A pressure limiting valve located in the exhaust chamber of the air supply pump. Its function is to relieve part of the exhaust air flow if the pressure exceeds a pre-determined value.

Retard—Usually associated with spark timing mechanisms of the engine. Opposite of spark advance. To delay the introduction of the spark into the combustion chamber.

Road Draft Tube—The traditional method of scavenging the engine crankcase of fumes and pressure. A means by which the engine crankcase was ventilated. Prior to the introduction of crankcase emission control systems a tube, vented at the crankcase and suspended a few inches from the ground. Depends on "venturi action" to create a partial vacuum as the vehicle moves. Very ineffective below 20 mph.

Schematic—A pictorial representation, most often in the form of a line drawing. A systematic positioning of components in a system and their relationship to each other or to the total function.

Smog—A derivative of two words—smoke and fog; caused by a chemical reaction between hydrocarbons and air in the presence of oxides of nitrogen and sunlight.

Solvent—A petroleum product of low volatility used in the cleaning of engine or component parts.

Test Gauge Adaptor—An adaptor used in conjunction with a fuel pump tester to check the air supply pump.

Thermactor—An air injection type of exhaust emission control system. A product identification name of Ford Marketing Corporation which is similar to exhaust emission control systems used by G.M. and American Motors vehicles. Currently used with engines coupled with standard transmissions or high performance engines.

Thermostat—A valve which depends on heat to control temperature by opening or closing a damper. In emission systems, to control hot or cold carburetor inlet air.

Vacuum—A term used to describe a pressure that is less than atmospheric pressure; hence, a partial vacuum. A perfect vacuum has not yet been created, as this would necessitate a complete lack of pressure. Used for control purposes throughout the automotive industry.

Vacuum Advance—Advances ignition timing with relation to engine load conditions. This is achieved by using engine vacuum.

Vacuum Control Temperature Sensing Valve—A valve that connects manifold vacuum to the distributor advance mechanism under hot idle conditions.

Vane—Any flat, extended surface attached to an axis and moved by or in air or liquids. Part of the integral revolving portion of an air supply pump.

Ventilation—The process by which fresh air is caused to circulate, so as to replace impure air. Principle utilized in crankcase emission systems.

Pinto Tune-up kits available

Autolite has recently released two Pinto Tune-Up Kits as additions to the popular electrical tune-up kit line. Each is packaged in a sealed metal container to keep parts factory-fresh. TKF-18 is released for the 1600 cc Pinto engine and the TKF-24 for the Pinto 2000 cc engine. Both kits contain (4) Autolite Resistor-Type Spark Plugs, an Autolite Distributor Point Set, an Autolite Condenser, a Lube Packet for lubricating the cam rubbing surfaces, an Illustrated Instruction Sheet, a ½ Pacemaker Prize Point, a Feeler Gauge, PLUS a new "mechanics' friend" which is a Special Point Gap Adjusting Sleeve to help reduce the time needed to set and adjust distributor point gap.

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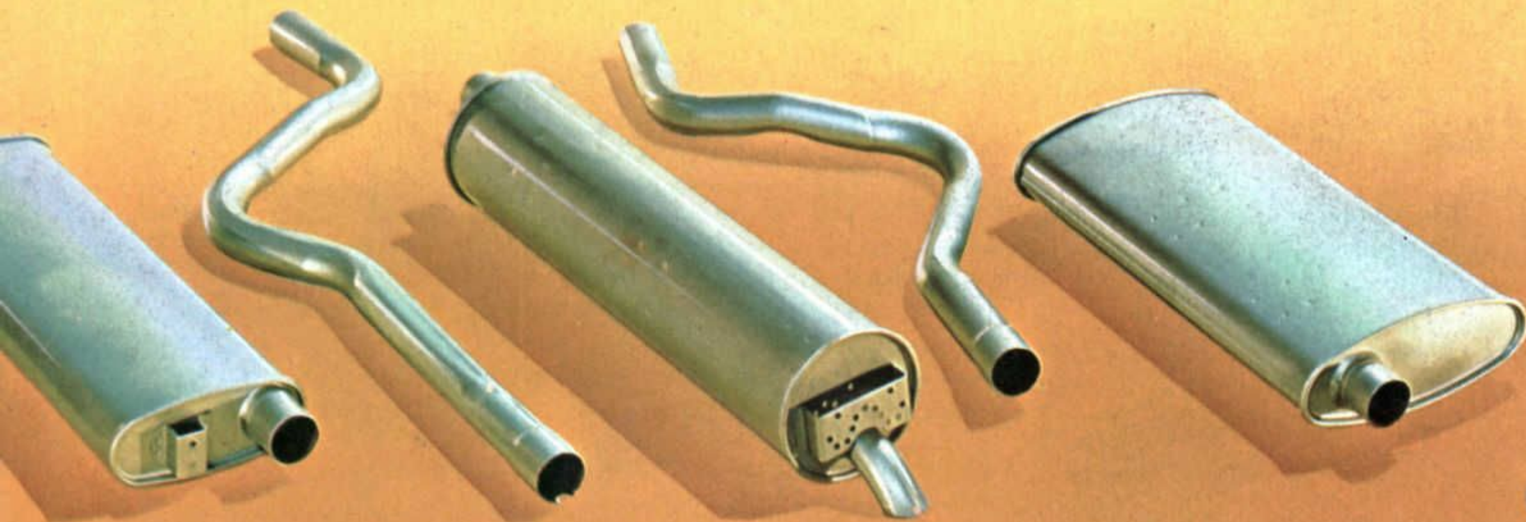

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