PONTIAC'S

1974 Exhaust Emissions

PONTIAC MOTOR DIVISION
GENERAL MOTORS CORPORATION

INTRODUCTION

This booklet has been prepared to provide for a better understanding of the emission control systems used on the 1974 Pontiac cars.

OCTOBER, 1973
LITHO. IN U.S.A.

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EXHAUST POLLUTANTS

The normal operation of the automobile engine results in the release of several compounds to the atmosphere. The Federal Government and the State of California have enacted legislation which places a limit on the quantities of three compounds. To meet the 1974 Federal and California requirements, it has been necessary to revise some of the control systems for the 1974 cars.

The three compounds emitted are:

- Unburned Hydrocarbons, HC
- Carbon Monoxide, CO
- Oxides of Nitrogen, NOx

GLOSSARY OF TERMINOLOGY

A.I.R.	Air Injection Reactor
A/F	Air and Fuel Mixture
A.T.	Automatic Transmission
CO	Carbon Monoxide
E.E.C.S.	Evaporative Emission Control System
E.G.R.	Exhaust Gas Recirculation
HC	Hydrocarbon
M.T.	Manual Transmission
NO_x	Oxides of Nitrogen
PORTED	A vacuum source in the carburetor that is above the throttle valve. Vacuum is not available when the throttle is closed.
P.C.V.	Positive Crankcase Ventilation
RUN-ON	Continuation of engine firing at idle after the ignition has been cut.
SURGE	A light or slight engine roughness that may occur during light acceleration or at constant throttle. Is induced mainly by presence of EGR and lack of vacuum advance.
T.C.S.	Transmission Controlled Spark
T.V.S.	Thermal Vacuum Switch
V.B.V.	Vacuum Bias Valve. Part of an E.G.R. System

EXHAUST GAS RECIRCULATION SYSTEM (E.G.R.)

DESCRIPTION

E. G. R. is a control system that allows the introduction of controlled amounts of exhaust gas into the intake manifold. By the addition of exhaust gas to the incoming air and fuel mixture, the combustion temperatures are lowered, and a reduction in oxides of nitrogen (NOx) results.

OPERATION

NOx formation is minimal at idle and at very low loads, but is increased rapidly during acceleration. Therefore, the E.G.R. valve is closed at idle, but as the throttle is opened, the E.G.R. valve opens and provides for exhaust gas recirculation.

There are four variations of the E.G.R. system used by Pontiac.

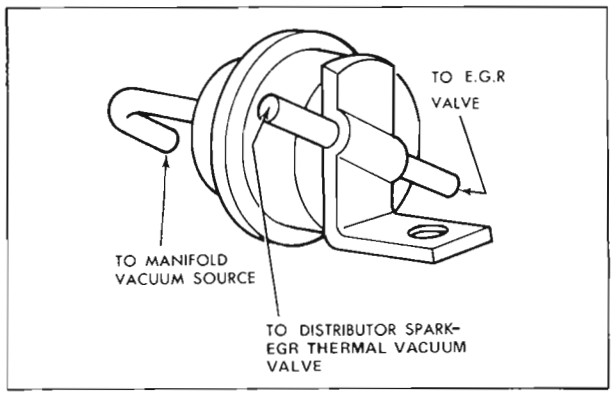
Basically, all E.G.R. systems utilize a carburetor vacuum source to control the E.G.R. valve, but the variations modulate and/or supplement carburetor vacuum.

The 1974 California NOx requirements are lower than the Federal requirements, and the larger amounts of E.G.R. required during acceleration would be of such magnitude as to cause objectionable surge at highway speeds. Therefore, variations to the basic E.G.R. system are required, and are listed below followed by a description of each.

- Vacuum operated EGR valve – used on most engines.
- Vacuum Bias Valve & EGR valve – used only on the non-California B Station Wagon with a V400-2 barrel engine.
- Dual Diaphragm EGR valve – used on some California 4 barrel engines.
- Exhaust Back Pressure Transducer & EGR valve – used on all California 2 barrel engines.

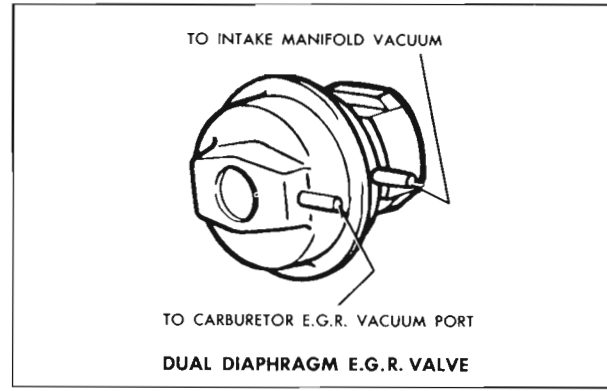
- Vacuum Operated EGR Valve. The EGR valve operation is controlled by the carburetor which contains an EGR vacuum port. The EGR vacuum port as designed uses a combination of throttle position and intake manifold vacuum to provide the necessary EGR valve control.

- Vacuum Bias Valve & EGR Valve. The vacuum bias valve (BVB) is located between the EGR valve and the distributor spark–EGR thermal vacuum valve. The VBV also has its own manifold vacuum source. Under relatively high manifold vacuum conditions, such as highway cruising, the VBV reduces the amount of EGR, and in turn, acts to reduce surge. During acceleration, when NOx formations is the greatest, and manifold vacuum is low, the VBV will not reduce EGR.



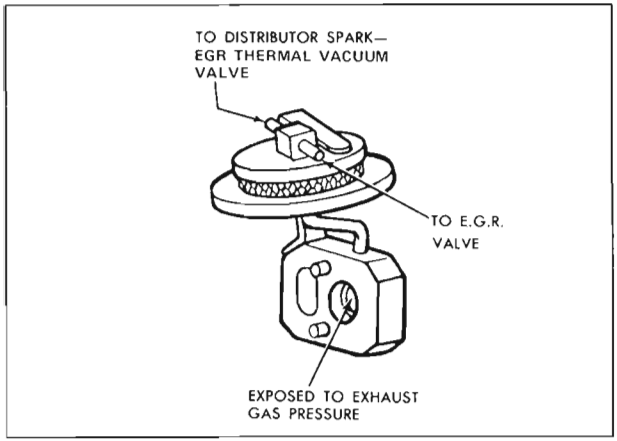
- Dual Diaphragm EGR Valve. The dual diaphragm EGR valve has two diaphragms of effectively different diameters, and two vacuum sources; one vacuum source is connected to the carburetor EGR vacuum port, and the other to intake manifold vacuum. The amount of EGR is determined by the inter-action of the diaphragms. For example, carburetor vacuum will open the valve; however, the valve opening is reduced by the presence of high intake manifold vacuum such as occurs during highway cruising. Therefore, during cruise conditions, the EGR valve is opened only a small amount because the high intake manifold vacuum partially offsets the carburetor

vacuum and the reduced amount of exhaust gas recirculation results in reduced surge. During acceleration when intake manifold vacuum is low, there is little opposing force to offset the carburetor vacuum, and greater amounts of exhaust gas are recirculated to reduce NOx formation.

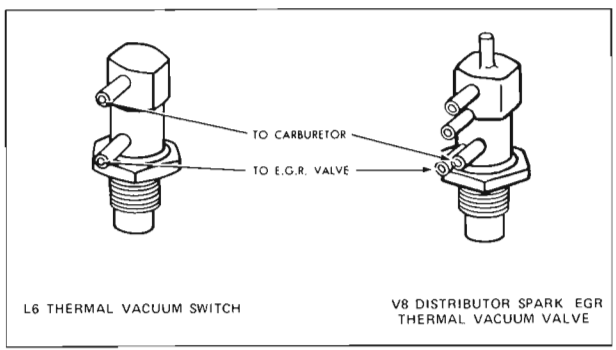


DUAL DIAPHRAGM E.G.R. VALVE

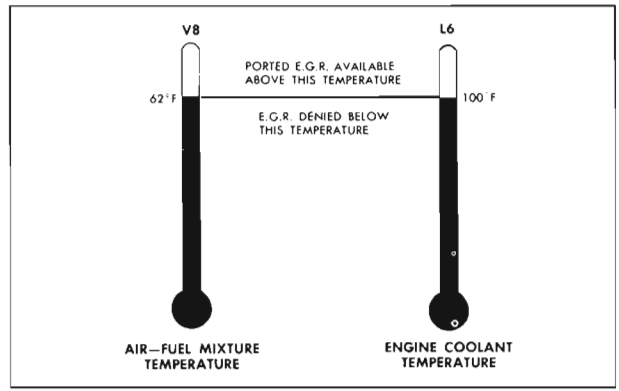
- Exhaust Back Pressure Transducer & EGR Valve. The exhaust back pressure transducer is located in the vacuum line between the EGR valve and the distributor spark – EGR thermal vacuum valve The base is sandwiched between the EGR valve and intake manifold in order to monitor the exhaust back pressure. The exhaust back pressure transducer in a normal or low pressure condition reduces the carburetor vacuum to the EGR valve; but a high exhaust back pressure condition will provide a higher vacuum signal to the EGR valve. Therefore, when accelerating, the high exhaust back pressure allows the full carburetor vacuum to reach the EGR valve. At cruising speeds or other conditions when NOx formation is low, the transducer senses the reduced exhaust back pressure and in turn reduces EGR. The result is maximum EGR when accelerating, and reduced EGR at other conditions to minimize surge.

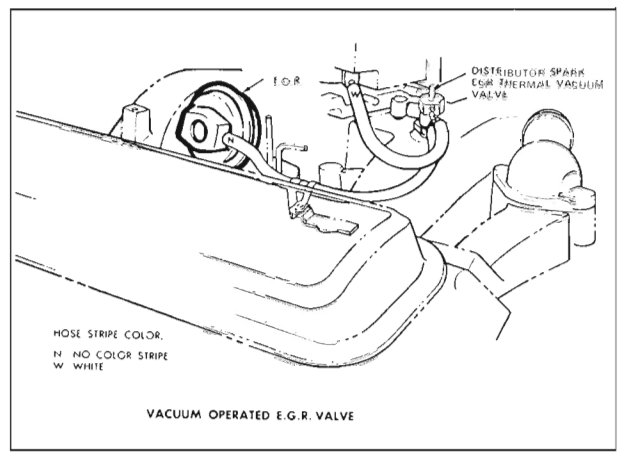


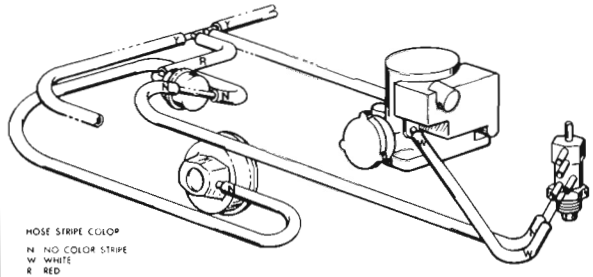
For both the V8 and L6 engines, there is a thermal valve or switch between the carburetor EGR vacuum source and the EGR valve. The valve or switch denies EGR during the early part of the initial cold driveaway. However, once the coolant temperature in the L6, and the air-fuel mixture temperature in the V8 reaches the calibrated setting, the thermal valve opens and EGR becomes available at all times except at idle and during closed throttle decelerations.



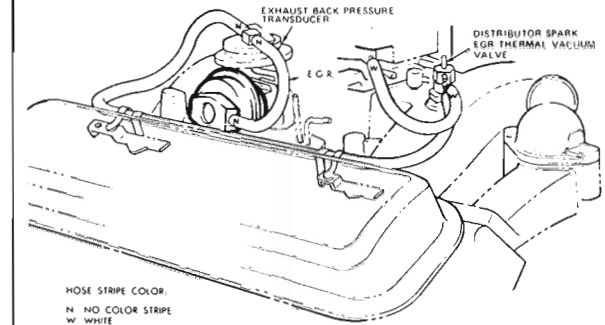
The EGR system operates independent of transmission gear position and independent of the TCS system. Only engine air-fuel mixture temperature on the V8's and engine coolant temperature on the L6's control EGR system operation. See illustration below.



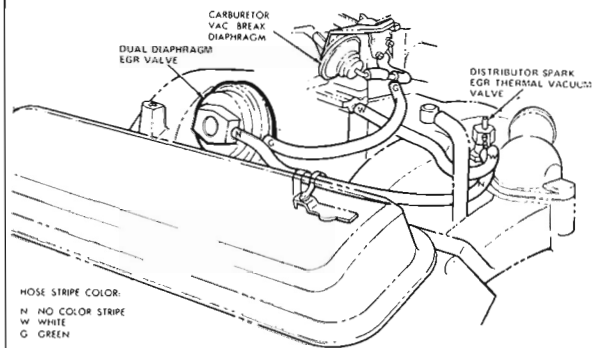




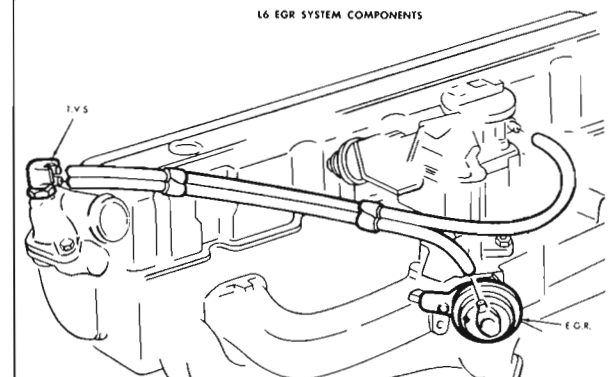
Vacuum Bias Valve & EGR Valve



EXHAUST BACK PRESSURE TRANSDUCER & EGR VALVE



DUAL DIAPHRAGM E.G.R. VALVE



EFFECT ON VEHICLE OPERATION

Since E.G.R. consists of adding exhaust gas to the mixture of air and fuel, the driveability quality will be reduced slightly depending upon the amount of exhaust gas that is recirculated. To help improve the driveability, the carburetor calibration must be richened, and when possible, the amount of EGR reduced under highway cruising conditions. By contrast, enriching the carburetor calibration to reduce NOx generally causes increases in HC and CO.

The EGR valve calibration as designed will reduce NOx formation when the car is accelerated, and consequently, the EGR levels at cruising speeds are in many cases sufficient to induce surge. To minimize engine surge during cruising speeds and yet retain sufficient EGR to control NOx formation during acceleration, the EGR system variations described in the preceding sections have been utilized.

USAGE

All 1974 Pontiacs will be equipped with an EGR system. Numerous EGR valves which have specific calibrations are used, and consequently, the valves cannot be interchanged.

EGR FUNCTIONAL TEST

1. Warm up the engine.

   V8: Run engine until the air-fuel mixture temperature exceeds 62°F.

   L6: Run engine until the coolant temperature exceeds 100°F.

2. Remove air cleaner so EGR valve diaphragm movement can be observed.

   The EGR valve has a cut away portion on the inboard side.

3. Open throttle part way and then release.

   The throttle must be opened to expose the vacuum source port in the carburetor throttle body.

4. Observe the diaphragm for movement.

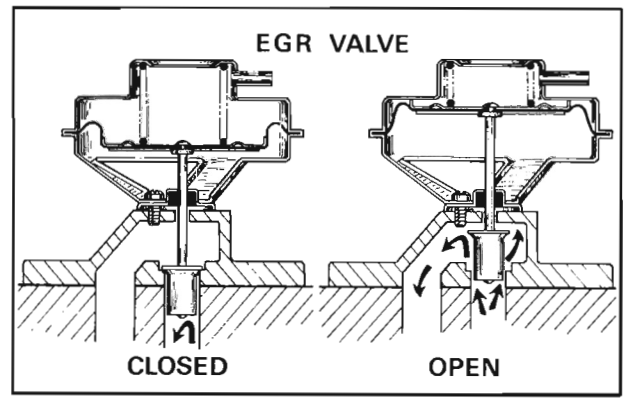
   The valve should open when the throttle is opened, and close when it is released.

EGR FUNCTIONAL TEST FAILURE MODE

The most likely failure mode is to fail step 4 of the function test (no valve movement—valve stays closed).

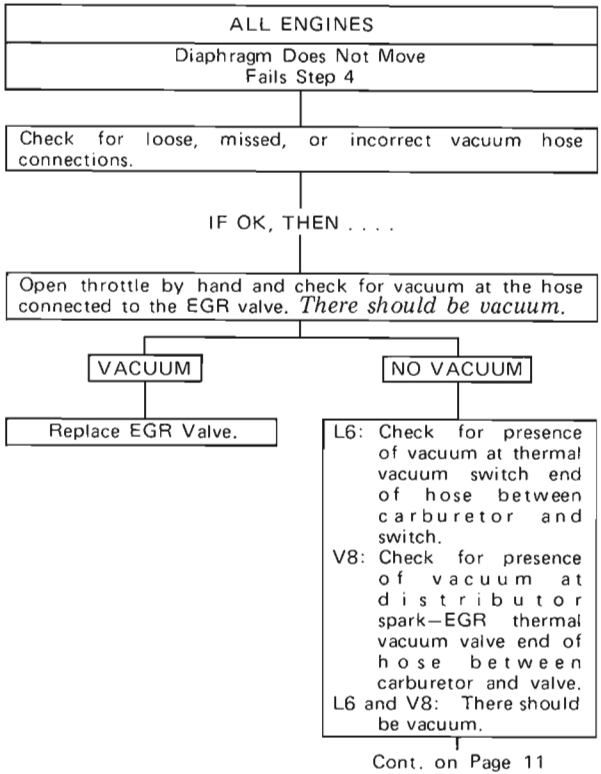
It is very doubtful if the EGR system would ever fail to have movement because the valve was in the open position because of the following:

1. Engine will not idle with an open EGR valve.
2. Internal valve failure such as a ruptured diaphragm would result in a closed shut valve.



EGR FUNCTIONAL TEST FAILURE DIAGNOSIS

NOTE: Use a vacuum gauge when checking for the presence of vacuum.



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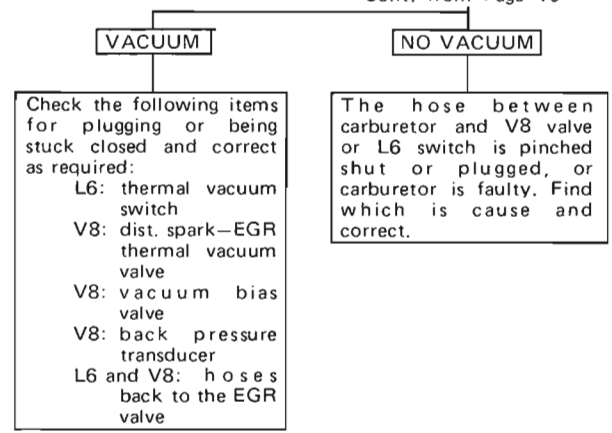


EGR FUNCTIONAL TEST FAILURE DIAGNOSIS

Summary of Functional Test Failure Diagnosis
Diaphragm Does Not Move

Action and/or Observation	Component Being Checked
1. Check of vacuum system for routing and connections.	1. Hose routing and hose connections.
2. Remove hose from EGR valve and check for vacuum.	2. EGR valve.
3. Remove hose from distributor spark–EGR thermal vacuum valve that goes to carburetor on V8, or hose from TVS to carburetor on L6 and check for vacuum.	3. L6: Thermal vacuum switch. V8: Distributor spark–EGR thermal vacuum valve, VBV, and back pressure transducer. L6 and V8: Plugged or pinched hoses, and carburetor.

TRANSMISSION CONTROLLED SPARK SYSTEM (T.C.S.)

DESCRIPTION

T.C.S. is a control system that regulates the supply of vacuum for distributor vacuum advance to reduce hydrocarbon (HC) and oxides of nitrogen (NOx) formation. In the V8 engines and the L6 manual engine, the vacuum advance is normally controlled by means of transmission gear position.

In addition to transmission gear position, there are times when other T.C.S. system components can provide vacuum advance to the distributor. The additional T.C.S. system components are used to improve driveability, or to protect the engine from damage.

OPERATION

V8 With Automatic Transmission

The system operation is broken down into four basic categories:

- Engine Start-Up
- Cold Driveaway
- Normal Operation
- Hot Engine Protection

1. Engine start-up.

   Vacuum advance is supplied for the first 20 seconds following every engine start-up. *Start-up relay switch is grounded.*

2. Cold driveaway.

   During the initial cold driveaway, there are two distinct phases of operation. Vacuum advance in any gear (for driveability) followed by no vacuum advance in any gear (for emission control).

   a. For improved driveability, vacuum advance is available in any gear whenever the air-fuel mixture temperature is below 62°F. *The distributor spark—EGR thermal vacuum valve TCS port is open.*

   b. For added emission control during the latter portion of the cold driveaway, no vacuum advance is available in any gear between an air-fuel mixture temperature of 62°F. and cylinder head metal temperature of 140°F. (or 155°F.). *The cold feed switch at the rear of the cylinder head is open.*

3. Normal Operation

   Under normal operating temperatures, the T.C.S. system will provide for vacuum advance during high gear operation. However, the TCS switch on automatic transmission engines is closed in the reverse gear position, so there will be vacuum advance available in reverse also. *The T.C.S. switch is grounded in high gear and reverse.*

4. Hot Engine Protection

   To provide engine protection when the coolant temperature exceeds 240°F., vacuum advance will be available in any gear. *The hot coolant switch is grounded.*

V8 With Manual Transmission

The manual transmission engines have a ported spark vacuum source whereas the automatic transmission engines have a full time spark vacuum source.

However, during cold operation, vacuum advance is supplied through the distributor spark-EGR thermal vacuum valve, and the M.T. engine under this condition receives full vacuum advance.

Under normal operating conditions, the TCS switch provides for ported vacuum advance only in high gear. No vacuum advance is available in neutral or reverse. *The TCS switch is grounded in high gear.*

Other than the above, the MT TCS system operation is the same as for the AT TCS system.

L6 With Automatic Transmission

There is no T.C.S. system on the automatic L6. For distributor

vacuum advance control, the distributor is connected to a ported vacuum source. Vacuum advance is available whenever the throttle is opened.

L6 With Manual Transmission

The system operation is broken down into three basic categories:

- Engine Start-Up
- Cold Driveaway
- Normal Operation

1. Engine start-up.

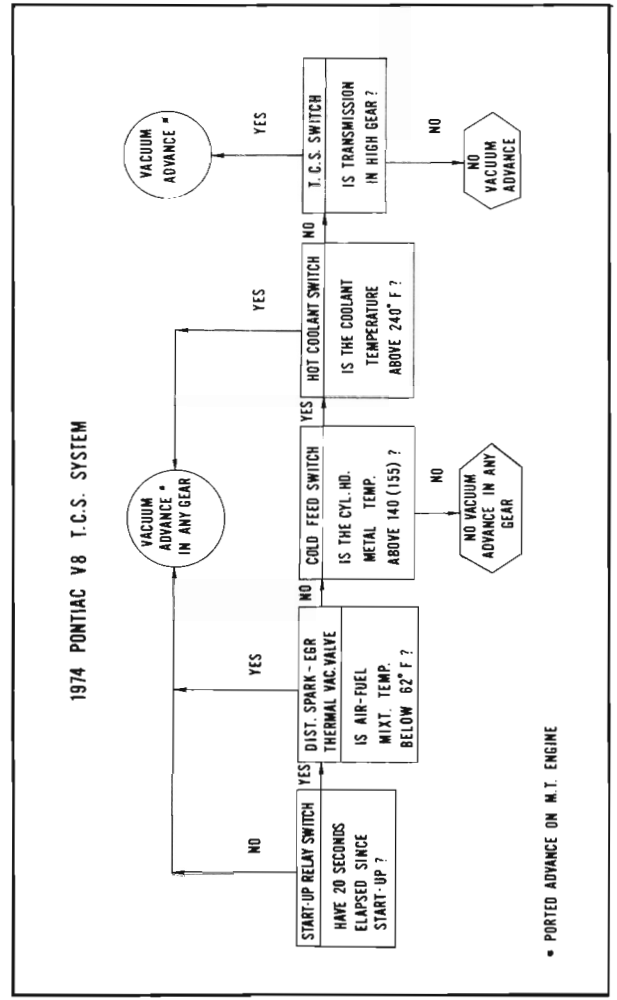
   Ported vacuum advance is supplied for the first 20 seconds following every engine start-up. *Start-up relay switch is grounded.*

2. Cold Driveaway

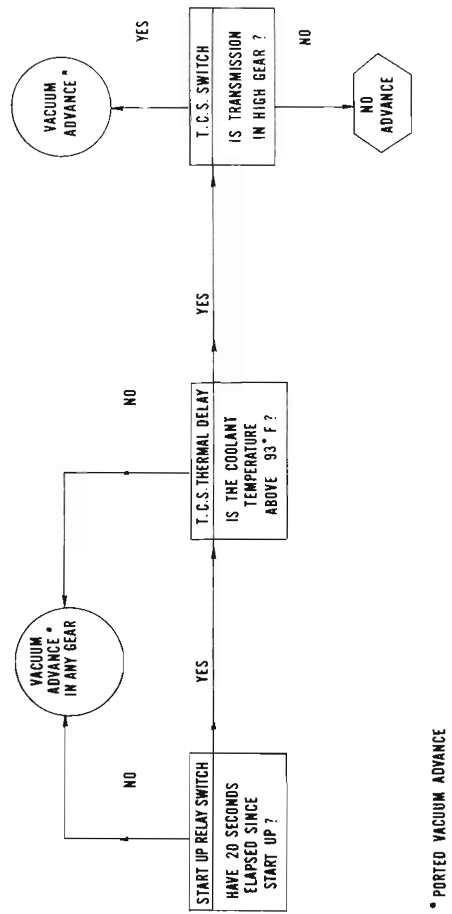
   During the initial cold driveaway, vacuum advance is available in any gear at all times whenever the coolant temperature is below 93° F. *The TCS thermal delay switch is grounded.*

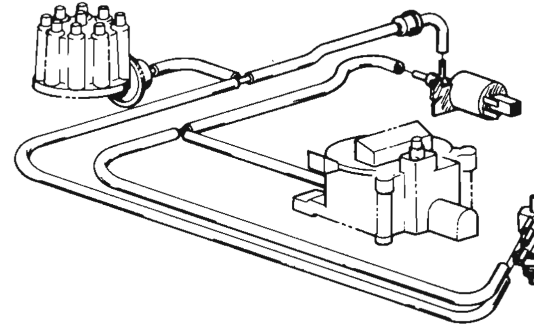
3. Normal Operation

   Under normal operating temperatures and conditions, the T.C.S. system will provide for ported vacuum advance during high gear operation. *The TCS switch is grounded in high gear.*

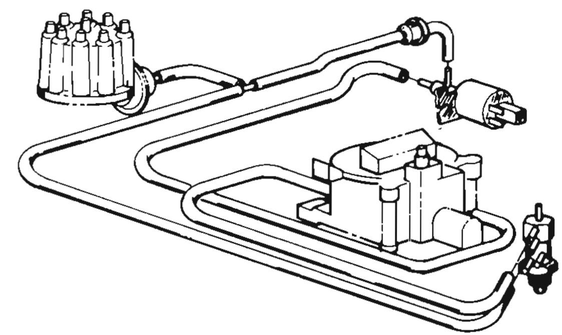


1974 L6 MANUAL TRANSMISSION T.C.S. SYSTEM



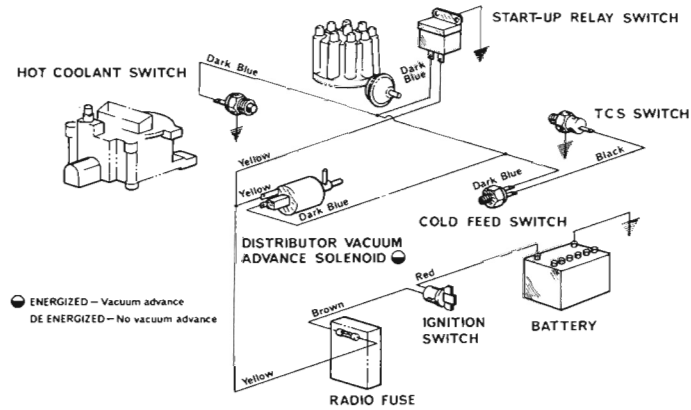


V8-Automatic Transmission TCS System



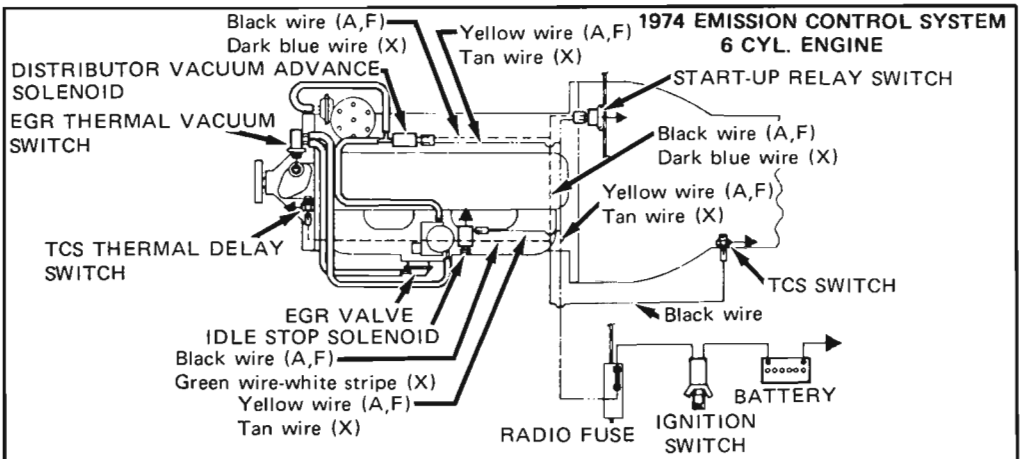
V8-Manual Transmission TCS System

V8 TCS SYSTEM WIRING DIAGRAM



SWITCH POSITION	START-UP RELAY SWITCH	COLD FEED SWITCH	HOT COOLANT SWITCH	TCS SWITCH		
				AT	MT-3	MT-4
open	over 20 seconds after start	below 140°F (or 155°F.)	below 240°F	1,2,N,P	1,2,N,R	1,2,3,N,R
closed or grounded	less than 20 seconds after start	above 140°F (or 155°F.)	above 240°F	3,R	3	4

1974 EMISSION CONTROL SYSTEM 6 CYL. ENGINE



SWITCH	START-UP RELAY SWITCH	TCS THERMAL DELAY SWITCH	TCS	DIST. VAC. SOL. Condition	VACUUM ADVANCE
open	over 20 seconds	above 93°F	N,R,1,2	de-energized	NO
closed	less 20 seconds	below 93°F	3	energized	YES

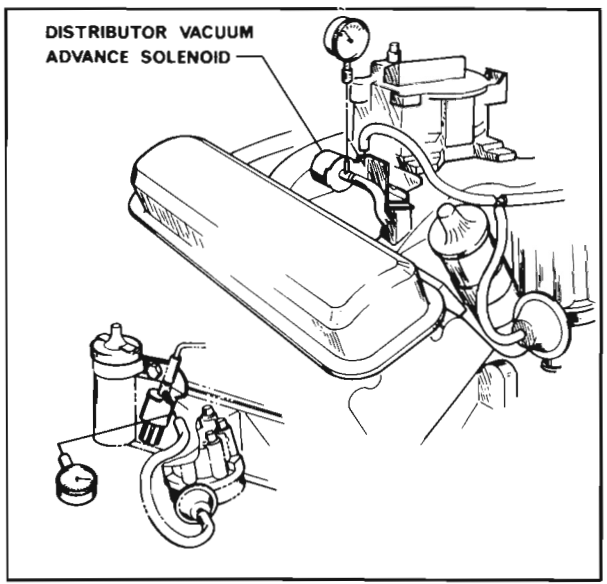
EFFECT ON VEHICLE OPERATION

The T.C.S. system denies distributor vacuum advance for reduced emissions. However, driving a car with no vacuum advance requires more throttle opening for a given condition than if advance were allowed.

When the TCS system denies vacuum advance, EGR is always available, and surge will most likely be encountered. However, the surge will be lessened and/or may become negligible during high gear operation since vacuum advance will be in conjunction with EGR.

USAGE

A T.C.S. system is used on all 1974 Pontiacs having V8 engines, and the L6 engines having manual transmissions. The V8 engines use different cold feed switches as needed to provide the necessary emission control.



FUNCTIONAL TEST

Preparation and Equipment

L6

1. Hook a vacuum gauge to the distributor vacuum advance solenoid fitting that leads to the distributor.

2. Run engine until it is thoroughly warmed up.

V8

1. If car has a distributor vacuum spark delay valve in the line between the solenoid and the distributor, hook the vacuum gauge to the "DIST" fitting of the delay valve, otherwise hook vacuum gauge to the vertical fitting at the rear of the distributor vacuum advance solenoid. Place gauge on the cowl so it can be observed from the driver's seat.

2. Run engine until it is thoroughly warmed up.

Most important because . . . .

if distributor spark—EGR thermal vacuum valve closes, but the cold feed switch is still open, system will be denied vacuum advance at all times.

Caution: Do not allow coolant temperature to exceed 240°F.

High Gear Check

1. Test as follows:

AT—There should be no vacuum advance in park or neutral. Shift into reverse and observe for vacuum advance. There should be vacuum advance in reverse.

MT—There should be no vacuum advance in any gear except high gear. Open throttle slightly, and observe for vacuum advance when shifting into high gear (3rd or 4th). There should be vacuum advance in high gear.

Note: For cars having a distributor vacuum spark delay valve, the vacuum will slowly rise to a peak in less than 30 seconds.

2. Shut off engine before proceeding.

Start-Up Check

1. Restart engine in park or neutral and observe for vacuum advance. There should be vacuum advance for about 20 seconds except for those V8 models that have a delay valve in the distributor vacuum line. (For cars having a delay valve, the vacuum will slowly rise to a peak in less than 30 seconds.)

   Manual transmission . . . . for MT engines it is necessary to open the throttle slightly to uncover the vacuum port in the carburetor.

2. After 20 seconds, there should be no vacuum advance.

3. Remove vacuum gauge and reconnect distributor hose.

FUNCTIONAL TEST FAILURE DIAGNOSIS

There are four basic failure modes of the function test:

- Gauge reads vacuum at all times.

  Due to a closed electric circuit or a stuck open V8 distributor spark—EGR thermal vacuum valve.

- Gauge does not read vacuum in high gear or reverse.

  Due to an open electric circuit, missed hose connection, or a plugged orifice in the V8 distributor vacuum spark delay valve.

- Gauge does not read vacuum druing first 20 seconds following start-up.

  Due to open circuit in start-up relay switch or broken wire.

- No vacuum delay occurs on those V8 cars equipped with the distributor vacuum spark delay valve.

  Dirt inside distributor vacuum spark delay valve.

Following is a list of the possible causes of a functional test failure

Vacuum Reading At All Times

- Grounded wire in the system
- Start-up relay swtich stuck in grounded mode
- TCS switch stuck closed
- Hot coolant switch (TCS thermal delay in L6) stuck closed or activated
- Distributor spark—EGR thermal vacuum valve stuck open.
- Cold feed switch short to ground
- Distributor vacuum advance solenoid plunger stuck in the energized position

No Vacuum Reading in High Gear or Reverse

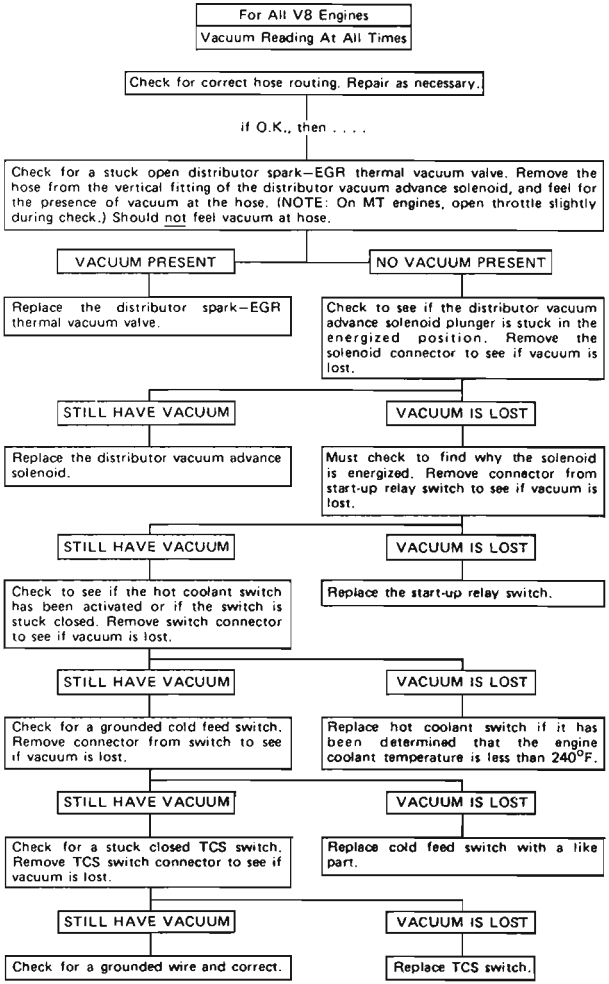
- Vacuum blockage in hoses, carburetor fitting, or the carburetor itself
- Missed hose connection
- Plugged orifice in distributor vacuum spark delay valve
- Broken wire in system
- Missed electrical connection
- Blown radio fuse
- Distributor vacuum advance solenoid coil wire broken or open
- Cold feed switch stuck open
- TCS switch with open circuit

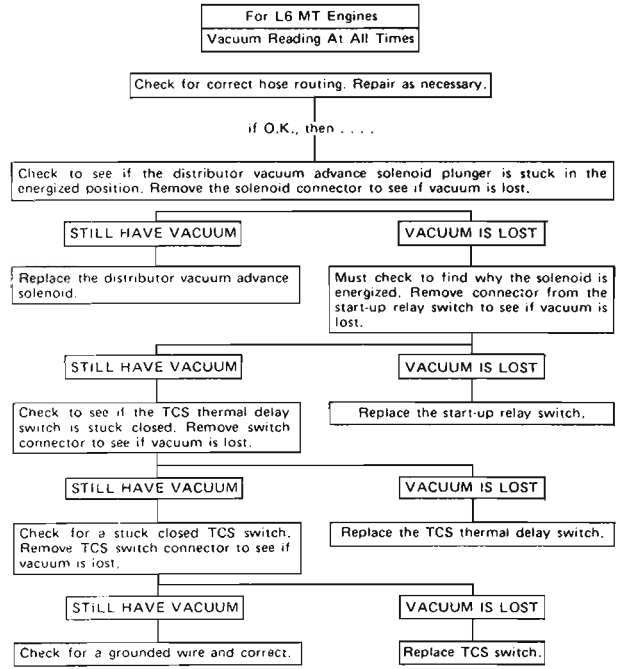
No Vacuum Reading During Start-Up

- Open circuit in start-up relay switch
- Broken wire between start-up relay switch and distributor solenoid.

No Vacuum Delay

- Dirt or foreign material inside the distributor vacuum spark delay valve holding the orifice disk off its seat.


For All V8 Engines
Vacuum Reading At All Times
Check for correct hose routing. Repair as necessary.
if O.K., then . . . .
Check for a stuck open distributor spark—EGR thermal vacuum valve. Remove the hose from the vertical fitting of the distributor vacuum advance solenoid, and feel for the presence of vacuum at the hose. (NOTE: On MT engines, open throttle slightly during check.) Should not feel vacuum at hose.
VACUUM PRESENT
NO VACUUM PRESENT
Replace the distributor spark—EGR thermal vacuum valve.
Check to see if the distributor vacuum advance solenoid plunger is stuck in the energized position. Remove the solenoid connector to see if vacuum is lost.
STILL HAVE VACUUM
VACUUM IS LOST
Replace the distributor vacuum advance solenoid.
Must check to find why the solenoid is energized. Remove connector from start-up relay switch to see if vacuum is lost.
STILL HAVE VACUUM
VACUUM IS LOST
Check to see if the hot coolant switch has been activated or if the switch is stuck closed. Remove switch connector to see if vacuum is lost.
Replace the start-up relay switch.
STILL HAVE VACUUM
VACUUM IS LOST
Check for a grounded cold feed switch. Remove connector from switch to see if vacuum is lost.
Replace hot coolant switch if it has been determined that the engine coolant temperature is less than 240°F.
STILL HAVE VACUUM
VACUUM IS LOST
Check for a stuck closed TCS switch. Remove TCS switch connector to see if vacuum is lost.
Replace cold feed switch with a like part.
STILL HAVE VACUUM
VACUUM IS LOST
Check for a grounded wire and correct.
Replace TCS switch.


For L6 MT Engines
Vacuum Reading At All Times
Check for correct hose routing. Repair as necessary.
if O.K., then . . . .
Check to see if the distributor vacuum advance solenoid plunger is stuck in the energized position. Remove the solenoid connector to see if vacuum is lost.
STILL HAVE VACUUM
VACUUM IS LOST
Replace the distributor vacuum advance solenoid.
Must check to find why the solenoid is energized. Remove connector from the start-up relay switch to see if vacuum is lost.
STILL HAVE VACUUM
VACUUM IS LOST
Check to see if the TCS thermal delay switch is stuck closed. Remove switch connector to see if vacuum is lost.
Replace the start-up relay switch.
STILL HAVE VACUUM
VACUUM IS LOST
Check for a stuck closed TCS switch. Remove TCS switch connector to see if vacuum is lost.
Replace the TCS thermal delay switch.
STILL HAVE VACUUM
VACUUM IS LOST
Check for a grounded wire and correct.
Replace TCS switch.

For All V8 and L6 MT Engines

No Vacuum Reading During the First 20 Seconds Following Start-Up

Check for an open circuit in the start-up relay switch by using a test wire connected from the blue (or black) wire to ground. The distributor vacuum advance solenoid should energize and give a vacuum reading.

ENERGIZED – VACUUM READING

Replace start-up relay switch

DID NOT ENERGIZE – NO VACUUM READING

The distributor solenoid is not being grounded. Check for broken wire between start-up relay switch and the distributor vacuum advance solenoid.

For V8 Engines

No Vacuum Delay

Dirt or foreign material inside the distributor vacuum spark delay valve is holding the orifice disc off its seat. Replace the distributor vacuum spark delay valve.

For All V8 Engines

No Vacuum Reading In High Gear Or Reverse

NOTE: Whenever checking for vacuum on the manual transmission engines, it will be necessary to open the throttle slightly to uncover the vacuum source port.

Check for correct hose routing, missed or loose hose connections, plugged hoses, plugged vacuum source, or plugged orifice in the distributor vacuum spark delay valve, and for any missed electrical connections. Repair as necessary.

if O.K., then . . . .

Search out the item having an open circuit. Use a 12 volt test light to see if there is voltage available to the distributor vacuum advance solenoid. With engine running, connect test light from yellow wire to ground. The light should go on.

LIGHT OFF

There is no voltage available to the distributor solenoid. Check radio fuse and wiring from solenoid back to the battery. Correct as required.

LIGHT ON

There is voltage available to the distributor solenoid. Check to see if solenoid can be energized by running engine in park or neutral and connecting a test wire from the blue wire to ground. There should be a vacuum reading, and energizing the solenoid should also produce an audible click.

NO VACUUM READING

The solenoid has an open circuit or is plugged internally. Replace the distributor vacuum advance solenoid.

VACUUM READING

The distributor solenoid operates and is not plugged internally. Check to see if the cold feed switch has an open circuit. With engine running, connect a test wire from the solid black wire to ground. There should be a vacuum reading, and energizing the solenoid should also produce an audible click.

NO VACUUM READING

The cold feed switch has an open circuit or the blue wire between distributor solenoid and the cold feed switch has an open circuit. Repair or replace the faulty part.

VACUUM READING

The cold feed switch is closed. Check the TCS switch and the wire between the cold feed switch and the TCS switch by removing the TCS switch connector and grounding the black wire with the engine running. There should be a vacuum reading, and energizing the solenoid should also produce an audible click.

NO VACUUM READING

The black wire between cold feed switch and TCS switch has a break. Repair as required.

VACUUM READING

Replace the TCS Switch. (The M40 TCS switch is internal.)

For L6 MT Engines

No Vacuum Reading In High Gear

NOTE: Whenever checking for vacuum on the manual transmission engines, it will be necessary to open the throttle slightly to uncover the vacuum source port.

Check for missed or loose hose connections, plugged hoses, plugged vacuum source, and for any missed electrical connections. Repair as necessary.

If O.K., then . . . .

Search out the item having an open circuit. Use a 12 volt test light to see if there is voltage available to the distributor vacuum advance solenoid. With engine running, connect test light from yellow (or tan) wire to ground. The light should go on.

LIGHT OFF

There is no voltage available to the distributor solenoid. Check radio fuse and wiring from solenoid back to the battery. Correct as required.

NO VACUUM READING

The solenoid has an open circuit or is plugged internally. Replace the distributor vacuum advance solenoid.

NO VACUUM READING

The black wire to the TCS switch has a break. Repair as required.

LIGHT ON

There is voltage available to the distributor solenoid. Check to see if solenoid can be energized by running engine in neutral, and connecting a test wire from the blue (or black) wire to ground. There should be a vacuum reading, and energizing the solenoid should also produce an audible click.

VACUUM READING

The solenoid operates and is not plugged internally. Check the TCS switch and the wire to the TCS switch by removing the TCS switch connector and grounding the black wire with the engine running. There should be a vacuum reading, and energizing the solenoid should also produce an audible click.

VACUUM READING

Replace the TCS switch.

Summary of Functional Test Failure Diagnosis

No Vacuum Reading in High Gear or Reverse

Checks required for L6	Checks required for V8	Action and/or Observation	Component Being Checked
X	X	1. Check vacuum system for routing, connections, or plugged source; dist. vacuum spark delay valve for plugged orifice; and electrical connections.	1. Routing, connections, or restrictions in vacuum system. Distributor vacuum spark delay valve Electrical system connections.
X	X	2. Test light on distributor vacuum advance solenoid source lead.	2. Distributor vacuum advance solenoid voltage availability.
X	X	3. Test wire on distributor vacuum advance solenoid blue (or black) wire to ground.	3. Distributor vacuum advance solenoid for an open circuit.
	X	4. Test wire on cold feed switch black wire to ground.	4. Cold feed switch for an open circuit
X	X	5. Remove TCS switch connector and ground black wire.	5. TCS switch and the wire between cold feed switch and TCS switch.

Summary of Functional Test Failure Diagnosis

Vacuum Reading At All Times

Checks required for L6	Checks required for V8	Action and/or Observation	Component Being Checked
X	X	1. Hose routing.	1. Vacuum plumbing.
X	X	2. Remove hose from vertical fitting on distributor solenoid.	2. Distributor spark—EGR thermal vacuum valve.
X	X	3. Remove distributor solenoid connector.	3. Distributor vacuum advance solenoid.
X	X	4. Remove start-up relay switch connector.	4. Start-up relay switch.
X	X	5. Remove hot coolant switch (L6 TCS thermal delay switch) connector.	5. Hot coolant switch on V8's; TCS thermal delay switch on L6's.
X	X	6. Remove cold feed switch connector.	6. Cold feed switch.
	X	7. Remove TCS switch connector.	7. TCS switch.
	X	8. Look for a grounded wire.	8. System wiring.

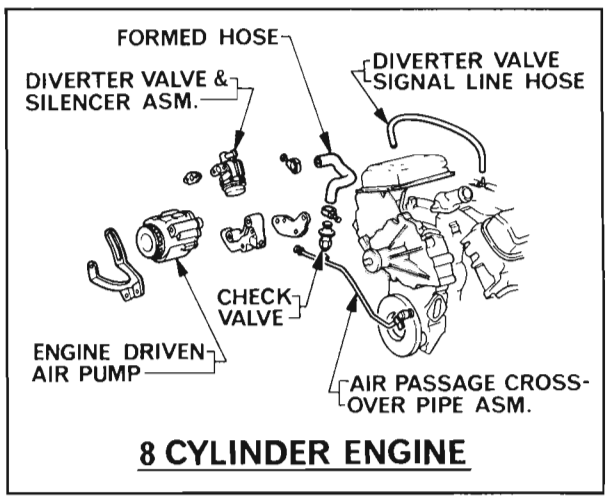
AIR INJECTION REACTOR SYSTEM (A.I.R.)

DESCRIPTION

A.I.R. is a control system that directs pressurized air into the cylinder head exhaust ports for the continued burning of the exhaust gas. The air will induce oxidation or burning of some of the hydrocarbon and carbon monoxide content of the exhaust gas to reduce these pollutants to water and carbon dioxide. The exhaust gas as it exits from the exhaust pipes will be reduced in HC and CO content.

OPERATION

Compressed air from an engine driven pump is discharged into a diverter valve, passes through a check valve, and is then directed into the exhaust ports at the base of each exhaust valve. The A.I.R. system operates at all times and will by-pass only for a short duration of time during deceleration and at high speeds. The diverter valve performs the by-pass function, and the check valve protects the air pump from damage by preventing back flow of exhaust gas.



SYSTEM COMPONENTS

Specific cylinder heads are required for A.I.R. engines. The V8 engines have internally drilled air passages, which supply air to six of the eight cylinders. The L6 engines require an external distributor pipe in addition to specific cylinder heads.

EFFECT ON VEHICLE OPERATION

Driveability is not adversely affected by an A.I.R. system.

The A.I.R. system produces burning in the cylinder head exhaust ports which results in slightly hotter exhaust manifold temperatures than a vehicle without an A.I.R. system. To reduce operating temperatures at sustained high speed, there is a built-in safeguard in the system which by-passes some of the air to the atmosphere.

USAGE

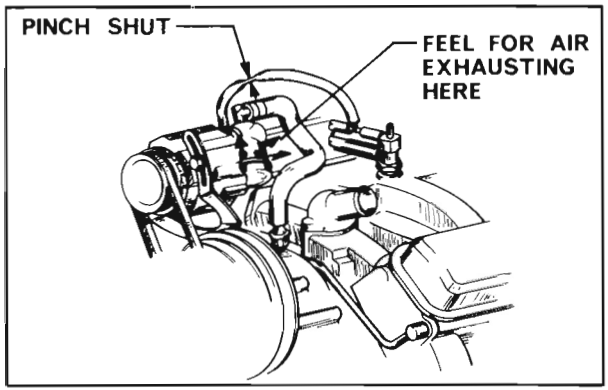
Pontiac will equip the following 1974 vehicles with the A.I.R. system:

- All L6 M.T. engines
- All L6 A.T. engines built for sale in California
- All V8 M.T. 2-barrel engines
- All V8 A.T. 2-barrel engines built for sale in California

FUNCTIONAL TEST

1. Start engine and let idle in neutral or park.
2. Feel for presence of air exhausting out of the lower portion of diverter valve. There should be no air exhausting.
3. Seal off vacuum supply to the diverter valve by pinching shut the hose.
4. Keep hose pinched shut for at least one second.
5. Release hose.

6. There should be air exhausting out of the lower portion of the diverter valve. Air will exhaust for about four seconds.



All L6 and All V8 Engines

Air Exhausting From the Diverter Valve All the Time — Fails Step 2 of Test

Disconnect formed hose at the check valve.

EXHAUSTING AIR STOPS

Replace check valve and reconnect hose.

EXHAUSTING AIR CONTINUES

Replace the diverter valve.

EXHAUSTING AIR CONTINUES

The V8 crossover pipe or L6 manifold pipe assembly, or the cylinder head passages are plugged and must be cleaned.

All L6 and All V8 Engines

No air exhausting from the diverter valve — fails step 6 of test.

Check belt tension. Adjust if necessary.

IF O.K., THEN . . . .

Check diverter valve signal line hose for the presence of vacuum at the diverter valve end. There should be vacuum in the hose.

NO VACUUM

Signal line hose plugged, pinched shut, or not receiving vacuum from source. Correct as required.

VACUUM

Reconnect signal line hose. Disconnect formed hose at the check valve and feel for exhausting air.

NO AIR EXHAUSTING

Replace A.I.R. pump.

AIR EXHAUSTS

Replace diverter valve.

IDLE STOP SOLENOID

DESCRIPTION

The idle stop solenoid's main purpose is to prevent engine run-on. Vehicles are equipped with idle stop solenoids because they require high idle speeds in order to reduce hydrocarbon (HC) emission during closed throttle decelerations. These idle speeds are high enough that under some operating conditions the engine may run on when the ignition key is turned off. To prevent engine run-on, the idle stop solenoid allows the throttle to close more than it does at normal operating conditions when the ignition key is turned off.

OPERATION

When the ignition system is turned on, the idle stop solenoid is energized. When energized, the solenoid plunger is extended and acts as the throttle stop. Idle speed adjustments are made by adjusting the idle stop solenoid plunger rather than the carburetor idle screw.

Turning the ignition off will deenergize the idle stop solenoid. When de-energized, the plunger pulls away from the throttle lever and the throttle closes until it is stopped by the carburetor idle screw. There is a specified idle speed for a de-energized idle stop solenoid which is made by adjustment of the carburetor idle screw. The speeds are generally 150-400 RPM less than the normal idle speed.

FUNCTIONAL TEST

1. Turn ignition on. Plunger should be extended.
2. Remove wire from solenoid to de-energize. Plunger should retract.

CAUTION: If solenoid is energized and the throttle is not depressed, the plunger may not extend because it cannot overcome the throttle linkage effort. Therefore, open throttle to verify plunger extension. When the solenoid is de-energized, it relies on the throttle linkage effort to cause retraction.

USAGES

The idle stop solenoid is used on the following engines:

- All Manual Transmission V8 Engines
- All Super Duty LS2 Engines – Automatic and Manual
- All L6 Engines

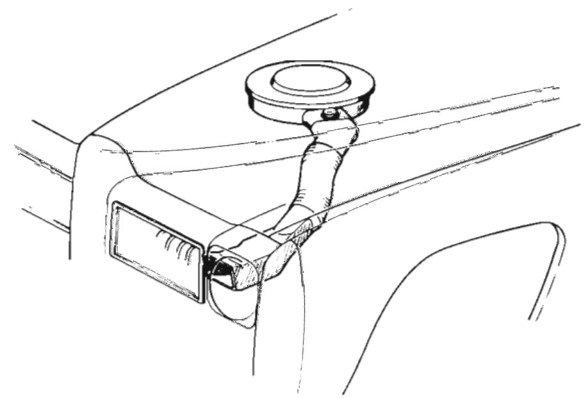
HEATED AIR SYSTEM AND COLD AIR INDUCTION

DESCRIPTION

The heated air system provides warm air to the carburetor when the underhood air temperature is low. The purpose of heating the air is to allow use of a leaner fuel mixture during warm-up, with a resultant reduction in hydrocarbon (HC) and carbon monoxide (CO) emission, and to reduce the tendency for carburetor icing.

The cold air induction system introduced in 1973 on the V8 engines is used in conjunction with the heated air system. Cold air induction draws cool air from just behind the grille area to provide a more dense air change under normal operating conditions.

COLD AIR INDUCTION



OPERATION

Typical operation of a heated air system is as follows:

1. Warm-Up Operation

   During warm-up, air is heated by a shroud surrounding the exhaust manifold, and the warm air is piped to the air cleaner. A vacuum motor controls an air mixing valve in the air cleaner snorkel which is closed to outside air. Therefore, all air entering the carburetor is heated.

2. Normal Operation

   As the air temperature entering the air cleaner increases, the air mixing valve opens to allow the heated air to mix with the inducted cold air to keep the air temperature at approximately 115°F.

3. Wide-Open Throttle Operation

   An exception to either of the above conditions occurs during wide-open throttle, or at any engine vacuum below 4-6" Hg. Under those conditions the vacuum motor can no longer hold the mixing valve open to hot air, and the hot air duct is closed off allowing only cold air to enter the carburetor.

SYSTEM COMPONENTS

The heated air system consists of an air cleaner which contains a combination thermostatic and vacuum operated mixing valve, a flexible heat duct or tube and a heat shroud mounted to the exhaust manifold.

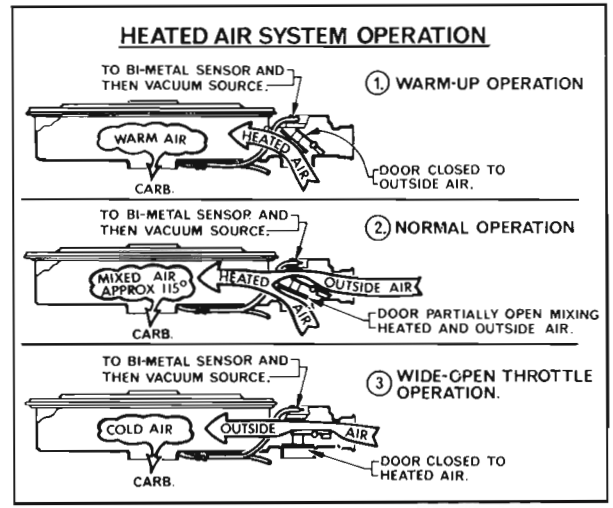
The cold air induction system components consist of an upper duct attached to the air cleaner snorkel, a lower duct attached near the radiator support and baffle, and a flexible duct connecting the two rigid ducts.

EFFECT ON VEHICLE OPERATION

The heated air system allows for a leaner choke calibration to reduce emission levels during the warm-up period, and reduces the tendency for carburetor icing. The cold air induction system allows use of cold air rather than underhood air during normal operating conditions.

USAGE

All Pontiacs are equipped with heated air systems; however, only the V8 engines will be equipped with cold air induction.



EVAPORATIVE EMISSION CONTROL SYSTEM (E.E.C.S.)

DESCRIPTION

The E.E.C.S. is a closed system that prevents gasoline vapors in the fuel tank and carburetor from entering the atmosphere. This system controls the hydrocarbon (HC) emission from the fuel vapors.

OPERATION

The fuel tank uses a non-vented cap to prevent the fuel vapors from entering the atmosphere. The vapors are routed to a charcoal canister which serves as a storage place for the fuel vapors when the engine is not running.

- V8 Engines. When the engine is running, the stored vapors from the canister are drawn into the engine and are consumed. The carburetor has two ports which draw the majority of the fuel vapors into the engine when the throttle is open. At idle, only very small amounts of vapors are drawn into the engine.

  The V400-2 barrel non-California B station wagon engine has an additional component in the E.E.C.S. system. A thermal purge valve is located on the right side of the intake manifold water crossover and is in line between the carburetor and the charcoal canister. The thermal purge valve remains closed until the engine coolant temperature reaches 170° F. Over 170° F. coolant temperature, the valve opens and the fuel vapors collected in the canister are drawn into the engine. The purpose of the thermal purge valve is to delay the introduction of fuel vapors until the choke opens fully.

- L6 Engines. All the L6 engines have a staged purge system which uses a canister having three fittings, and two means of drawing vapors into the engine. At closed throttle, only vapors from the fuel tank are drawn into the engine. When the throttle is opened, a ported carburetor vacuum source operates a valve in the canister which allows the engine to consume the vapors stored in the canister in addition to the fuel tank vapors.

EFFECT ON VEHICLE OPERATION

The addition of fuel vapors by E.E.C.S. has not affected vehicle operation because the majority of the vapor entry is at part throttle. Vapor entry at idle is restricted to maintain idle quality.

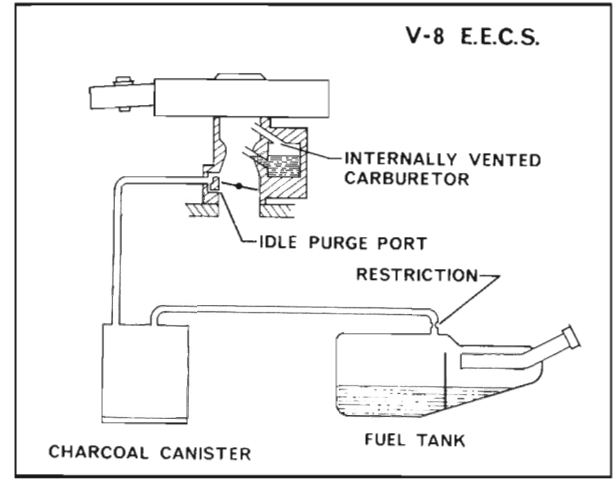
USAGE

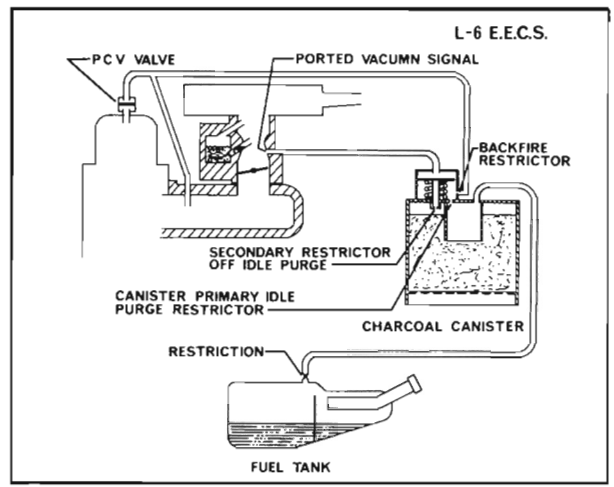
All Pontiacs are equipped with an evaporative emission control system.

POSITIVE CRANKCASE VENTILATION (P.C.V.)

DESCRIPTION

Positive crankcase ventilation is a closed crankcase vent system that prevents crankcase fumes from entering the atmosphere. This is one of the first forms of emission control, and it has eliminated hydrocarbon (HC) emission from the crankcase.





OPERATION

The P.C.V. system supplies fresh air to the crankcase through the air cleaner. Inside the crankcase, the fresh air is mixed with oil fumes and blow-by gases, and this mixture passes through a positive crankcase vent valve into the induction system.

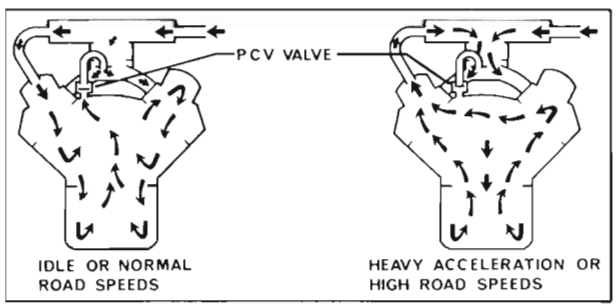
The P.C.V. valve is a metered orifice through which the mixture of fresh air, oil fumes, and blow-by gases are drawn into the intake manifold at a rate dependent upon manifold vacuum. The valve capacity is adequate for all normal driving conditions. Under heavy acceleration or high-speed driving, there is less engine vacuum available, and the blow-by gases exceed the P.C.V. capacity. In this case the mixture of air, fumes, and blow-by gases backflow up through the tube between the engine and the air cleaner where they are drawn into the carburetor.

EFFECT ON VEHICLE OPERATION

The P.C.V. system has been calibrated so as to not affect vehicle operation.

USAGES

All Pontiacs are equipped with a P.C.V. system.



1974 PONTIAC V8 EXHAUST EMISSION TCS AND EGR SYSTEMS CHART

ENGINE COOLANT TEMPERATURE (HOT COOLANT SWITCH)	ELAPSED TIME AFTER START-UP (START-UP RELAY SWITCH)	AIR/FUEL MIXTURE TEMPERATURE (DIST. SPARK-EGR) THERMAL VAC. VALVE)	CYLINDER HEAD METAL TEMP. (COLD FEED SWITCH)	TRANSMISSION GEAR POSITION (T.C.S. SWITCH)	DIST. VACUUM ADVANCE (DIST. VAC. ADV. SOLENOID)	PORTED EGR AVAILABLE
Less than 240°F. (open)	Less than 20 sec. (grounded)	N/A	N/A	Any gear	Yes (energized)	**
	More than 20 seconds (open)	Less than 62°F.	N/A	Any gear	Yes*	No
		Above 62°F.	Less than 140°F. (156°F.) (open)	Any gear	No (de-energized)	Yes
			Above 140°F. (or 155°F.) (closed)	AT: 1, 2, N, P MT: 1, 2, N, R (open)	No (de-energized)	Yes
				AT: 3, R MT: 3 (closed)	Yes (energized)	Yes
Above 240°F. (grounded)	N/A	N/A	N/A	Any gear	Yes (energized)	Yes

* Vacuum advance is supplied by the dist. spark-EGR thermal vacuum valve.

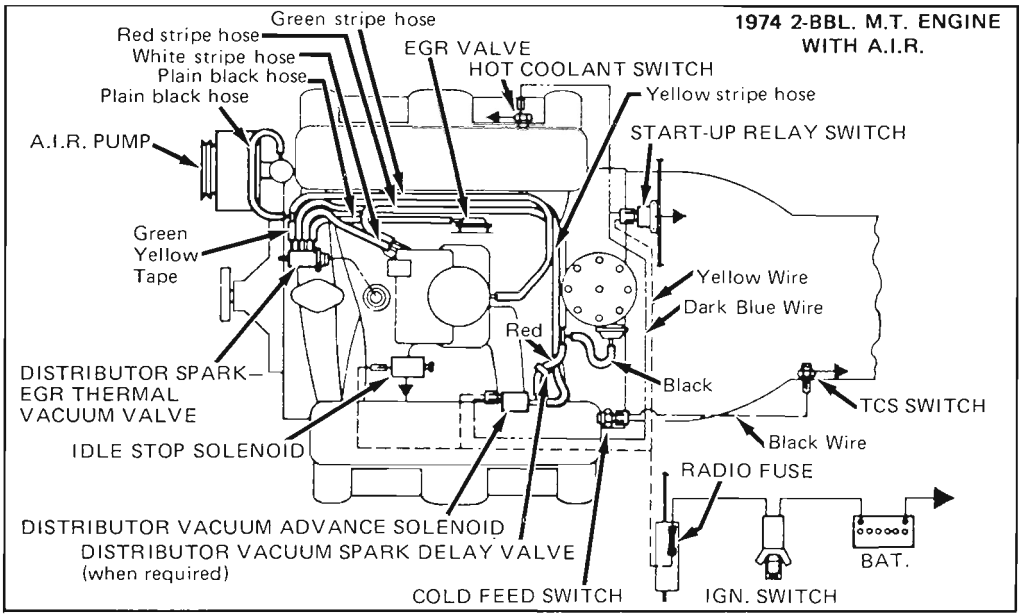
** Will have EGR if A/F mixture temperature is above 62°F.

N/A = not applicable

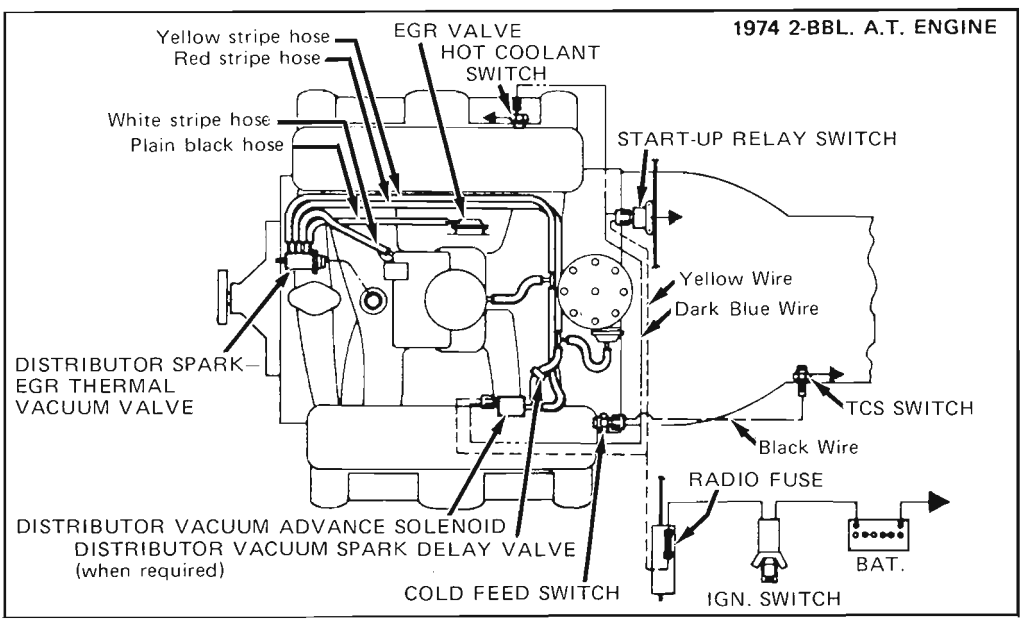
FUNCTION OF THE 1974 EXHAUST EMISSION SYSTEM COMPONENTS

COMPONENT	FUNCTIONAL OPERATION		PURPOSE
	CONDITION	SITUATION	
I. Common EGR and TCS Parts:			
A. Carburetor	V8 & L6 EGR vacuum source	Ported @ front	Provides vacuum source for both EGR & TCS systems. The EGR has a ported source. The TCS has a ported source on MT V8s and all L6s. The AT V8 has a full vacuum TCS source.
	V8 TCS vacuum source	AT—full @ rear MT—ported @ front	
	L6 TCS vacuum source	Ported side	
B. V8 Distributor Spark—EGR Thermal Vacuum Valve	Less than 62°F. air/fuel mixture temperature	EGR port—closed TCS port—open	Valve denies EGR during initial cold driveaway and at the same time allows for vacuum advance during initial cold driveaway. The TCS portion of this valve supplies vacuum advance to the distributor without passing through the distributor vacuum advance solenoid.
	Greater than 62°F. air/fuel mixture temperature	EGR port open TCS port—closed	
II. EGR System Parts:			
A. EGR Valve	No vacuum available	Closed	Valve which meters controlled amounts of exhaust gas for entry into the intake manifold.
	Vacuum applied	Open	
B. L6 Thermal Vacuum Switch	Less than 100°F. coolant	Closed	Switch which denies EGR during initial cold driveaway.
	Greater than 100°F. coolant	Open	
C. V8 Vacuum Bias Valve	Less than 8.5" Hg. signal	No vacuum bleed	Monitors intake manifold vacuum to provide less EGR at highway cruising speeds to reduce surge, while still providing maximum EGR during acceleration.
	Greater than 8.5" Hg. signal	Vacuum bleed	
D. V8 Back Pressure Transducer	Less than 3" H_2O exhaust pressure	Vacuum bleeds	Monitors exhaust system back pressure to provide maximum EGR during acceleration, while supplying lesser amounts of EGR to reduce surge during highway driving.
	Greater than 3" H_2O exhaust pressure	No vacuum bleed	
III. TCS System Parts:			
A. Start-Up Relay Switch	Less than 20 seconds after start-up	Grounded	Provides vacuum advance for the first twenty seconds following every engine start-up.
	More than 20 seconds after start-up	Open	

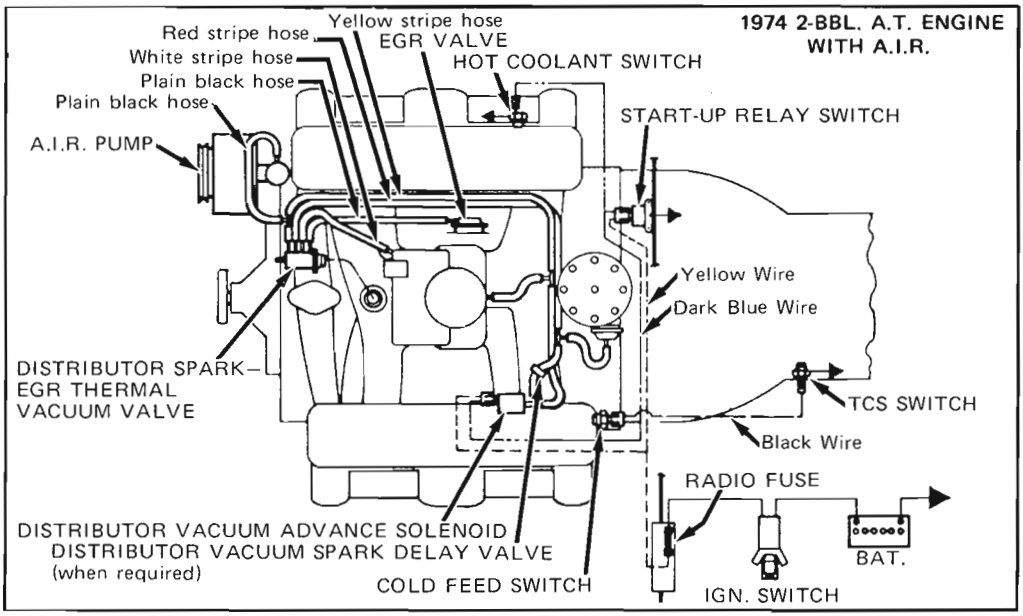
B. L6 TCS Thermal Delay	Less than 93°F. coolant	Grounded	Provides vacuum advance in all gears during the initial cold driveaway.
	Greater than 93°F. coolant	Open	
C. V8 Cold Feed Switch	Less than 140°F. (or 155°F.) cylinder head metal temperature	Open	Denies vacuum advance during latter part of the initial cold driveaway.
	Greater than 140°F. (or 155°F.) cylinder head metal temperature	Closed	
D. TCS Switch	AT	Open in N, P, 1, 2 Closed in R, 3	Provides the signal to the distributor vacuum advance solenoid when transmission is shifted into high gear unless overridden by the cold feed switch.
	MT	Open in N, R, 1, 2, (3) Closed in 3, (4)	
E. V8 Distributor Vacuum Spark Delay Valve	Less than 15 (or 30) seconds after application of vacuum	Vacuum at "DIST" end of valve slowly increases to equal source vacuum	Provides a controlled delay in the application of vacuum advance.
	More than 15 (or 30) seconds after application of vacuum	Vacuum at "DIST" end of valve equals the source vacuum	
F. V8 Distributor Vacuum Advance Solenoid; L6 TCS Solenoid	De-energized	No vacuum allowed to the distributor	This solenoid is the exclusive control of the vacuum supply to the distributor for vacuum advance in the L6, and provides control of vacuum supply for advance in the V8s except when the air/fuel mixture temperature is below 62°F.
	Energized	Allows vacuum advance to distributor	
G. V8 Hot Coolant Switch	Less than 240°F. coolant	Open	Provides vacuum advance in any gear when the coolant becomes very hot.
	Greater than 240°F. coolant	Grounded	
IV. Miscellaneous Emission System Parts:			
A. Idle Stop Solenoid	De-energized	Plunger retracted	Provides additional throttle closure when the ignition is turned off to prevent engine run-on.
	Energized	Plunger extended	
B. V8 Thermal Purge Valve	Less than 170°F. coolant	Closed	Prevents fuel vapors from being consumed by the engine until engine is near normal operation temperature.
	Greater than 170°F. coolant	Open	

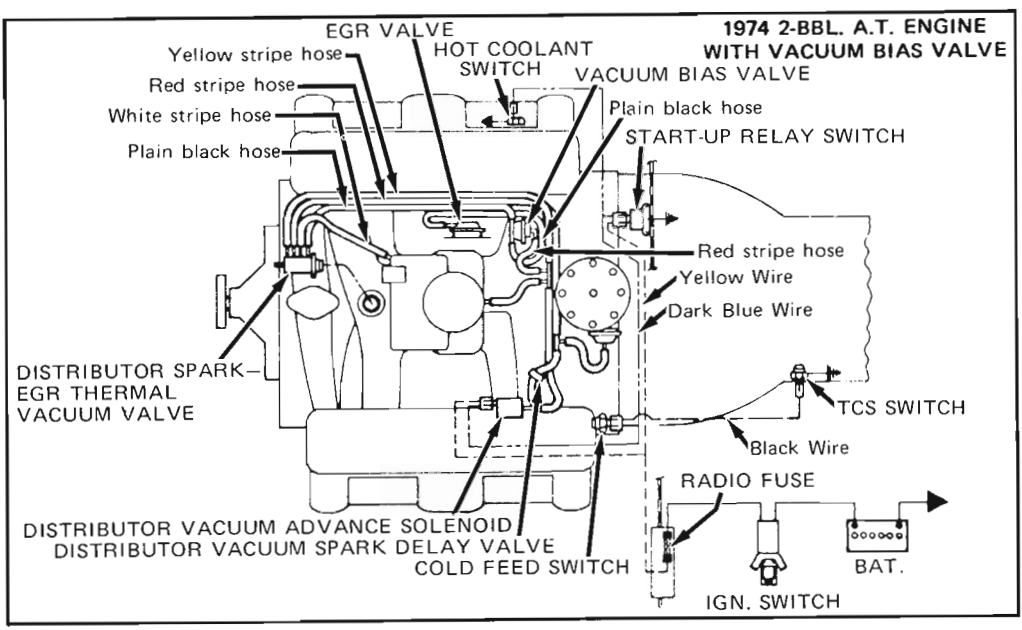

1974 2-BBL. M.T. ENGINE
WITH A.I.R.
Green stripe hose
Red stripe hose
White stripe hose
Plain black hose
Plain black hose
EGR VALVE
HOT COOLANT SWITCH
Yellow stripe hose
START-UP RELAY SWITCH
A.I.R. PUMP
Green
Yellow
Tape
Yellow Wire
Dark Blue Wire
Red
Black
DISTRIBUTOR SPARK—
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
IDLE STOP SOLENOID
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH

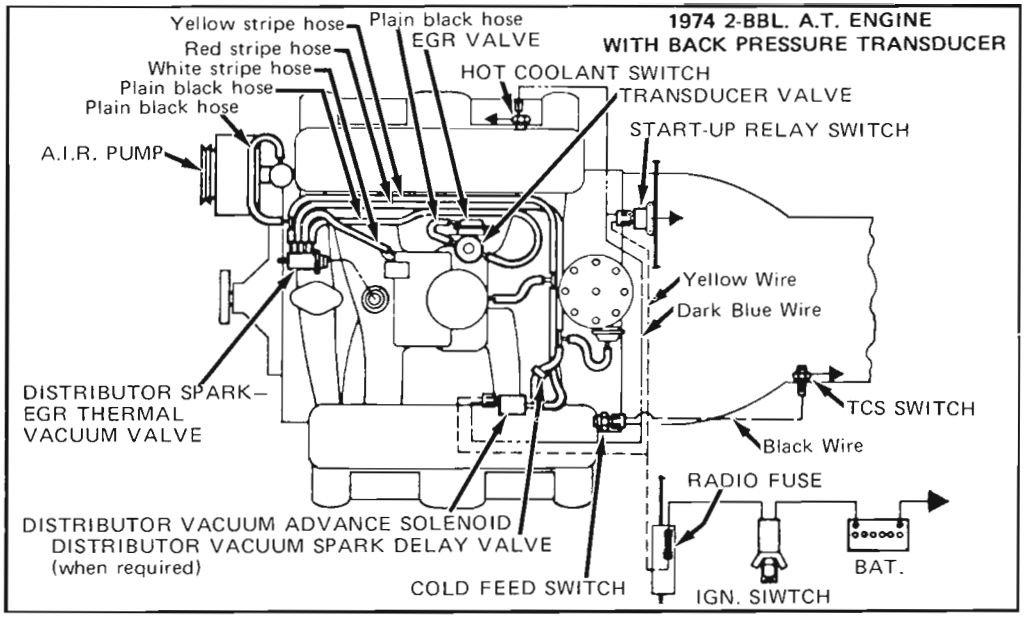
44


1974 2-BBL. A.T. ENGINE
Yellow stripe hose
Red stripe hose
EGR VALVE
HOT COOLANT
SWITCH
White stripe hose
Plain black hose
START-UP RELAY SWITCH
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK—
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH

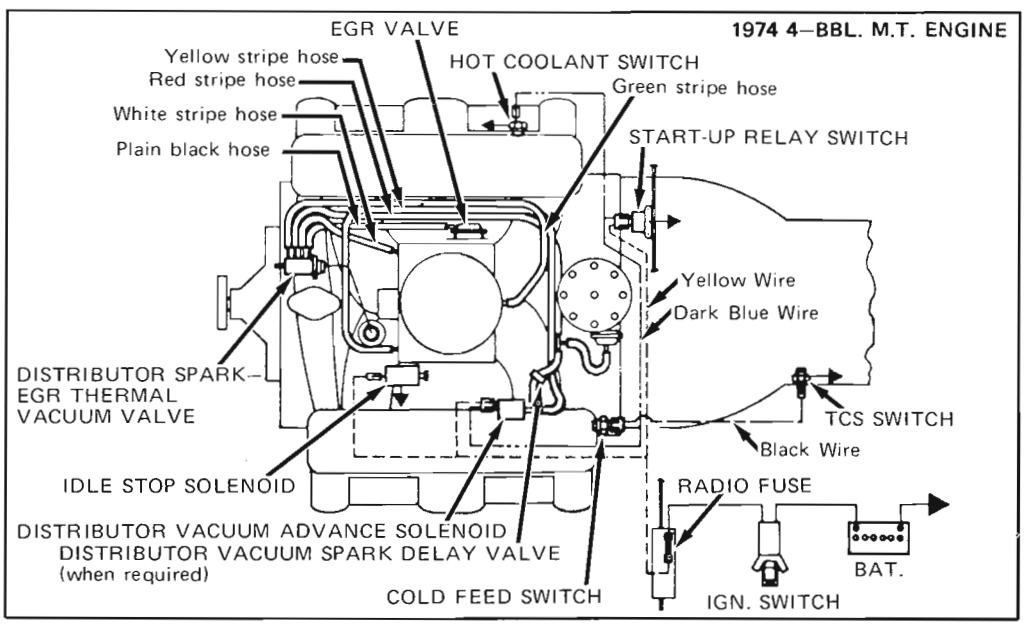
45


1974 2-BBL. A.T. ENGINE
WITH A.I.R.
Red stripe hose
Yellow stripe hose
EGR VALVE
White stripe hose
HOT COOLANT SWITCH
Plain black hose
Plain black hose
START-UP RELAY SWITCH
A.I.R. PUMP
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH

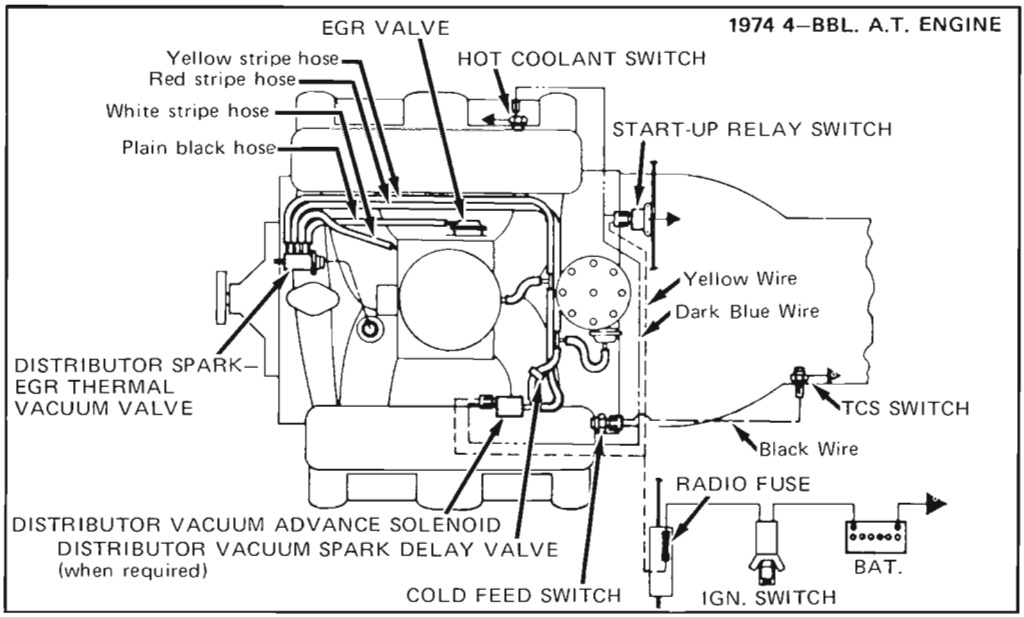

1974 2-BBL. A.T. ENGINE
WITH VACUUM BIAS VALVE
EGR VALVE
Yellow stripe hose
HOT COOLANT SWITCH
VACUUM BIAS VALVE
Red stripe hose
White stripe hose
Plain black hose
Plain black hose
START-UP RELAY SWITCH
Red stripe hose
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
COLD FEED SWITCH
BAT.
IGN. SWITCH


1974 2-BBL. A.T. ENGINE
WITH BACK PRESSURE TRANSDUCER
Yellow stripe hose
Red stripe hose
White stripe hose
Plain black hose
Plain black hose
Plain black hose
EGR VALVE
HOT COOLANT SWITCH
TRANSDUCER VALVE
START-UP RELAY SWITCH
A.I.R. PUMP
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SIWTCH

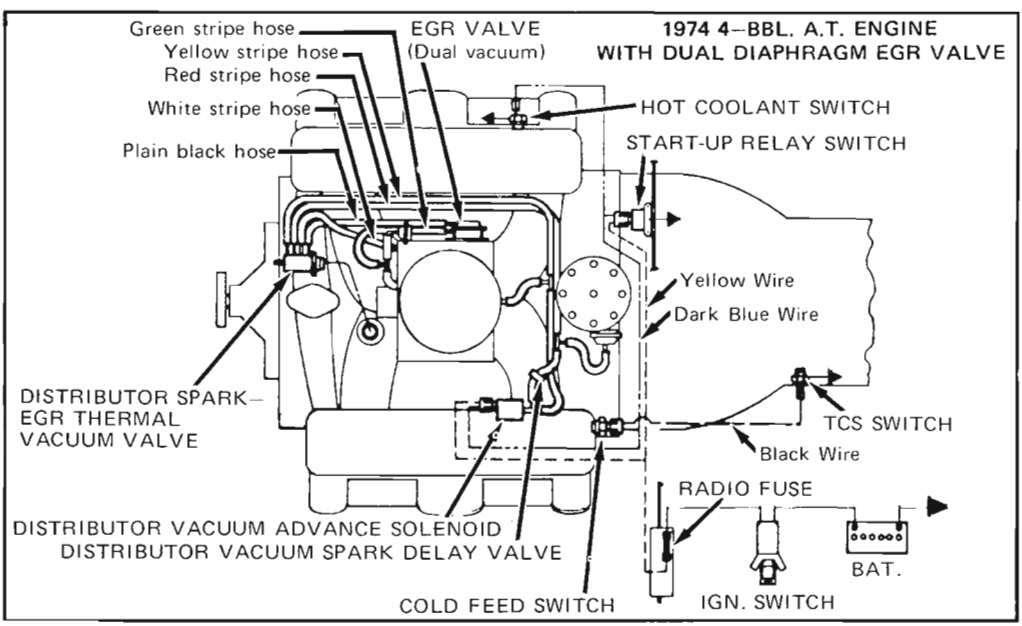
48


1974 4–BBL. M.T. ENGINE
EGR VALVE
Yellow stripe hose
Red stripe hose
White stripe hose
Plain black hose
HOT COOLANT SWITCH
Green stripe hose
START-UP RELAY SWITCH
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
IDLE STOP SOLENOID
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH

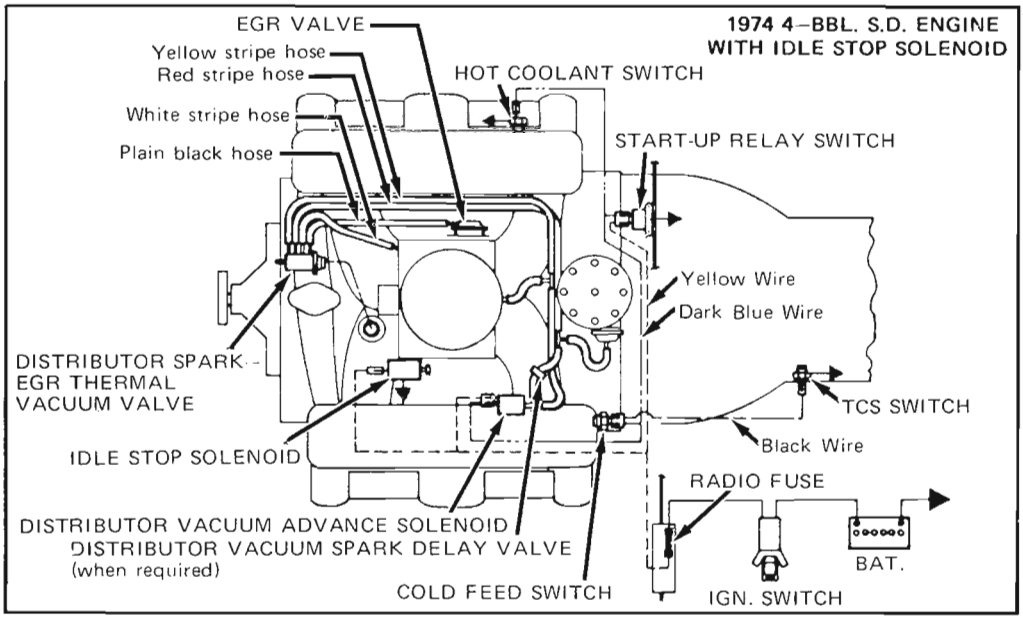
49

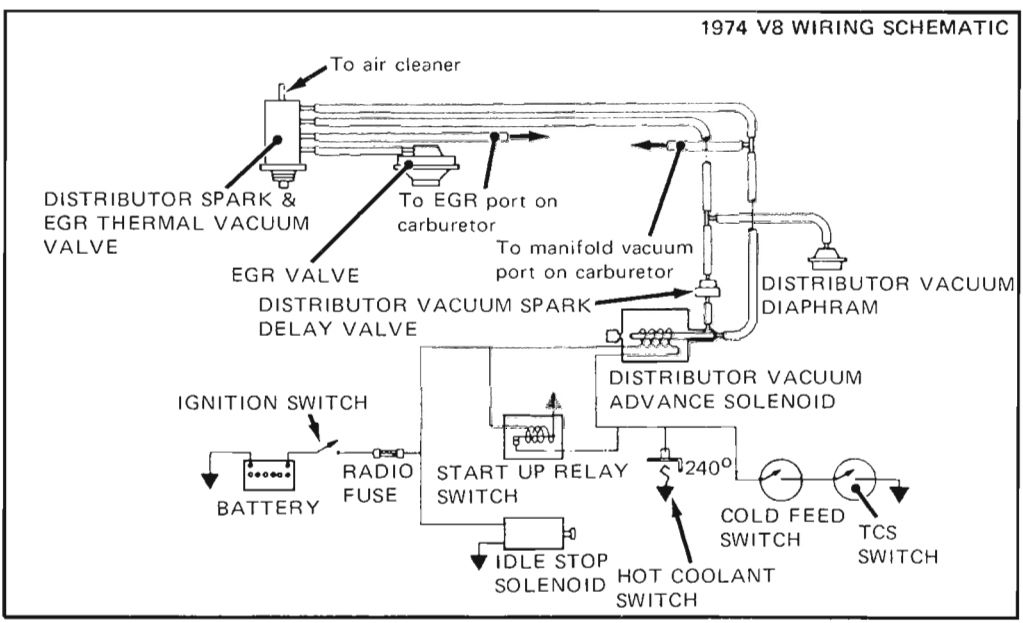

1974 4–BBL. A.T. ENGINE
EGR VALVE
HOT COOLANT SWITCH
Yellow stripe hose
Red stripe hose
White stripe hose
Plain black hose
START-UP RELAY SWITCH
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH

50


Green stripe hose
EGR VALVE
(Dual vacuum)
1974 4–BBL. A.T. ENGINE
WITH DUAL DIAPHRAGM EGR VALVE
Yellow stripe hose
Red stripe hose
White stripe hose
HOT COOLANT SWITCH
Plain black hose
START-UP RELAY SWITCH
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK–
EGR THERMAL
VACUUM VALVE
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
BAT.
COLD FEED SWITCH
IGN. SWITCH

51


1974 4–BBL. S.D. ENGINE
WITH IDLE STOP SOLENOID
EGR VALVE
Yellow stripe hose
Red stripe hose
White stripe hose
Plain black hose
HOT COOLANT SWITCH
START-UP RELAY SWITCH
Yellow Wire
Dark Blue Wire
DISTRIBUTOR SPARK
EGR THERMAL
VACUUM VALVE
IDLE STOP SOLENOID
TCS SWITCH
Black Wire
RADIO FUSE
DISTRIBUTOR VACUUM ADVANCE SOLENOID
DISTRIBUTOR VACUUM SPARK DELAY VALVE
(when required)
BAT.
COLD FEED SWITCH
IGN. SWITCH


1974 V8 WIRING SCHEMATIC
To air cleaner
DISTRIBUTOR SPARK &
EGR THERMAL VACUUM
VALVE
To EGR port on
carburetor
EGR VALVE
To manifold vacuum
port on carburetor
DISTRIBUTOR VACUUM
DIAPHRAM
DISTRIBUTOR VACUUM SPARK
DELAY VALVE
DISTRIBUTOR VACUUM
ADVANCE SOLENOID
IGNITION SWITCH
BATTERY
RADIO
FUSE
START UP RELAY
SWITCH
240°
COLD FEED
SWITCH
TCS
SWITCH
IDLE STOP
SOLENOID
HOT COOLANT
SWITCH