

EMISSION CONTROLS—EXHAUST SYSTEMS

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EMISSION CONTROLS

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GENERAL

Emission control systems are required to meet existing standards for exhaust, crankcase, and raw fuel vapor emissions. The systems control emission of hydrocarbons, carbon monoxide, and oxides of nitrogen at the levels specified by Federal or California standards.

Federal Emission Standards and the standards which apply in California differ. This necessitates a number of differences between emission control systems on ve-

hicles built for sale in California and in the remaining 49 states.

Emission control system usage varies in relation to engine, transmission, and series application. The Emission Control Systems Application Chart at the end of this section may be used to determine the current system usage for any particular vehicle.

This section outlines service procedures for all Jeep Emission Control Systems. Tuneup specifications and procedures as prescribed by the U.S. Emission Control Services Maintenance Chart are also included.

Service Diagnosis

The following table lists causes of service problems in descending order of probability. It is more likely a problem results from the first listed "possible cause" than the tenth, for instance.

However, visual examination often leads directly to the correct solution and all service procedures should begin with a careful look at any suspected part or assembly.

Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY)	(1) Binding linkage, choke valve or choke piston.	(1) Repair as necessary.
	(2) Initial choke valve setting incorrect.	(2) Adjust initial choke valve correctly.
	(3) Restricted choke vacuum and hot air passages or disconnected vacuum hose.	(3) Clean passages or connect vacuum hose.
	(4) Improper fuel level.	(4) Adjust float level.
	(5) Dirty, worn or faulty needle valve and seat.	(5) Repair as necessary.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction	
HARD STARTING (ENGINE CRANKS NORMALLY) (Continued)	(6) Float sticking.	(6) Repair as necessary.	
	(7) Exhaust manifold heat valve stuck.	(7) Repair as necessary.	
	(8) Faulty fuel pump.	(8) Replace fuel pump.	
	(9) Incorrect choke cover adjustment.	(9) Adjust choke cover.	
	(10) Inadequate unloader adjustment.	(10) Adjust unloader.	
	(11) Faulty ignition coil.	(11) Test and replace as necessary.	
	(12) Improper spark plug gap.	(12) Adjust gap.	
	(13) Incorrect initial timing.	(13) Adjust timing.	
	(14) Incorrect valve timing	(14) Check valve timing; repair as necessary.	
	ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed.	(1) Adjust curb or fast idle speed.
		(2) Faulty EGR valve operation.	(2) Test EGR system and replace as necessary.
		(3) Vacuum leak.	(3) Check manifold vacuum and repair as necessary.
		(4) Improper choke setting.	(4) Adjust choke.
		(5) Improper fast idle cam adjustment.	(5) Adjust fast idle.
(6) Choke binding.		(6) Locate and eliminate binding condition.	
(7) Improper idle mixture adjustment.		(7) Adjust idle mixture.	
(8) Faulty TAC unit or disconnected TAC hose.		(8) Repair as necessary.	
(9) Damaged tip on idle mixture screw(s).		(9) Replace mixture screw(s).	
(10) Improper fuel level.		(10) Adjust fuel level.	
(11) Incorrect initial timing.		(11) Adjust timing to specifications.	
(12) Faulty distributor rotor or cap.		(12) Replace rotor or cap.	
(13) Secondary throttle valves not closing (4350 Model, 4V carburetor).		(13) Locate and eliminate binding condition.	
(14) Exhaust manifold heat valve inoperative.		(14) Lubricate or replace heat valve as necessary.	
(15) Faulty PCV valve air flow.		(15) Test PCV valve and replace as necessary.	

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(16) Leaking engine valves.	(16) Check cylinder leakdown rate or compression and repair as necessary.
	(17) Incorrect ignition wiring.	(17) Check wiring and correct as necessary.
	(18) Faulty coil.	(18) Test coil and replace as necessary.
	(19) Clogged air bleed or idle passages.	(19) Clean passages.
	(20) Restricted air cleaner.	(20) Clean or replace air cleaner.
FAULTY LOW-SPEED OPERATION	(1) Clogged idle transfer slots.	(1) Clean transfer slots.
	(2) Restricted idle air bleeds and passages.	(2) Clean air bleeds and passages.
	(3) Restricted air cleaner.	(3) Clean or replace air cleaner.
	(4) Improper fuel level.	(4) Adjust fuel level.
	(5) Faulty spark plugs.	(5) Clean or replace spark plugs.
	(6) Dirty, corroded, or loose secondary circuit connections.	(6) Clean or tighten secondary circuit connections.
	(7) Faulty ignition cable	(7) Replace ignition cable.
	(8) Faulty distributor cap.	(8) Replace cap.
FAULTY ACCELERATION	(1) Improper pump stroke.	(1) Adjust pump stroke.
	(2) Incorrect ignition timing.	(2) Adjust timing.
	(3) Inoperative pump discharge check ball or needle.	(3) Clean or replace as necessary
	(4) Worn or damaged pump diaphragm or piston.	(4) Replace diaphragm or piston
	(5) Leaking main body cover gasket.	(5) Replace gasket.
	(6) Engine cold and choke too lean.	(6) Adjust choke.
	(7) Improper metering rod adjustment (YF Model carburetor or 4350 Model carburetor).	(7) Adjust metering rod.
	(8) Faulty spark plug(s).	(8) Clean or replace spark plug(s).
	(9) Leaking engine valves.	(9) Check cylinder leakdown rate or compression, repair as necessary.
	(10) Faulty coil.	(10) Test coil and replace as necessary.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
FAULTY HIGH SPEED OPERATION	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor vacuum advance.	(2) Check vacuum advance and repair as necessary.
	(3) Faulty distributor centrifugal advance.	(3) Check centrifugal advance and repair as necessary.
	(4) Defective TCS system.	(4) Test TCS System; repair as necessary.
	(5) Low fuel pump volume.	(5) Replace fuel pump.
	(6) Improper spark plug gap.	(6) Adjust gap.
	(7) Faulty choke operation.	(7) Adjust choke.
	(8) Partially restricted exhaust manifold, exhaust pipe, muffler, or tailpipe.	(8) Eliminate restriction
	(9) Incorrect valve timing.	(9) Check valve timing and repair as necessary
	(10) Improper size or obstructed main jets.	(10) Clean or replace as necessary.
	(11) Clogged secondary metering passages (4350 V4 carburetor).	(11) Clean passages.
	(12) Restricted air cleaner.	(12) Clean or replace as necessary.
	(13) Secondary linkage, throttle valves, or shaft binding (4350 4V carburetor).	(13) Locate and eliminate binding condition
	(14) Auxiliary inlet valve not adjusted properly (4350 4V carburetor).	(14) Adjust inlet valve.
	(15) Faulty distributor rotor or cap.	(15) Replace rotor or cap
	(16) Intake manifold restricted.	(16) Pass chain through passages.
	(17) Faulty coil.	(17) Test coil and replace as necessary.
	(18) Leaking engine valve(s).	(18) Check cylinder leak down or compression and repair as necessary.
	(19) Faulty valve spring(s).	(19) Inspect and test valve spring tension and replace as necessary.
	(20) Clogged vacuum passages.	(20) Clean passages.
	(21) Worn distributor shaft.	(21) Replace shaft.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
MISFIRE AT ALL SPEEDS	<ul style="list-style-type: none"> (1) Vacuum leak. (2) Faulty spark plug(s). (3) Faulty spark plug cable(s). (4) Faulty distributor cap or rotor. (5) Distributor trigger wheel set too high. (6) Faulty coil. (7) Primary circuit shorted or open intermittently. (8) Leaking engine valve(s). (9) Faulty hydraulic tappet(s). (10) Faulty valve spring(s). (11) Worn lobes on camshaft. (12) Improper carburetor settings. (13) Fuel pump volume or pressure low. (14) Blown cylinder head gasket. (15) Intake or exhaust manifold passage(s) restricted. 	<ul style="list-style-type: none"> (1) Check manifold vacuum and repair as necessary. (2) Clean or replace spark plug(s). (3) Replace as necessary. (4) Replace cap or rotor. (5) Set trigger wheel to specification. (6) Test coil and replace as necessary. (7) Trace primary circuit and repair as necessary. (8) Check cylinder leakdown rate or compression and repair as necessary. (9) Clean or replace tappet(s). (10) Inspect and test valve spring tension, repair as necessary. (11) Replace camshaft. (12) Adjust carburetor. (13) Replace fuel pump. (14) Replace gasket. (15) Pass chain through passages.
POWER NOT UP TO NORMAL	<ul style="list-style-type: none"> (1) Incorrect ignition timing. (2) Faulty distributor rotor. (3) Distributor trigger wheel set too high. (4) Incorrect spark plug gap. (5) Faulty fuel pump. (6) Incorrect valve timing. (7) Faulty coil. (8) Faulty ignition. (9) Leaking engine valves. (10) Blown cylinder head gasket. (11) Leaking piston rings. 	<ul style="list-style-type: none"> (1) Adjust timing. (2) Replace rotor. (3) Set trigger wheel to specification. (4) Adjust gap. (5) Replace fuel pump. (6) Check valve timing and repair as necessary. (7) Test coil and replace as necessary. (8) Test cables and replace as necessary. (9) Check cylinder leakdown rate or compression and repair as necessary. (10) Replace gasket. (11) Check compression and repair as necessary.



Service Diagnosis (Continued)

Condition	Possible Cause	Correction
INTAKE BACKFIRE	(1) Lean fuel mixture. (2) Improper ignition timing. (3) Faulty accelerator pump discharge. (4) Improper choke operation. (5) Defective EGR CTO (6) Defective TAC unit.	(1) Check float level or manifold vacuum for vacuum leak. (2) Adjust timing. (3) Repair as necessary. (4) Repair as necessary. (5) Replace EGR CTO (6) Repair as necessary.
EXHAUST BACKFIRE	(1) Vacuum leak. (2) Faulty diverter valve. (3) Faulty choke operation. (4) Exhaust leak.	(1) Check manifold vacuum and repair as necessary. (2) Test diverter valve and replace as necessary. (3) Repair as necessary. (4) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing. (2) Distributor centrifugal or vacuum advance malfunction. (3) Excessive combustion chamber deposits. (4) Carburetor set too lean. (5) Vacuum leak. (6) Excessively high compression. (7) Fuel octane rating excessively low. (8) Heat riser stuck in heat on position.	(1) Adjust timing. (2) Check advance and repair as necessary. (3) Use combustion chamber cleaner. (4) Adjust carburetor. (5) Check manifold vacuum and repair as necessary. (6) Check compression and repair as necessary. (7) Try alternate fuel source. (8) Free-up or replace heat riser.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	(1) Low fuel level. (2) Low fuel pump pressure or volume. (3) Metering rod(s) not adjusted properly (Model YF Carburetor, Model BBD Carburetor, or Model 4350 Carburetor). (4) Improper PCV valve air flow. (5) Vacuum leak. (6) Clogged main jet(s). (7) Undersize main jets (8) Blocked air bleeds. (9) Clogged fuel filter screen.	(1) Adjust fuel level. (2) Replace fuel pump. (3) Adjust metering rod(s). (4) Test PCV valve and replace as necessary. (5) Check manifold vacuum and repair as necessary. (6) Clean main jet(s). (7) Replace main jet(s). (8) Clean air bleeds. (9) Replace fuel filter.

AIR GUARD SYSTEM

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GENERAL

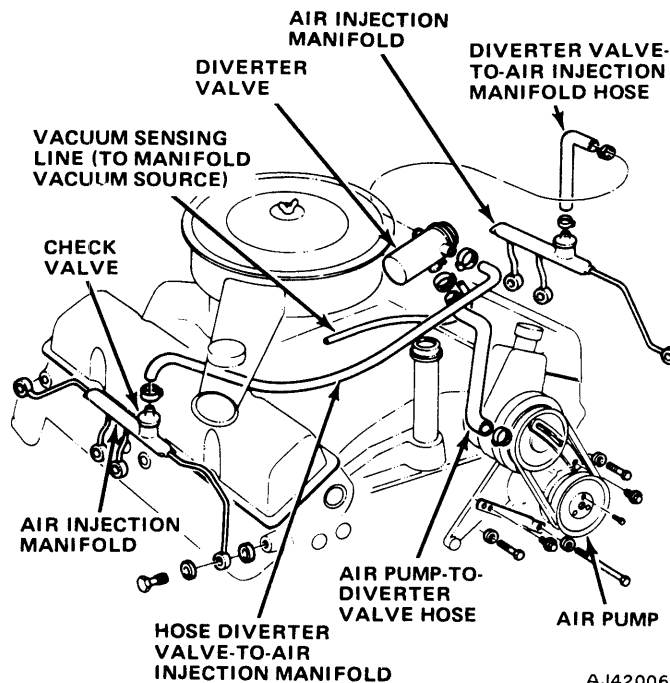
This system incorporates a belt driven air pump, diverter (bypass) valve, air injection manifold(s) and connecting hoses (fig. 4A-1 and 4A-2).

Air is discharged from the air pump to the diverter valve which directs it to the air distribution manifold(s) or dumps it through a bypass port, depending on engine operating conditions. Air pressure in this system is kept to approximately 5 psi by a relief valve incorporated in the diverter valve.

Air is routed through the air injection manifold into the engine exhaust ports. The air mixes with hot unburned exhaust products and causes a further burning of the mixture, reducing hydrocarbon and carbon monoxide emissions to the atmosphere.

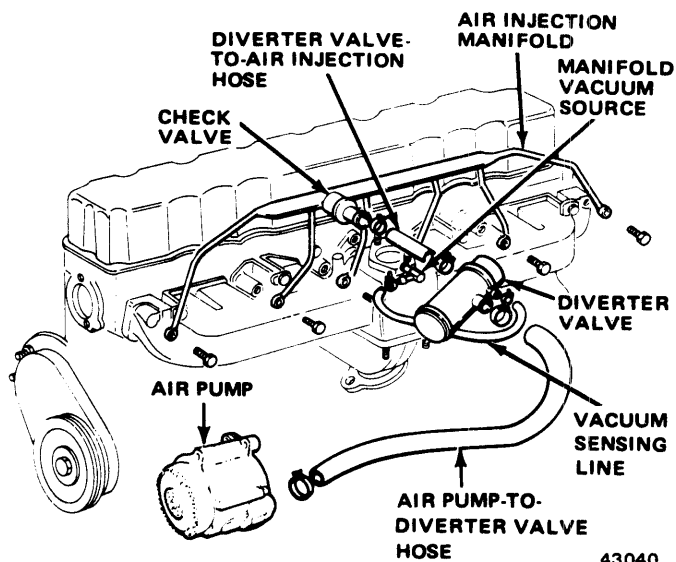
AIR PUMP

The air pump used for V-8 and six-cylinder engines is the same. A pump with a smaller diameter pulley is used on V-8 engines with altitude compensation. The major components of the air pump are enclosed in a die-cast aluminum housing. A filter fan assembly, rotor shaft and drive hub are visible on the pump exterior (fig. 4A-3).



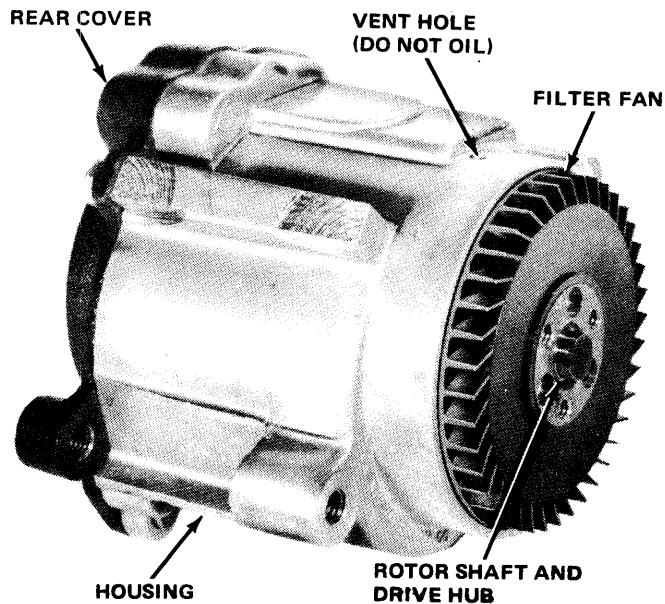
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Fig. 4A-2 Air-Guard System—V-8



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Fig. 4A-1 Air-Guard System—Six-Cylinder



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Fig. 4A-3 Air Pump

The pump is designed for long life and is serviceable only by replacement. It is not recommended that the rear housing cover be removed for any reason, since the internal components of the pump are not serviceable.

The aluminum housing has cavities for air intake, compression and exhaust and a bore for mounting the front bearing. The housing also includes cast metering areas that reduce the noise of intake and compression. Mounting bosses are located on the housing exterior.

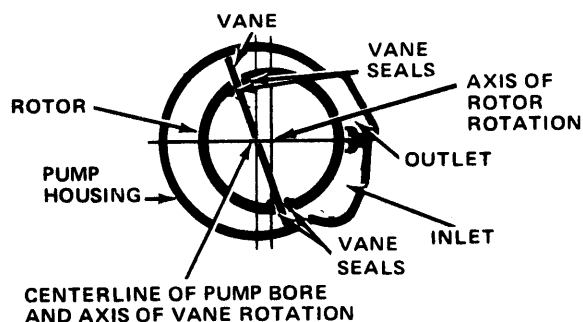
NOTE: *The relief valve assembly is incorporated in the diverter valve. If defective, the diverter valve assembly must be replaced.*

The front bearing supports the rotor shaft. The bearing is secured in position by plastic, injected around grooves in the housing and bearing outer race.

The rear cover supports the vane pivot pin, rear bearing race and exhaust tube. Dowel pins pressed into the housing correctly position the end cover which is fastened by four bolts.

The rotor positions and drives the two vanes. A stamped steel liner supports carbon shoes and shoe springs which seal the vanes and rotor. The two plastic vanes are molded to hubs which support bearings that rotate on the pivot pin. The pulley drive hub is pressed on the rotor shaft, and bolt holes in the hub provide for attachment of a pulley.

The pump vanes are located 180 degrees apart and rotate around the pivot pin which is located on the centerline of the pump housing. The rotor which drives the vanes rotates off the centerline of the pump housing (fig. 4A-4). This creates changes in the distance between the outside of the rotor and the inner wall of the pump housings during rotor rotation. As the leading vane moves past the intake opening, it is moving from a small area to a large area (defined by the rotor-to-pump housing clearance). This forms a vacuum which draws air into the pump. As the vanes and rotor continue to rotate, the trailing vane passes the intake and traps the air between the vanes. The vanes and rotor move into small area and the entrapped air begins to be compressed. The compression continues until the leading vane passes the exhaust opening where the compressed air passes out of the pump and on to the rest of the Air Guard System.



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Fig. 4A-4 Air Pump Operation

Air Pump Diagnosis

The air pump is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. Allow for normal break-in wear of the pump prior to replacement for excessive noise.

First check the drive belt tension and tighten as specified. Do not pry on the aluminum housing. Check hoses to be sure they are properly connected and are in good condition and check that the pump mounting bracket is securely fastened.

Air pump noise can be confused with other engine noise. On a noise complaint, first remove the drive belt and check the pump to make sure it is operative. A seized pump will not rotate and the noise could be caused by belt slippage.

A chirping or squeaking noise probably originates from vane rub in the housing bore and is noticeable at low speed intermittently. Vane chirping is often eliminated at increased pump speeds, or with additional wear-in time.

Bearing noise is easily distinguished from vane chirping. It is a rolling sound noticeable at all speeds. It does not necessarily indicate bearing failure. If bearing noise reaches an objectionable level at certain speeds, the pump may have to be replaced.

Failure of a rear bearing is identified by a continuous knocking noise and replacement of the pump is required.

If it is determined that the air pump is not delivering air (determine presence of airflow by removing an exhaust hose), the pump must be replaced.

NOTE: *The pump is equipped with a centrifugal fan-type air filter, located behind the drive pulley. In the event that the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the filter should be masked off to prevent liquids from entering the pump.*

Service Precautions

The following is a list of service precautions to prevent damage to the air pump. **DO NOT:**

- Attempt to prevent pulley from rotating by inserting tools into the centrifugal filter fan.
- Operate engine with pump belt removed or disconnected except for noise diagnosis.
- Attempt to lubricate.
- Clean centrifugal filter.
- Disassemble pump or remove rear cover.
- Exceed 20 foot-pounds torque on mounting bolts.
- Pry on aluminum housing to adjust belt tension.
- Clamp pump in vise.

Removal—Six-Cylinder

- (1) Disconnect air pump output hose at back of air pump.
- (2) Loosen adjustment bolt and remove drive belt.

- (3) Remove front mount bracket-to-engine attaching bolts.
- (4) Remove rear mount bracket-to-pump attaching bolts.
- (5) Loosen rear mount bracket-to-power steering attaching bolts.
- (6) Pull pump down and forward to remove.

Installation—Six-Cylinder

- (1) Position pump and install rear mount bracket-to-pump attaching bolts.
- (2) Install front mount bracket-to-engine attaching bolts.
- (3) Tighten attaching bolts to specified torque.
- (4) Adjust power steering drive belt to specified tension.
- (5) Connect air pump output hose to back of pump.
- (6) Adjust air pump drive belt to specified tension.

Removal—V-8

- (1) Disconnect air pump output hose at pump.
- (2) Loosen mount bracket-to-pump attaching screws and remove drive belt.
- (3) Remove mount bracket-to-pump attaching bolts.
- (4) Remove pump.

Installation—V-8

- (1) Position pump at mounting location and install mount bracket-to-pump attaching bolts (do not tighten).
- (2) Install drive belt and adjust to the specified tension.
- (3) Tighten mounting bolts and adjusting strap screw to 20 foot-pounds torque.

NOTE: If air pump is driven by the air conditioning belt, adjust the belt to the tension specified for the air conditioning belt. Pry only against the cast iron cover when adjusting the belt. Do not pry on the aluminum housing.

DIVERTER (BYPASS) VALVE

A diverter valve is used in all Air Guard applications. The valves for V-8 and six-cylinder engines differ only in the number of outlets. The V-8 diverter valve has two outlets and the six-cylinder diverter valve has only one. The valve momentarily diverts air pump output from reaching the exhaust during rapid deceleration and acts as a pressure release when air pump output is excessive. An internal silencer is incorporated in the diverter housing to muffle the airflow.

In a rapid deceleration condition, high intake manifold vacuum is applied to the diaphragm in the diverter. When the vacuum signal is 20 inches of mercury or more, the spring tension of the diaphragm is overcome.

This moves the metering valve down against its upper seat and away from its lower seat, forcing air pump output to vent to atmosphere (fig. 4A-5). Air pump output is diverted only momentarily because of a bleed hole in the diaphragm. This hole allows vacuum to quickly equalize on both sides of the diaphragm and the diaphragm spring returns the metering valve to its normal position.

If the air pump develops excessive output pressure, this pressure will overcome the diaphragm spring tension, pushing the metering valve down and venting pump output pressure to the atmosphere. When pump output pressure returns to normal, the metering valve will move up and away from the upper seat and against the lower seat, returning to its normal open position, allowing air pump pressure to flow to the exhaust manifold(s).

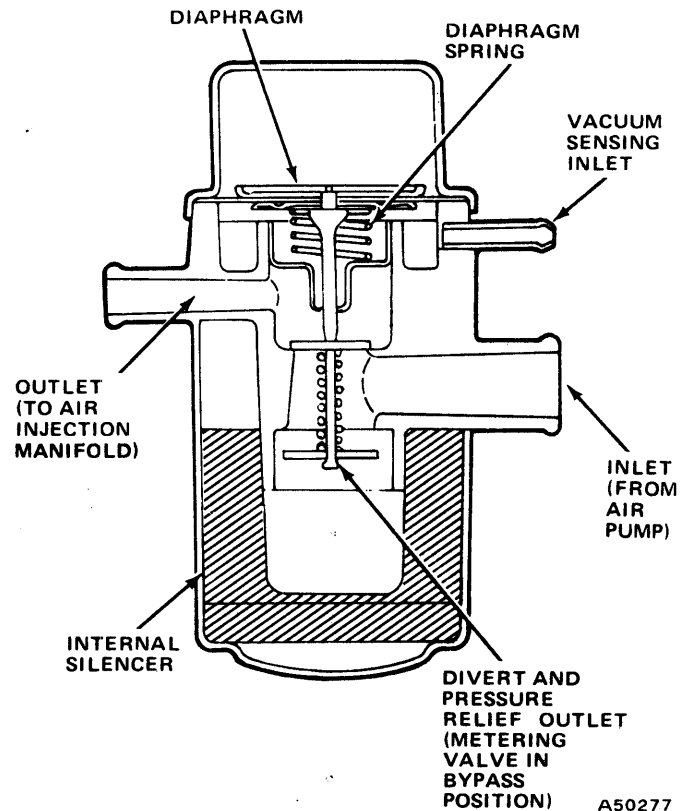


Fig. 4A-5 Diverter Valve

Diverter Test

- (1) Start engine and let idle.
- (2) Check diverter vents. Little or no air should flow from vents.
- (3) Accelerate engine to 2000 to 3000 rpm and rapidly close throttle. A strong flow of air should pass from the diverter vents for approximately 5 seconds. The high-flow diverter used on some engines should vent for approximately 3 seconds. If air does not flow or if back-fire occurs, make certain vacuum sensing line has vacuum and is not leaking.

NOTE: The diverter valve diverts air pump output when 20 inches of Hg or more is applied at vacuum sensing line or pump output exceeds 5 psi (8 psi on some models).

(4) Slowly accelerate engine. Between 2500 and 3500 rpm, air should begin to flow from diverter vents.

Diverter Replacement

The diverter valve is not serviceable and must be replaced if defective. The valve is attached to a bracket or suspended by the hoses between the air pump and air injection manifold(s) (fig. 4A-1 and 4A-2). Removal involves disconnecting the hoses and the vacuum sensing line and bracket clamp, if equipped. Installation involves reconnecting the hoses and vacuum line and attaching the bracket clamp, if equipped.

AIR INJECTION MANIFOLDS

The air injection manifold(s) are constructed of cold rolled steel with a zinc plating and distribute air from the pump to the exhaust ports.

A check valve, incorporating a stainless steel spring plunger and an asbestos seat, is integral with the air injection manifold. Its function is to prevent the reverse flow of exhaust gases to the pump during pump failure or diverter valve bypass operation. Reverse flow would damage the air pump and connecting hoses.

The distribution tubes of the air injection manifold are connected directly to the exhaust manifolds. The hollow attaching screws conduct airflow into the exhaust manifolds. Air distribution tubes are used for all cylinders except No. 7 on V-8 engines.

Removal—Six-Cylinder

- (1) Disconnect air delivery hose at check valve.
- (2) Remove injection screws from each cylinder exhaust port.

NOTE: Some resistance to removal may be encountered due to carbon build-up on screws.

- (3) Remove air injection manifold.

Installation—Six-Cylinder

(1) Assemble air injection manifold and screws to exhaust manifold. Tighten screws to 20 foot-pounds torque.

- (2) Connect air delivery hose to check valve.

Removal—V-8

- (1) Disconnect air delivery hose at check valve.
- (2) Remove injection screws.

NOTE: Some interference to removal may be encountered due to carbon buildup on the screws.

- (3) Remove air injection manifold.
- (4) Remove sealing gaskets from air injection manifold.

Installation—V-8

- (1) Install air injection manifold using a replacement sealing gasket at either side of each opening.
- (2) Install screws to exhaust manifold. Tighten screws to 38 foot-pounds torque.
- (3) Connect air delivery hose.

Check Valve Test

To check the air injection manifold valve for proper operation, disconnect the air supply hose at the injection manifold. With the engine running above idle speed, listen and feel for exhaust leakage at the check valve. A slight leak is normal.

ENGINE MODIFICATIONS

The design of certain engine components is directly related to emission standards. The operation of such items as the camshaft, carburetor, ignition distributor and cylinder head affects the amount of emissions.

Therefore, the correct combination of engine components, as prescribed by government certification, must be used in service. Refer to the appropriate sections of this manual for servicing these components.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

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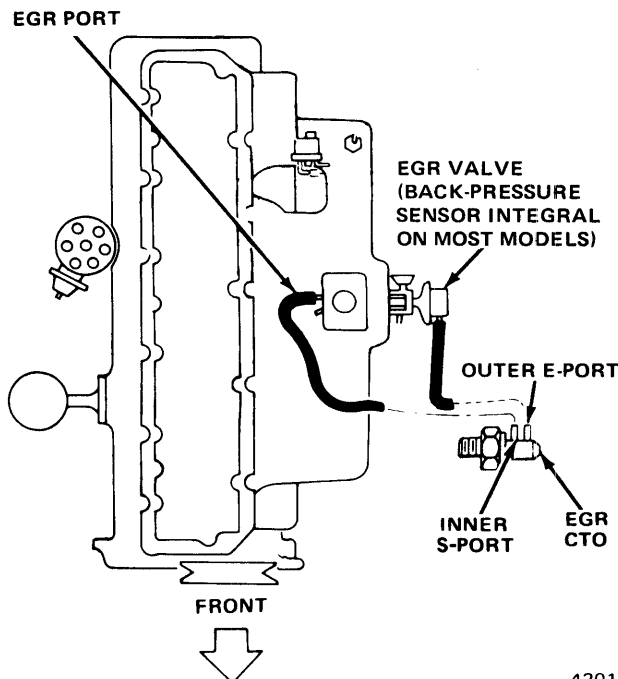
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GENERAL

The EGR (Exhaust Gas Recirculation) system used on all Jeeps reduces the formation of oxides of nitrogen (NOx) by introducing a metered amount of exhaust gas into the combustion chambers. Exhaust gas is inert, will not burn, and therefore combustion temperatures are reduced. Fewer oxides of nitrogen are produced at lower combustion temperatures.

Jeep vehicles for 1977 use three different types of EGR systems (fig. 4A-6, 4A-7 and 4A-8). The EGR system **with no back-pressure sensor** is used on all 49-state Cherokee, Wagoneer and Truck models. The EGR system **with integral back-pressure sensor** is used on all California Cherokee, Wagoneer and Truck models and all CJ models except California 304 V-8 with manual transmission. The EGR system **with external, non-integral back-pressure sensor** is used on California CJ models with 304 V-8 and manual transmission.

The EGR CTO switch prevents EGR action until engine temperature reaches a preset level, and the back-pressure sensor permits EGR action only at increased engine loads, improving driveability.



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Fig. 4A-6 EGR System—Six-Cylinder—Typical

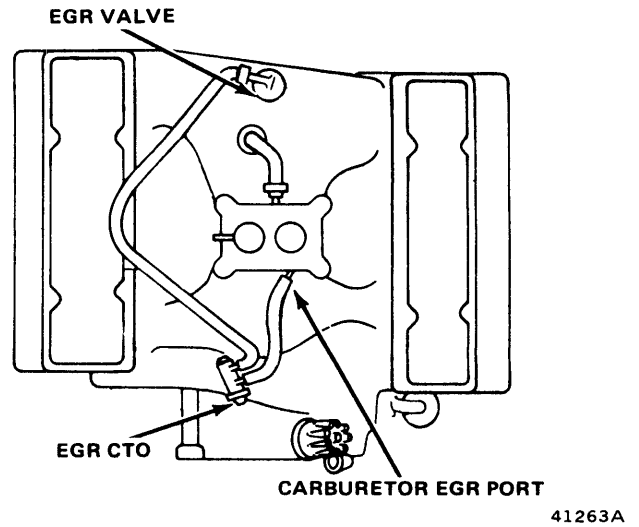


Fig. 4A-7 EGR System—V-8—Typical

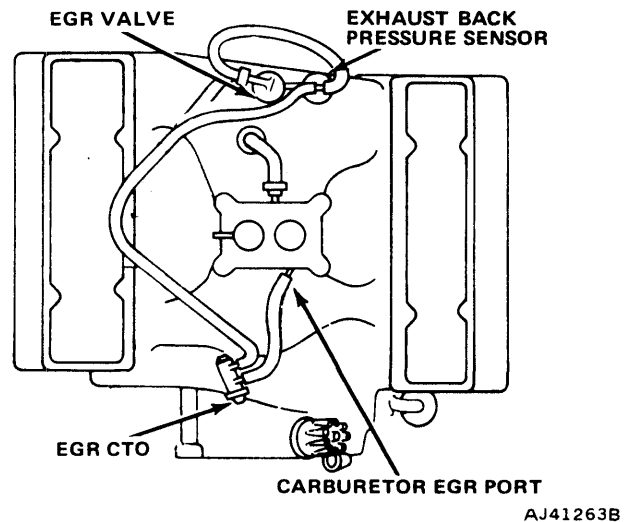


Fig. 4A-8 EGR System—V-8—California CJ 304 Manual Transmission

EGR VALVE

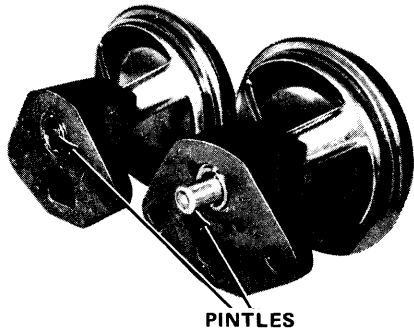
The EGR valve mounts on a machined surface at the rear of the intake manifold on V-8 engines and on the side of the intake manifold on six-cylinder engines. When the separate back-pressure sensor is used, the EGR valve mounts on the spacer which is an integral

part of the back-pressure sensor. Exhaust gas is drawn from the exhaust crossover passage in V-8 engines, from an area near the heat riser in six-cylinder engines.

EGR Valve without Integral Back-Pressure Sensor

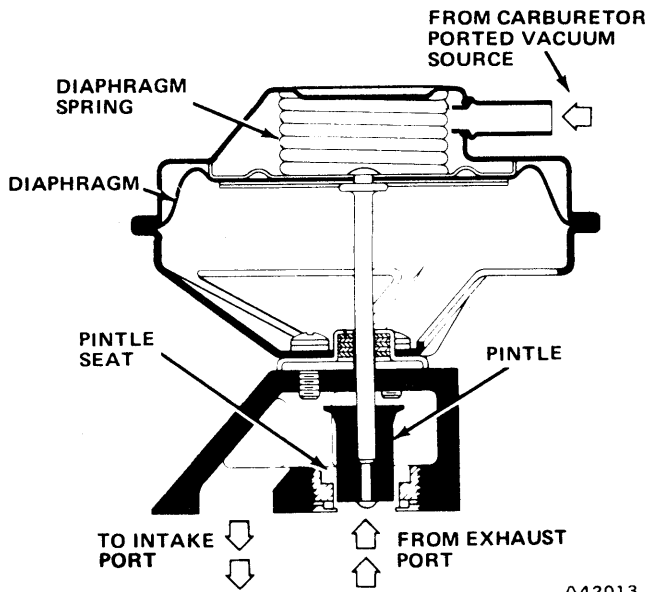
EGR valves are calibrated by the use of differently shaped pintles (fig. 4A-9). The valve is normally held closed by a spring located above the diaphragm (fig. 4A-10). The valve opens when sufficient vacuum is applied through hoses connecting the CTO switch and the back-pressure sensor (if used) to the EGR vacuum port at the carburetor.

When vacuum overcomes the diaphragm spring pressure, a pintle within the valve is lifted off its seat and exhaust gas, which reaches the EGR valve through special passages, is metered into the intake manifold.



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Fig. 4A-9 EGR Valve Pintles



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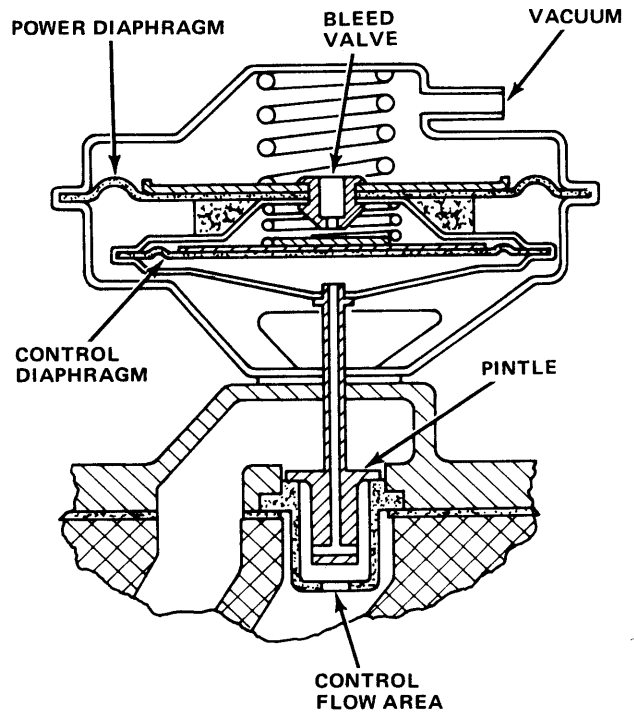
Fig. 4A-10 EGR Valve without Back-Pressure Sensor

EGR Valve with Integral Back-Pressure Sensor

Calibration is accomplished by the selective use of

different diaphragm spring loads and flow control orifices. The unit combines the functions of the EGR valve and back-pressure transducer into a single component. **A restrictor plate is not required.**

Refer to figure 4A-11. The flow (recirculation) of exhaust gas is controlled by a movable pintle. In the relaxed position, spring pressure holds the pintle against its seat, confining exhaust gases to the exhaust manifold. Carburetor vacuum is available at the power diaphragm to pull the pintle from its seat. This cannot happen while the vacuum bleed valve in the power diaphragm is open.



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Fig. 4A-11 EGR Valve with Integral Back-Pressure Sensor

Exhaust gas exerts pressure (back-pressure) inside the exhaust manifold whenever the engine is running. This pressure is conducted through the hollow pintle stem into the control diaphragm chamber. If this pressure is great enough to overcome control spring pressure, the control diaphragm is moved against the bleed valve. Full vacuum is now applied to the power diaphragm and the pintle moves. EGR now begins. If back-pressure drops sufficiently, the control diaphragm moves away from the bleed valve. The power diaphragm again relaxes and EGR stops.

System pressure remains constant, within the range of the unit. Recirculation is a function of the exhaust manifold back-pressure level. EGR is dependent on back-pressure and is a fixed percentage of the incoming charge.

EGR Valve Test

Valve Opening Test

With engine at operating temperature and curb idle, rapidly open and close throttle. Throttle should be opened sufficiently for engine to reach 1500 rpm. A definite movement should be noticed in the EGR diaphragm.

If the diaphragm does not move, the probable causes are: faulty vacuum signal to EGR, defective EGR diaphragm or defective back-pressure sensor diaphragm, if equipped. Check vacuum lines for leaks.

Valve Closing Test

With the engine at operating temperature and curb idle, manually depress the EGR valve diaphragm. This should cause an immediate engine speed drop, indicating that the EGR valve had been properly cutting off the flow of exhaust gas at idle.

If there is no change in engine rpm and the engine is idling properly, exhaust gases do not reach the combustion chamber. The probable difficulty is a plugged passage between the EGR valve and the intake manifold.

If the engine idles poorly and rpm is not greatly affected by compressing the EGR diaphragm, the EGR valve is not closing off the flow of exhaust gases. There is a fault in the hoses, hose routings or the valve itself.

EGR Valve Replacement

Removal

- (1) On V-8 engines, remove air cleaner assembly.
- (2) Disconnect vacuum hoses.
- (3) Remove two retaining bolts from manifold.
- (4) Remove EGR valve, gasket, spacer and attached exhaust back-pressure sensor assembly (if used), restrictor plate and its gaskets (if used).
- (5) Clean EGR pintle if required (refer to EGR Valve Maintenance).
- (6) Discard used gaskets and clean all mating surfaces.

Installation

- (1) Install restrictor plate (if used) between two gaskets and install spacer (if used), EGR gasket, and EGR valve.
- (2) Install retaining bolts and tighten to 13 foot-pounds torque.
- (3) Connect vacuum lines and install air cleaner assembly (if removed).

NOTE: *The non-integral exhaust back-pressure assembly, if used, should extend toward the left side on V-8 engines. The stainless steel restrictor plate is calibrated*

for the engine and exhaust system found on that vehicle. Always replace the same restrictor plate originally installed.

EGR Valve Maintenance—Cherokee-Wagoneer-Truck

Remove all lead or carbon deposits from the stainless steel metering pintle of the valve using a wire brush. After cleaning, depress the diaphragm, cap the vacuum inlet, and repeatedly open the EGR valve manually by pressing down on the diaphragm and releasing. Pintle should remain retracted; if it does not, diaphragm has a leak and valve must be replaced.

On six-cylinder engines, lead or carbon deposits will build most rapidly in the exhaust gas discharge passage (upper hole). If the deposits cannot be removed with a spiral-type wire brush, a 9/16-inch drill may be used. Coat the tip of the drill with heavy grease and use pliers (Vise-Grip) to rotate the bit in the discharge passage.

EGR CTO SWITCH

The EGR CTO switch is located at the coolant passage of the intake manifold adjacent to the oil filler tube on V-8 engines, and at the left side of the cylinder block on six-cylinder engines. The inner port (S) connects by hose to the EGR port at the carburetor, the outer port (E) connects to the exhaust back-pressure sensor, when the vehicle is so equipped, or to the EGR valve.

When coolant temperature is below the rating of the CTO switch there is no vacuum signal to the EGR system. The EGR CTO switch on the Jeep CJ models opens at 115°F and has a black body or a black paint dab. All other Jeep models have an 160°F CTO switch with a yellow body or yellow paint dab.

EGR CTO Test

NOTE: *Engine coolant temperature must be below 100°F.*

- (1) Check vacuum lines for leaks and correct routings (fig. 4A-6, 4A-7 and 4A-8).
- (2) Disconnect vacuum line at back-pressure sensor (if equipped) or at the EGR valve, and connect line to a vacuum gauge.
- (3) Operate engine at 1500 rpm. No vacuum should be indicated on gauge. If vacuum is indicated, replace EGR CTO switch.
- (4) Idle engine until coolant temperature exceeds 115°F (black color code) or 160°F (yellow color code). The temperature gauge needle is about halfway between the cold mark and the beginning of the band at 115°F and about at the beginning of the band at 160°F.
- (5) Accelerate engine to 1500 rpm; carburetor ported vacuum should be indicated on vacuum gauge. If not, replace EGR CTO switch.

EGR CTO Switch Replacement

Removal—Six-Cylinder

- (1) Drain coolant from radiator.
- (2) Disconnect vacuum lines.
- (3) Using 7/8-inch open-end wrench, remove switch from block.

WARNING: Serious burns can result if hot coolant is not drained before removing switch from block.

Installation—Six-Cylinder

- (1) Install EGR CTO switch in block.
- (2) Connect vacuum lines.
- (3) Install coolant and purge air from cooling system.

Removal—V-8 Engine

- (1) Drain coolant from radiator.
- (2) Remove air cleaner assembly.
- (3) Remove coil bracket attaching screw and tip coil away from EGR CTO switch.
- (4) Disconnect vacuum hoses from CTO switch.
- (5) Using 7/8-inch open-end wrench, remove switch from intake manifold.

WARNING: Serious burns can result if hot coolant is not drained before removing switch from intake manifold.

Installation—V-8 Engine

- (1) Install EGR CTO switch in intake manifold.
- (2) Install coil and bracket with attaching screw.
- (3) Connect vacuum hose to switch.
- (4) Install air cleaner assembly.
- (5) Install coolant and purge cooling system of air.

EXHAUST BACK-PRESSURE SENSOR—NON-INTEGRAL

A non-integral exhaust back pressure sensor is used on California Jeep CJ models with V-8 engine and manual transmission. This device monitors exhaust back-pressure and permits EGR operation only when engine operating conditions are favorable for EGR action with a given engine/exhaust combination. Back-pressure sensors are variously calibrated, are not serviceable, and must be replaced when necessary with the same part number.

The exhaust back-pressure sensor consists of a diaphragm valve and a spacer connected by a metal tube which projects into an exhaust port in the spacer body (fig. 4A-12). The EGR valve mounts directly on the spacer.

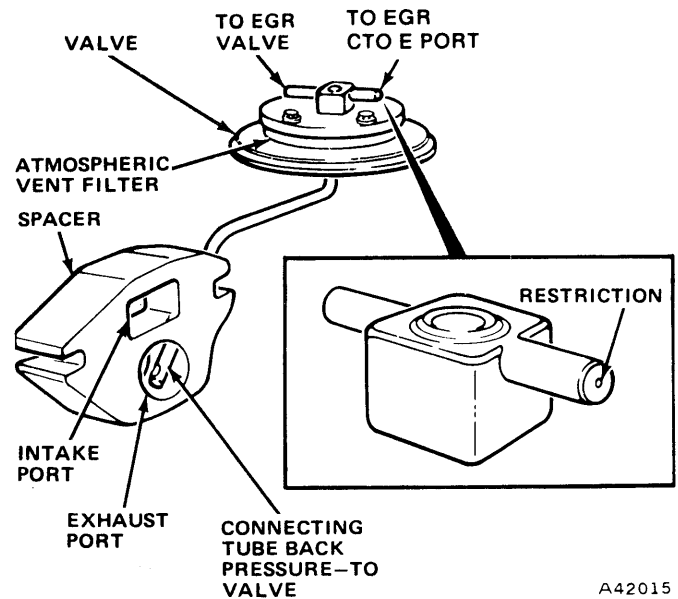


Fig. 4A-12 Non-Integral Exhaust Back-Pressure Sensor

The metal tube connecting the diaphragm valve to the spacer picks up exhaust back-pressure from the exhaust port into which it projects. When the back-pressure reaches the calibrated level of the sensor the diaphragm valve spring pressure is overcome, permitting a vacuum signal to the EGR valve when the coolant temperature override (CTO) switch is open. Refer to EGR CTO Switch in this section.

This system permits EGR operation only when the engine has warmed up sufficiently and when exhaust pressure is relatively high, as in acceleration and at some cruising speeds. When back-pressure has not reached calibrated levels, or if the CTO switch has not opened, the carburetor vacuum signal vents to the atmosphere from a vent at the diaphragm valve.

Removal

- (1) Remove vacuum lines from exhaust back-pressure sensor valve and EGR valve.
- (2) Remove two attaching nuts from EGR valve.
- (3) Remove EGR valve and exhaust back-pressure sensor assembly.
- (4) Clean all mating surfaces and intake manifold and back-pressure sensor ports.

Installation

- (1) Install replacement gasket on intake manifold and position exhaust back-pressure sensor on top of gasket.

NOTE: Exhaust back-pressure sensor assembly should extend toward the left side on V-8 engines.

- (2) Install replacement gasket on exhaust back-pressure sensor spacer and install EGR valve.
- (3) Install support bracket to valve portion of sensor and tighten screws.

(4) Install two attaching nuts and tighten to 13 foot-pounds torque.

(5) Attach vacuum lines to exhaust back-pressure sensor valve and EGR valve.

NOTE: Vacuum line from CTO switch must be connected to nipple with 0.030-inch restriction.

Non-Integral Exhaust Back-Pressure Sensor Test

(1) Inspect all EGR vacuum lines for leaks and correct routing.

(2) Install a tee in vacuum line between EGR valve and exhaust back-pressure sensor.

(3) Attach a vacuum gauge to tee.

(4) Start engine and allow to idle. No vacuum should be indicated.

NOTE: If vacuum is indicated at idle speed, verify correct line connections. Be sure manifold vacuum is not being used as a source. If carburetor is providing ported vacuum, inspect for partially open throttle plate, which could apply premature ported vacuum to back-pressure sensor.

(5) Accelerate engine to 2000 rpm and observe vacuum gauge for the following:

- If coolant temperature is below 115°F, no vacuum should be indicated.
- If coolant temperature is above 115°F (black CTO switch) or 160°F (yellow CTO switch), ported vacuum should be indicated.
- If no vacuum was indicated during test, be sure vacuum is being applied to inlet side of back-pressure sensor. Then remove back-pressure sensor and inspect spacer port and tube for restrictions. Restrictions caused by carbon or lead deposits can be removed with spiral wire brush. Otherwise, replace back-pressure sensor.

RESTRICTOR PLATES

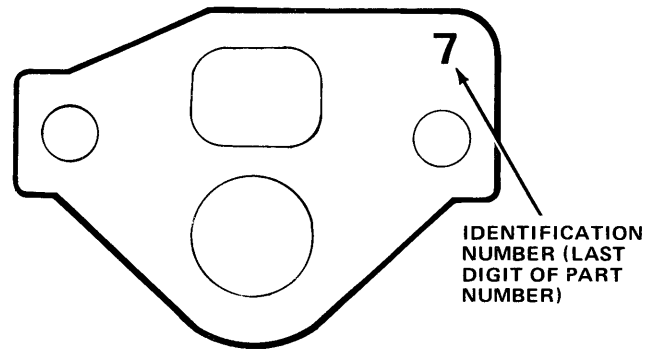
NOTE: Restrictor plates are used only on vehicles equipped with the non-integral back-pressure sensor.

The restrictor plate (fig. 4A-13) is located between the exhaust back-pressure sensor spacer and the intake manifold, mounted between gaskets. The stainless steel restrictor plate is calibrated for a particular engine/exhaust system and should never be altered or replaced with a restrictor plate of different calibration.

EGR DELAY VALVE

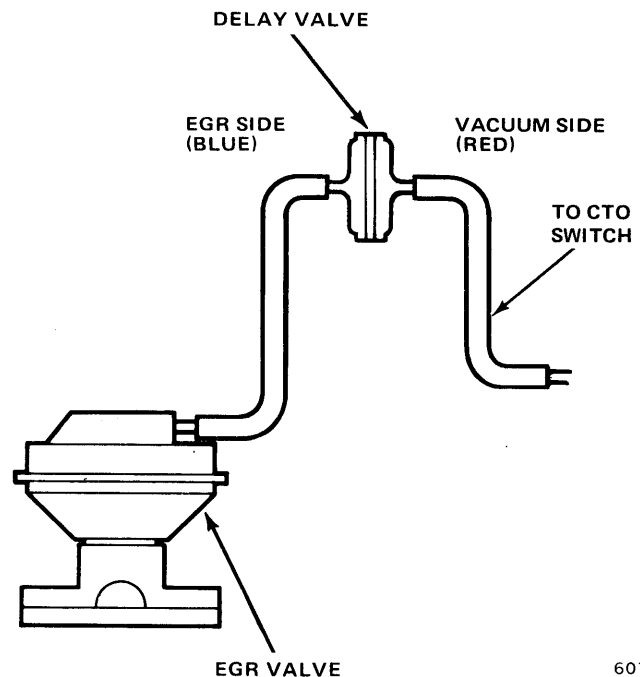
An EGR delay valve is used on 49-state models equipped with 360 and 401 CID engines and 4V carburetor. The delay valve is installed between the EGR valve and CTO switch (fig. 4A-14) and delays the vacuum signal to the EGR valve to prevent stumble or hesitation on initial acceleration. The delay valve is color coded to pre-

vent improper installation. The red side of the valve connects to the CTO switch and the blue side connects to the EGR valve.



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Fig. 4A-13 Restrictor Plate



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Fig. 4A-14 EGR Delay Valve

Delay Valve Test

(1) Install a tee in vacuum line between red side of delay valve and vacuum source.

(2) Attach vacuum gauge to tee.

(3) Start engine and, while observing EGR valve operation, increase rpm until 3 to 10 inches of vacuum are indicated on the gauge. It should take from 18 to 32 seconds for the vacuum signal to reach the EGR valve.

(4) Replace delay valve if delay is longer than 32 or less than 18 seconds.

(5) While maintaining a 3- to 10-inch vacuum, disconnect CTO switch line from delay valve. EGR valve should close (seat) within 0.5 second or less. If valve does not seat within this time, replace delay valve.

CATALYTIC CONVERTER

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Converter Operation	4A-16
Catalyst Replacement Procedure	4A-16

	Page
General	4A-16

GENERAL

All V-8 CJ models, all altitude CJ models, all California Jeep models Cherokee, Wagoneer and Truck models have a catalytic converter. Leaded fuel poisons the catalytic converter, although use of a few gallons of leaded fuel in an emergency does not seriously impair the converter.

All CJ models and all California Cherokee, Wagoneer and Truck models are fitted with a fuel filler neck restrictor (refer to Fuel—Carburetion section) which admits only the smaller nozzles used for unleaded fuel.

Most models use a single pellet-filled canister-type converter. California V-8 models use a monolithic-type converter.

CONVERTER TYPES

The **pellet-type converter** contains beads of alumina coated with platinum and palladium catalyzing agents. Thousands of pellets are contained in a stainless steel canister. A plug is provided in the converter to permit replacement of the pellets should they become poisoned.

The **monolithic converter** uses extruded substrates resembling a honeycomb. Each substrate is coated with a mixture of palladium and platinum. The substrates are mounted end-to-end in a stainless steel cylinder and are retained by wire mesh and mounting rings. The catalyst is not serviceable.

CONVERTER OPERATION

All exhaust gases flow through the catalytic converter where a chemical change takes place which reduces carbon monoxide and hydrocarbons to harmless carbon dioxide and water. The catalysts which produce this action are platinum and palladium.

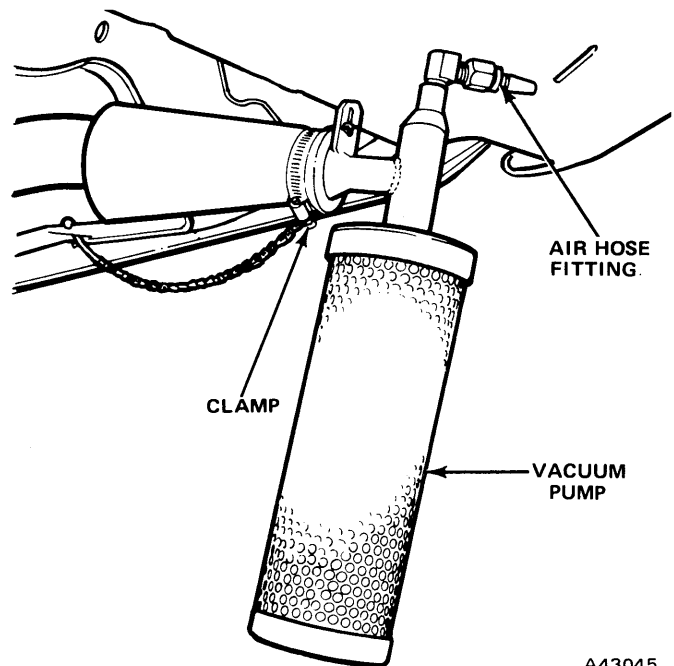
The temperature of the converter during this chemical reaction is somewhat higher than that of exhaust gases as they leave the engine. Due to its mass, the catalytic converter stays hot much longer than the muffler.

The catalytic converter body is stainless steel and is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat is not the fault of the converter. The vehicle has a carburetor, ignition or Air-Guard problem permitting unburned fuel to enter the converter, producing excessive heat. If a converter is heat damaged, the cause of

damage should be corrected at the same time the converter is replaced, and all other components of the exhaust system should also be checked for heat damage.

CATALYST REPLACEMENT PROCEDURE—PELLET-TYPE

- (1) Raise vehicle.
- (2) Place vacuum pump hose on exhaust pipe and tighten clamp (fig. 4A-15).



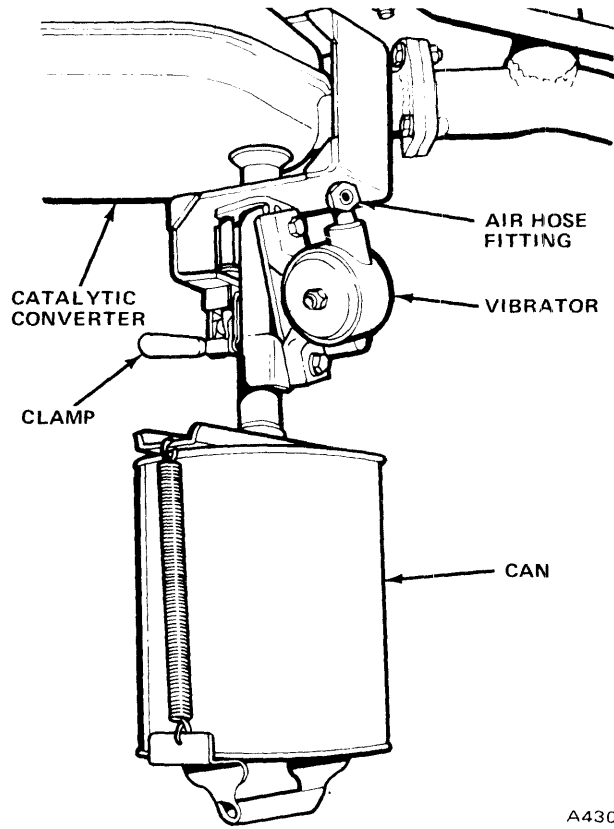
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Fig. 4A-15 Vacuum Pump

- (3) Connect shop air (80 psi minimum) to fitting on vacuum pump.
- (4) Remove plug from bottom of converter.

NOTE: It may be necessary to apply heat directly to the plug to ease removal.

- (5) Position vibrator on converter and lock in place (fig. 4A-16).
- (6) Remove shop air hose from vacuum pump.
- (7) Connect shop air hose to fitting on vibrator. Catalyst beads will fall into can for approximately 10 minutes.



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Fig. 4A-16 Vibrator Tool

- (8) When converter is empty, disconnect shop air hose, remove can, and discard beads.
- (9) Install refill bead can on vibrator.
- (10) Connect shop air hose to vacuum pump and vibrator. Beads will be drawn up and packed into place.
- (11) When converter is full, remove shop air hose from vibrator and remove vibrator from converter.

NOTE: Replace plug if damaged during removal. Coat threads of plug with a nickel-based anti-seize compound before installation.

- (12) Install plug on bottom of converter and tighten to 40 foot-pounds torque.
- (13) Disconnect shop air from vacuum pump and remove vacuum pump.
- (14) Lower vehicle.

FUEL TANK VAPOR EMISSION CONTROL SYSTEM

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Fuel Tank Filler Cap	4A-17
Fuel Vapor Storage Canister	4A-18

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Maintenance	4A-19
Rollover Check Valve	4A-18

GENERAL

A closed fuel tank vent system is used on all CJ models and California Cherokee, Wagoneer, and Truck models. This system routes raw fuel vapor into the intake system where it is burned along with the fuel-air mixture, preventing fuel vapors from entering the atmosphere (fig. 4A-17). Other vehicles do not have vent lines since they do not use a closed vent system.

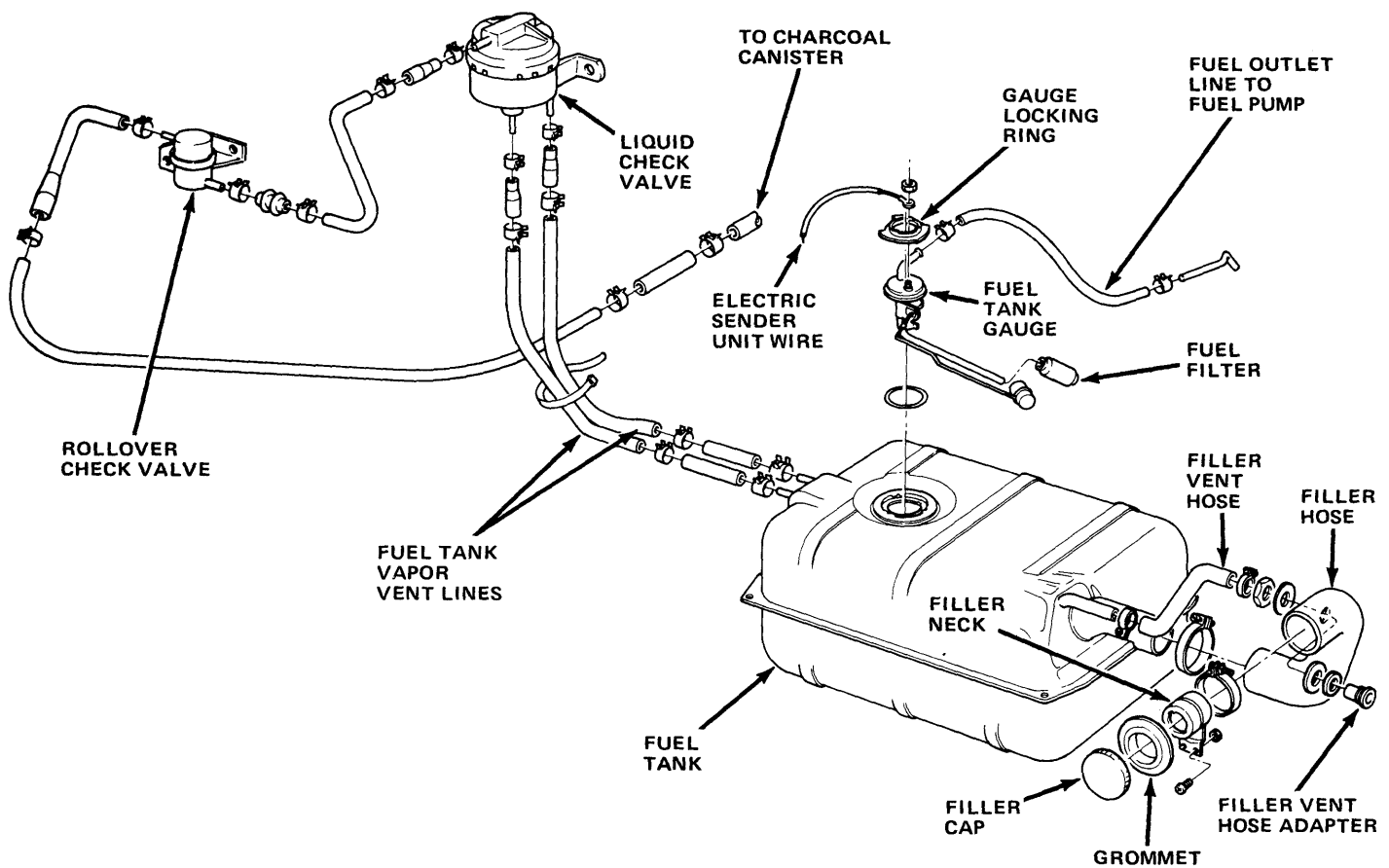
FUEL TANK FILTER

All vehicles use a woven Saran sleeve-type fuel filter which is attached to the end of the fuel outlet tube inside the fuel tank. This filter is rated at 65 micron and repels

water. Under normal conditions it requires no maintenance or service.

FUEL TANK FILLER CAP

The filler cap on California Cherokee, Wagoneer, and Truck models and all CJ models incorporates a two-way relief valve which is closed to atmosphere under normal operating conditions. The relief valve is calibrated to open only when a pressure of 0.75 to 1.5 psi or a vacuum of 15 to 25 inches of water occurs within the tank. When the pressure or vacuum is relieved, the valve returns to the normally closed position. The cap is identified by a black relief valve housing.



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Fig. 4A-17 Fuel Tank Vapor Emission System (Typical)

NOTE: It is normal to occasionally encounter an air pressure release when removing the filler cap.

All other 49-state vehicles use an externally vented cap.

LIQUID CHECK VALVE

The liquid check valve incorporates a float and Viton needle assembly. In the event that liquid fuel enters the check valve, the float will rise and force the needle upward to close the vent passage, preventing liquid fuel from flowing through the valve (fig. 4A-18).

After passing through the check valve, the fuel vapor is routed through a vent line to the vapor storage canister in the engine compartment.

ROLLOVER CHECK VALVE

CJ models have a rollover check valve located in the vapor vent line (fig. 4A-17 and 4A-19). This valve serves to close the vapor line in the event of a vehicle rollover, preventing the possibility of a fuel-fed fire.

FUEL VAPOR STORAGE CANISTER

The fuel-resistant nylon body of the canister contains activated charcoal granules which absorb and store the

fuel tank vapors until they are drawn into the intake manifold through the carburetor air cleaner (fig. 4A-20).

All canisters have three nipple connections, although one connection is plugged when used with the 2V V-8 engine which does not require a connection to the carburetor float bowl.

In all other applications, the canister has connections for the fuel tank vapor line, the carburetor float bowl and to a tube at the underside of the air cleaner snorkel.

The tube at the snorkel projects into the incoming airstream, creating a vacuum that draws fuel vapor from the canister. The amount of vapor drawn is relative to air velocity passing through the air cleaner snorkel. The canister on six-cylinder engines and V-8 engines with 4V carburetors has three hose connections: one for the fuel tank vapor line, one for the carburetor float bowl, and one hose connected to a tube at the underside of the air cleaner snorkel.

Outside air is drawn into the canister through a replaceable filter pad which is accessible through the bottom of the canister body. The filter pad should be replaced at the recommended mileage intervals listed in the Mechanical Maintenance Schedule.

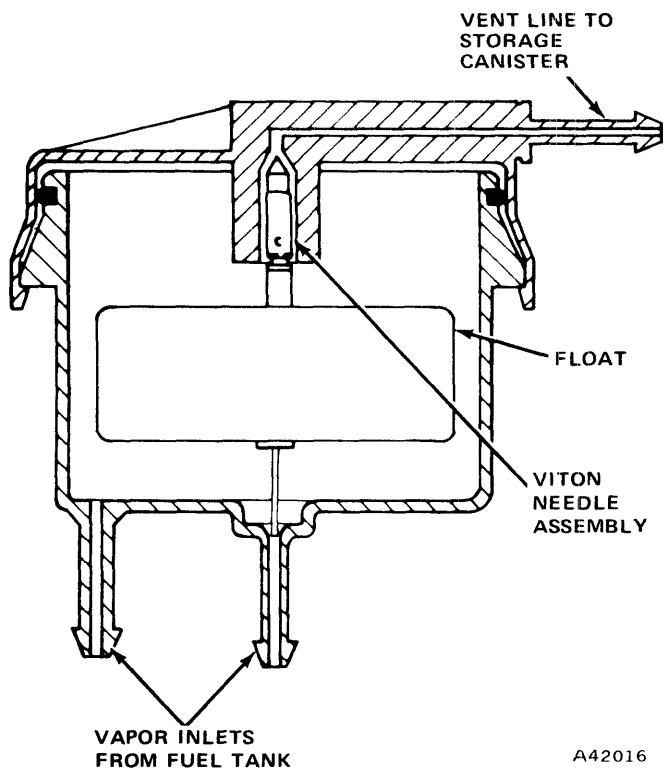


Fig. 4A-18 Liquid Check Valve (Typical)

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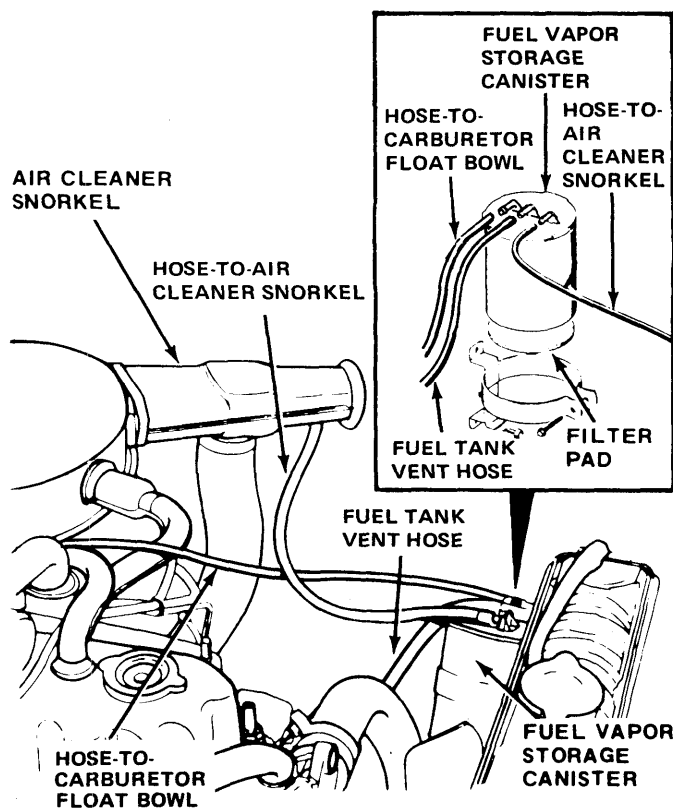


Fig. 4A-20 Fuel Vapor Storage Canister—Six-Cylinder Shown

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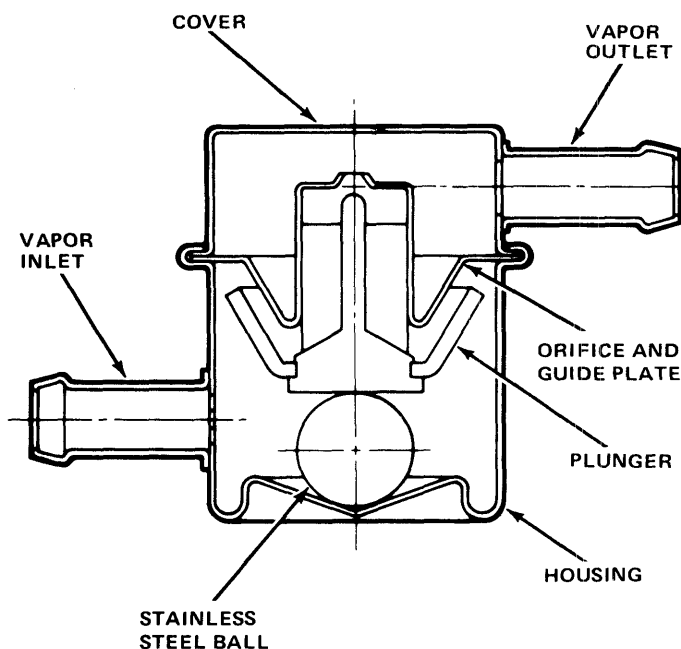


Fig. 4A-19 Rollover Check Valve

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MAINTENANCE

The fuel tank, filler cap, fuel lines, and vent lines must be maintained in good condition to prevent raw fuel vapors (hydrocarbons) from entering the atmosphere.

Inspect the filler cap for evidence of fuel leakage (stains) at the filler neck opening. Remove the cap and check the condition of the sealing gasket. Replace the filler cap if the gasket is damaged or deteriorated.

Inspect the fuel tank for evidence of fuel leakage (stains). Trace any stain back to its origin and repair or replace the tank as required.

Inspect the fuel and vent lines for leakage or damage, repair or replace as required. Be sure all connections are tight.

If liquid fuel is present at the fuel vapor storage canister, inspect the liquid check valve and replace if necessary.

The filter pad located at the bottom of the canister is the only serviceable item of the canister assembly. For service intervals, refer to the Mechanical Maintenance Schedule located in Section B of this manual.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

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PCV Air Inlet Filter	4A-21

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PCV Valve Flow Chart	4A-21
PCV Valve Test	4A-21

GENERAL

This system incorporates a calibrated airflow PCV valve connected between an intake manifold vacuum source and the engine. Crankcase vapors are drawn through the PCV valve into the intake manifold where they are burned along with the fuel-air mixture (fig. 4A-21). The oil filler cap is closed in this system to prevent any crankcase vapors from entering the atmosphere.

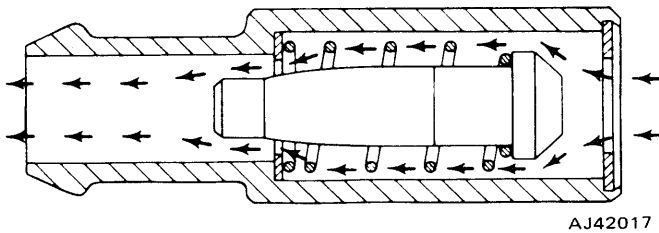


Fig. 4A-21 Positive Crankcase Ventilation Valve Flow

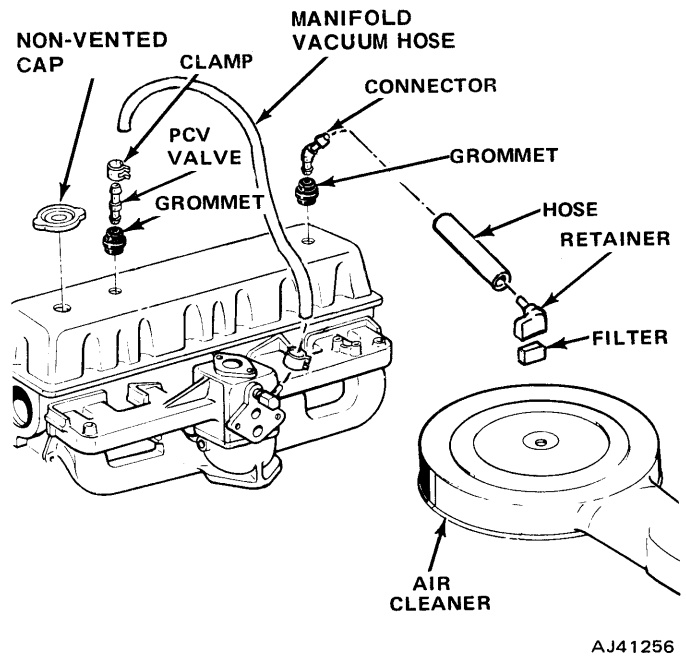


Fig. 4A-22 PCV System—Six-Cylinder

During periods of relatively high manifold vacuum, such as idle or cruise speeds, outside air is drawn from the air cleaner into the crankcase. On six-cylinder engines, the air passes through a polyurethane foam filter located in the air cleaner (fig. 4A-22). On V-8 engines, the air passes through a polyurethane foam filter located in the oil filler cap. The filler cap is connected by a hose to the air cleaner (fig. 4A-23).

If crankcase vapor pressures (blowby) exceed the flow capacity of the PCV valve, airflow in the system will reverse. Crankcase vapors are drawn through the air cleaner element and carburetor and burned along with the fuel-air mixture.

The positive crankcase ventilation system performs two functions:

- Prevents combustion blowby from entering the atmosphere.
- Ventilates the crankcase with clean air to help prevent the formation of sludge.

Positive Crankcase Ventilation (PCV) Valve

Two PCV valves with different flow rates (cfm) are used. The black valve is used on all V-8 engines and the silver valve is used on all six-cylinder engines.

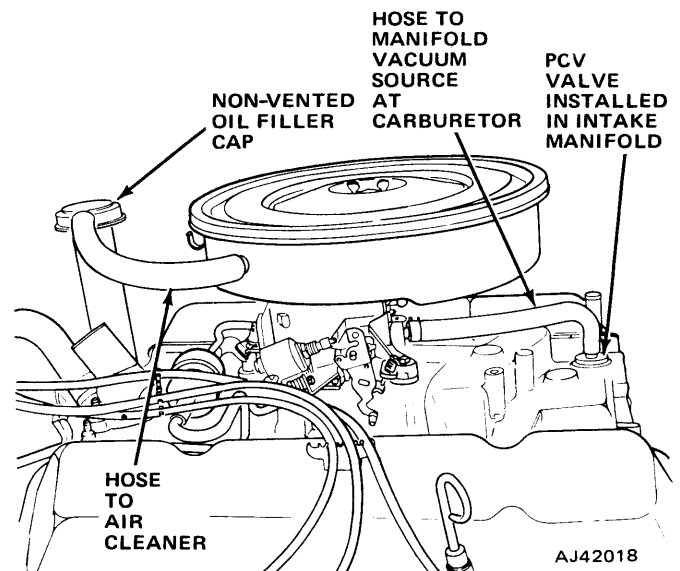


Fig. 4A-23 PCV System—V-8

The PCV valve must be replaced at the intervals specified in the Mechanical Maintenance Schedule. All hoses in the PCV system should be inspected at this time for leaks or restrictions and cleaned or replaced as required. PCV valve replacement may be required more often under adverse operating conditions.

PCV VALVE TEST

The valve may be tested at idle speed for correct flow rate (cfm) providing the engine manifold vacuum is at least 14 inches Hg. When checking vacuum, connect the gauge to a fitting which is as centrally located as possible on the intake manifold.

Remove the valve from the grommet in the intake manifold (V-8) or cylinder head cover (six-cylinder) and connect the plastic hose of PCV Valve Tester J-23111 to the valve (fig. 4A-24).

NOTE: The PCV valve must be held in a horizontal position and tapped lightly during the test. Hold the tester in a vertical position.

Start the engine and allow it to idle and observe the flow rate (cfm). Refer to PCV Valve Flow Chart. At low vacuum readings, it may be necessary to load the engine while checking flow rate.

A valve which flows above or below specification must be replaced. The correct PCV valve should be used for replacement.

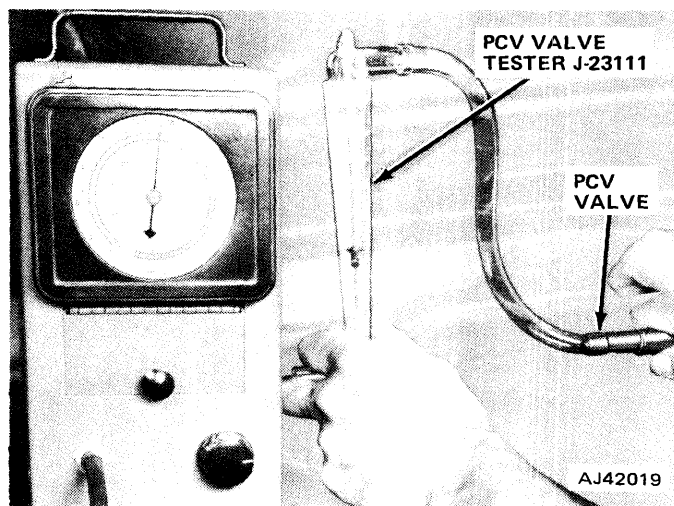


Fig. 4A-24 PCV Valve Test

PCV Valve Flow

ENGINE MANIFOLD VACUUM (In. Hg.)	AIR FLOW (CFM)	
	BLACK VALVE	SILVER VALVE
17	—	1.3 – 1.7
16	1.35 – 1.65	—
13	—	1.3 – 1.7
7	2.7 – 3.8	—
5	—	1.3 – 1.7
3	3.3 – 4.4	—

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PCV AIR INLET FILTER MAINTENANCE

Six-Cylinder

A polyurethane foam PCV air inlet filter is located in a filter retainer in the air cleaner. The retainer must be rotated to remove it from the air cleaner (fig. 4A-25). The filter must be cleaned in kerosene at the mileage intervals recommended in the Mechanical Maintenance Schedule. After cleaning, the filter should be lightly oiled with clean engine oil.

V-8

A polyurethane foam PCV air inlet filter is located in the sealed oil filler cap. To clean the filter, apply light air pressure in reverse direction of normal flow; that is, through the filler tube opening of the cap. Lightly oil the filter with clean engine oil. If the filter is deteriorated, the filler cap must be replaced.

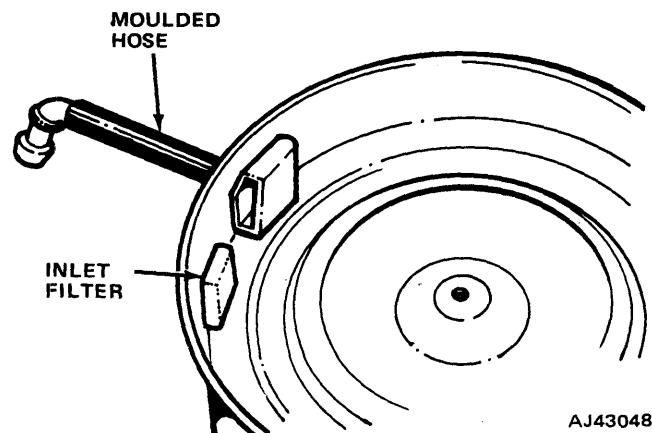


Fig. 4A-25 PCV Air Inlet Filter—Six-Cylinder

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC) SYSTEM

SIX-CYLINDER ENGINE

This system consists of a two-piece heat shroud positioned on the exhaust manifold, a hot air hose, and an

air duct and valve assembly which is located in the air cleaner snorkel (fig. 4A-26).

The air duct and valve assembly incorporates an air valve, a thermostat unit, and a spring.

The temperature of the air entering the air cleaner is thermostatically controlled by the air duct and valve assembly. Air from the engine compartment, or heated air from the shrouded exhaust manifold is supplied to the engine.

The thermostat unit in the air duct is exposed to incoming air. The spring-loaded air valve is connected to the thermostat unit through linkage. The spring holds the air valve in the closed position (heat on) until the thermostat unit overcomes the spring tension.

During the engine warmup period when the air temperature entering the air duct is less than 105°F (90°F on 258 2V), the thermostat is in the retracted position and the air valve is held in the closed position (heat on) by the spring, thus shutting off the air from the engine compartment. Air is then drawn from the shroud at the exhaust manifold.

As the temperature of the air passing the thermostat unit rises, the thermostat starts to open and pulls the air valve down. This allows cooler air from the engine compartment to enter the air cleaner. When the temperature of the air reaches 130°F, the air valve is in the open position (heat off) so that only engine compartment air is allowed to enter the air cleaner.

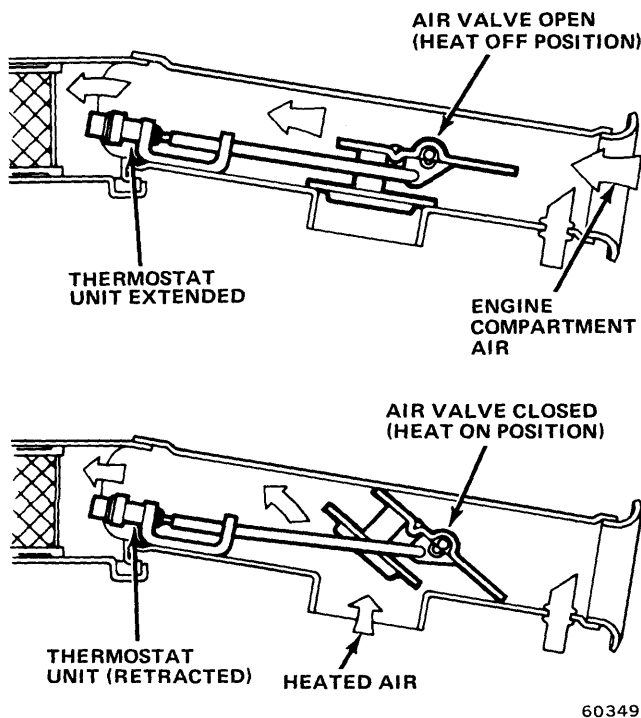


Fig. 4A-26 TAC System—Six-Cylinder

TAC Operational Test—Six-Cylinder

- (1) Remove air cleaner top half and hold snorkel in cold water, making certain thermostat unit is covered.
- (2) Place a thermometer in water and observe the temperature while slowly turning on hot water.

NOTE: With water temperature at 105°F (90°F on 258 2V) or less, air valve must be in closed (heat on) position.

(3) Heat water until temperature reaches 130°F; air valve must be in fully open (heat off) position.

NOTE: If air valve does not open and close at temperatures specified, check valve mechanism for a binding condition or a disconnected or defective spring. If valve mechanism is in satisfactory condition, thermostat unit is defective and air cleaner assembly must be replaced.

V-8 ENGINE

This system consists of a heat shroud which is integral with the right-hand exhaust manifold, a hot air hose, a special air cleaner assembly (equipped with a thermal sensor), and a vacuum motor and air valve assembly.

The thermal sensor incorporates an air bleed valve which regulates the amount of vacuum applied to the vacuum motor, thereby controlling the air valve position to supply either heated air from the exhaust manifold or air from the engine compartment (fig. 4A-27).

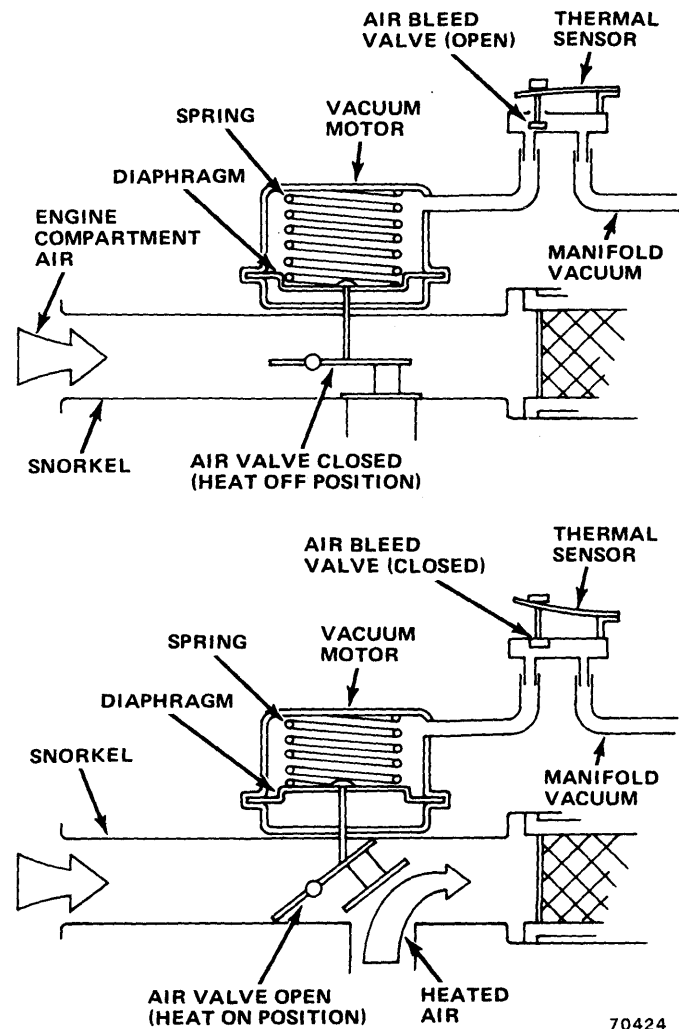


Fig. 4A-27 TAC System—V-8

During the warmup period when underhood air temperatures are low, the air bleed valve is closed and sufficient vacuum is applied to the vacuum motor to hold the air valve in the closed (heat on) position.

As the temperature of the air entering the air cleaner approaches approximately 115°F, the air bleed valve opens to decrease the amount of vacuum applied to the vacuum motor. The diaphragm spring in the vacuum motor then moves the air valve into the open (heat off) position, allowing only underhood air to enter the air cleaner.

The air valve in the air cleaner snorkel will also open, regardless of air temperature, during rapid acceleration to obtain maximum airflow through the air cleaner.

TAC Operational Test—V-8

(1) Remove air cleaner assembly from engine and allow to cool at room temperature

(2) After cooling, sight through air cleaner snorkel to observe position of air valve. It should be fully open to outside air.

(3) Install air cleaner assembly to engine and connect hot air tube and manifold vacuum hose.

(4) Start engine and observe position of air valve, it should be fully closed to outside air.

(5) Move the throttle lever rapidly to approximately 1/2 to 3/4 opening and release. Air valve should open and then close again.

(6) Allow engine to warm to operating temperature and observe position of air valve. It should be fully open to outside air.

If air valve does not close at room temperature with vacuum applied, check for a mechanical bind in the snorkel, disconnected vacuum motor linkage, or vacuum leaks in hoses or connections at the vacuum motor, thermal sensor and intake manifold.

If air valve mechanism is operating freely and no vacuum leaks are detected, connect a hose from an intake manifold vacuum source directly to vacuum motor.

If air valve now closes, thermal sensor is defective and must be replaced.

If air valve does not close, vacuum motor is defective and must be replaced.

VACUUM THROTTLE MODULATING SYSTEM (VTM)

This system is designed to reduce the emission of hydrocarbons (HC) during rapid throttle closure at high speeds. It is not used on CJ models, but is used on some 49-State and all California Cherokee, Wagoneer, and Truck models with V-8 engine.

The system consists of a deceleration valve located at the right front side of the intake manifold and a throttle modulating diaphragm located at the carburetor base. The deceleration valve is connected by one hose to a manifold vacuum source and by another hose to the throttle modulating diaphragm (fig. 4A-28).

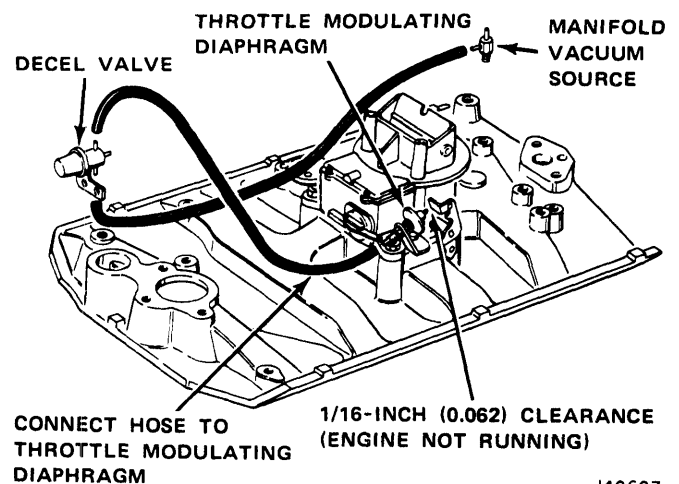
During high speed deceleration, when manifold vacuum reaches approximately 21 to 22 inches, the deceleration valve triggers a vacuum signal to the throttle modulating diaphragm and causes a plunger to move out and open the throttle slightly. The increased throttle opening allows more air to enter the combustion chambers and lean out the overrich mixture, thereby reducing the emission of the hydrocarbons.

The deceleration valve calibration is preset at time of manufacture and normally does not require adjustment. To check and adjust the throttle modulating diaphragm, proceed as follows:

(1) With engine not running and curb idle speed previously set, position throttle lever against curb idle adjusting screw.

(2) Measure clearance between the throttle modulating diaphragm plunger and the throttle lever. It should be 1/16 inch (0.062 inch).

(3) Adjust by loosening the jamnut and turning the diaphragm assembly.



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Fig. 4A-28 Vacuum Throttle Modulating System—Typical

TRANSMISSION CONTROLLED SPARK (TCS) SYSTEM

General	Page 4A-24
Solenoid Control Switch	Page 4A-25
Solenoid Vacuum Valve	Page 4A-24

Spark Coolant Temperature Override Switch	Page 4A-26
TCS Test	Page 4A-25

GENERAL

The purpose of this system is to reduce the emission of oxides of nitrogen by lowering the peak combustion temperature during the power stroke. The system incorporates a solenoid vacuum valve, a solenoid control switch, and related wiring and vacuum lines (fig. 4A-29 and 4A-30). This system is used on California CJ V-8 models, California CJ six-cylinder models with automatic transmission and altitude CJ models with automatic transmission.

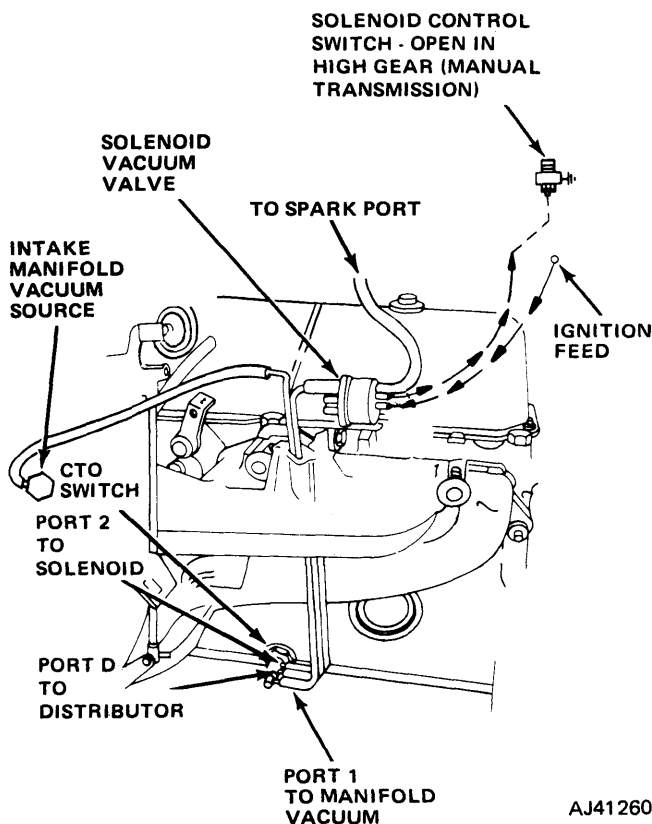


Fig. 4A-29 TCS System—Six-Cylinder

SOLENOID VACUUM VALVE

This valve is attached to the intake manifold at the rear right side of the intake manifold (V-8 engines) or to

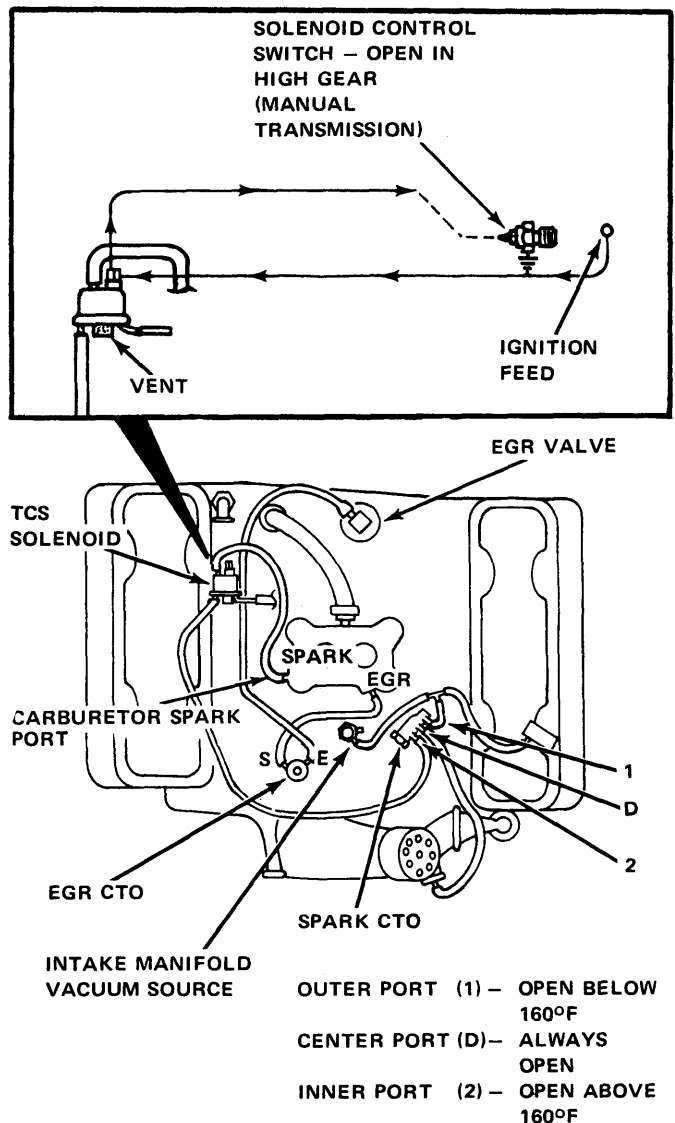


Fig. 4A-30 TCS System—V-8

a bracket at the rear of the intake manifold (six-cylinder engines). When the valve is energized (ground circuit complete), carburetor ported vacuum is blocked and the distributor vacuum line is vented to atmosphere through a port in the valve, resulting in no vacuum

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advance. When the valve is de-energized (ground circuit open), ported vacuum is applied to the distributor resulting in normal vacuum advance.

SOLENOID CONTROL SWITCH

This switch opens or closes according to gear selection (manual transmission) or road speed (automatic transmission). In manual transmissions, the solenoid control switch is closed in neutral and in all gears except high gear. Vacuum advance is possible only when the transmission is in high gear. The switch on automatic transmission-equipped vehicles opens at a pre-set road speed when the vehicle is accelerating and closes at a lower road speed when the vehicle is decelerating. Refer to Automatic Transmission Solenoid Switch Calibrations chart.

Automatic Transmission Solenoid Switch Calibrations

	Switch Opens With Increasing Speed	Switch Closes With Decreasing Speed
California 6 cyl and 8 cyl	34 to 38 mph	22 to 28 mph
Altitude 6 cyl	28 to 32 mph	20 to 26 mph
Altitude 8 cyl	34 to 38 mph	22 to 28 mph

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On manual transmissions, the switch is operated by the shifter shaft, which is screwed into the transmission case.

On automatic transmissions, the switch is located along the speedometer cable on the dash panel. The switch is operated by speedometer cable rpm. The cable attaches to both ends of the switch.

TCS TEST

A vacuum gauge, probe-type test lamp and a jumper wire are used to check the operation of the TCS system. The tests determine if the solenoid has a current supply, if the solenoid control switch opens and closes the solenoid ground circuit properly, and if the vacuum valve is functioning. Refer to fig. 4A-31.

Test 1—Current Supply Test

- (1) Turn ignition switch ON.
- (2) Disconnect wire connector from solenoid vacuum valve.
- (3) Connect wire lead of test lamp to ground.
- (4) Touch probe end of test lamp to each terminal of connector. Test lamp should light at terminal of orange wire. If not, ignition feed to TCS system is defective.

Test 2—Ground Circuit Test—Manual Transmission

- (1) Move gearshift lever to NEUTRAL.
- (2) Connect test lamp wire to battery positive post.

Touch probe to tan wire terminal in solenoid connector. Test lamp should light.

(3) Shift transmission to each gear except HIGH. Test lamp should remain lit.

(4) Shift transmission to HIGH gear. Test lamp should go out.

If test lamp does not light at all, perform Test 4—Solenoid Control Switch Test.

Test 3—Ground Circuit Test—Automatic Transmission

(1) Support vehicle so all four wheels are off ground.

(2) Connect test lamp wire to battery positive post.

(3) Disconnect wire connector from solenoid vacuum valve and insert probe in tan wire terminal.

(4) Start engine and put transmission in DRIVE. Observe test lamp. Note speed at which test lamp goes out (switch opens). Slowly decelerate and note speed at which test lamp goes on (switch closes).

(5) Refer to Automatic Transmission Solenoid Switch Calibrations chart.

(6) Replace switch if operation is outside operating range in chart.

(7) If test lamp does not light at all, perform Test 4—Solenoid Control Switch test.

Test 4—Solenoid Control Switch Test

Perform this test if test lamp did not light when connected to tan wire in Test 2 or Test 3.

(1) Disconnect tan wire from solenoid control switch at transmission (manual) or speedometer cable (automatic).

(2) Connect jumper wire from disconnected wire to ground.

If test lamp now lights as outlined in Test 2 or Test 3, control switch is defective.

Test 5—Solenoid Vacuum Valve Function Test

NOTE: Engine must be warm before performing this test.

(1) Place manual transmission gearshift lever in NEUTRAL and apply parking brake. Place automatic transmission in PARK.

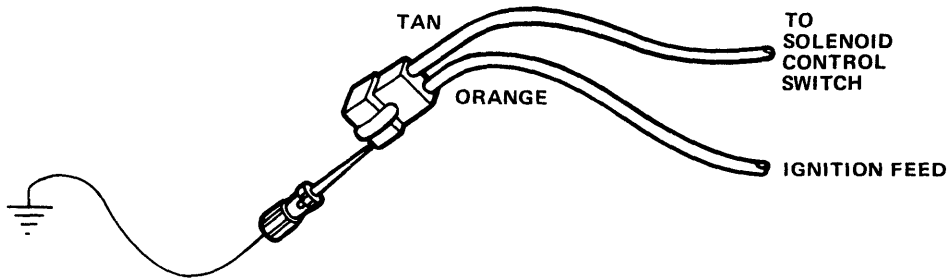
(2) Disconnect distributor vacuum advance line at solenoid valve.

(3) Install vacuum gauge to solenoid vacuum valve where distributor line was disconnected.

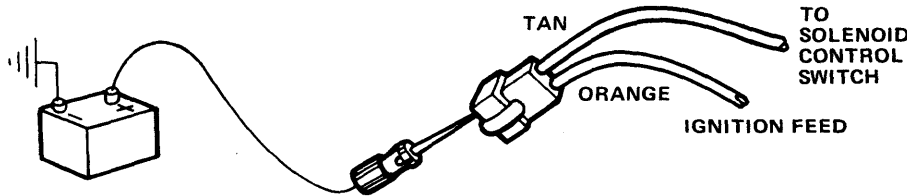
(4) Start engine and run at 1000—1500 rpm. No vacuum should be indicated.

(5) Maintain engine speed and disconnect two-wire connector from solenoid. Vacuum gauge should indicate ported vacuum. Connect and disconnect wire connector several times to verify operation.

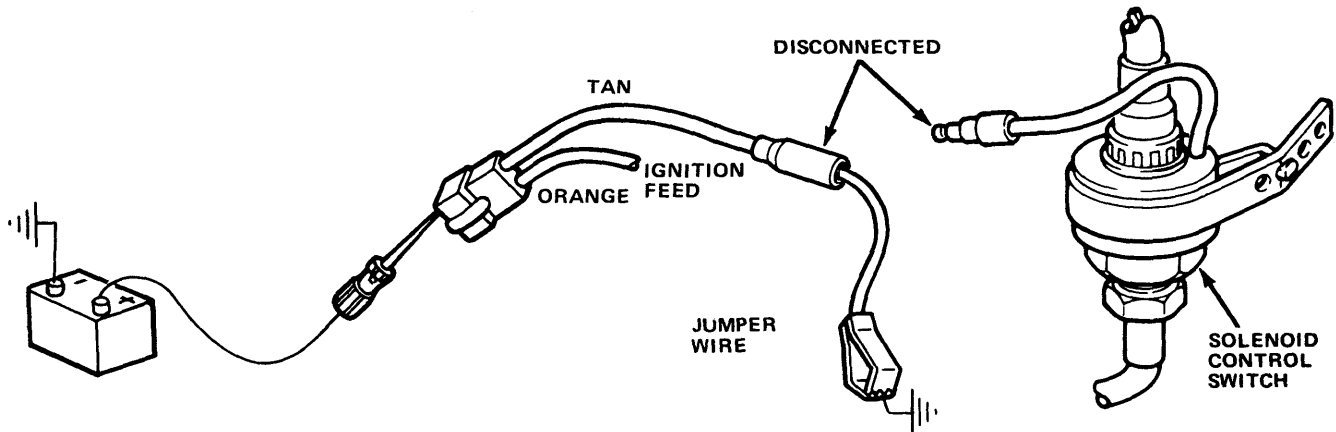
(6) Replace valve if defective. Be sure to connect vacuum lines correctly.



TEST 1 - CURRENT SUPPLY TEST



TEST 2 AND TEST 3 - GROUND CIRCUIT TEST



TEST 4 - SOLENOID CONTROL SWITCH TEST (AUTOMATIC TRANSMISSION SHOWN)

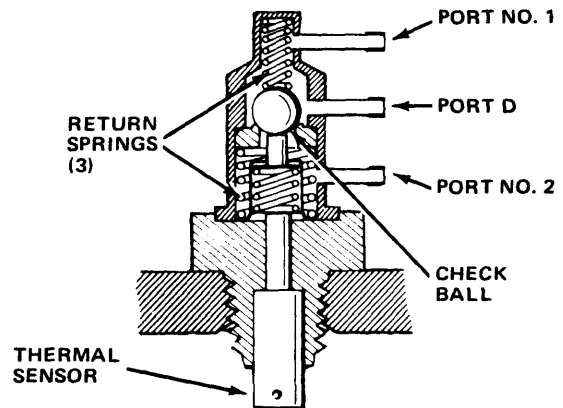
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Fig. 4A-31 TCS System Test

SPARK COOLANT TEMPERATURE OVERRIDE SWITCH (SPARK CTO)

This switch is threaded into the thermostat housing on V-8 engines and into the left rear side of the block on six-cylinder engines. Its purpose is to improve drivability during the warmup period by providing full distributor vacuum advance until the engine coolant temperature has reached 160°F. The switch incorporates a thermal unit which reacts to coolant temperatures and moves a check ball inside the switch up or down to open or close the switch ports. Either intake manifold or carburetor ported vacuum is routed to the distributor vacuum advance diaphragm (fig. 4A-32).

When the coolant temperature is below 160°F, ports No. 1 and D are open and port No. 2 is closed. When the coolant temperature reaches 160°F, port No. 1 closes and ports No. 2 and D are open.



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Fig. 4A-32 Spark CTO

Spark CTO Test

NOTE: Begin test with coolant temperature below 160°F.

- (1) Remove all vacuum lines from CTO switch. Plug those lines that will create a vacuum leak.
- (2) Connect a vacuum line from a manifold vacuum source to port No. 1 (outer) of the CTO.
- (3) Connect a vacuum gauge to port D (center) of CTO.
- (4) Start engine. Manifold vacuum should be indicated on vacuum gauge. If not, replace CTO.
- (5) With engine still running and coolant temperature **below** 160°F, disconnect vacuum line from port No. 1 (outer) of CTO and connect to port No. 2 (inner).
- (6) No manifold vacuum should be indicated on vacuum gauge. Replace CTO if vacuum is indicated.
- (7) Keep engine running until coolant temperature exceeds 160°F (approximately the beginning of the temperature gauge band). Manifold vacuum should be indicated. If not, replace CTO.
- (8) Disconnect line from port No. 2 and connect it to port No. 1. No vacuum should be indicated. If vacuum is indicated, replace CTO.
- (9) Reconnect vacuum lines to CTO.

Spark CTO Replacement

Removal—Six-Cylinder

- (1) Drain coolant from radiator.
- (2) Disconnect vacuum lines from spark CTO switch.

(3) Place a drain pan under the engine below CTO switch.

(4) Using a 7/8-inch open end wrench, remove switch from block.

WARNING: Be careful of scalding hot water leaking from block when removing the switch.

Installation—Six-Cylinder

- (1) Install switch.
- (2) Connect vacuum lines to switch.
- (3) Install coolant.

NOTE: Remove temperature gauge sending unit from head to aid in bleeding air while filling the cooling system.

Removal—V-8 Engine

- (1) Drain coolant from radiator.
- (2) Remove air cleaner assembly, coil and bracket assembly.
- (3) Disconnect vacuum lines from CTO switch.
- (4) Using a 7/8-inch open end wrench, remove switch from thermostat housing.

Installation—V-8 Engine

- (1) Install spark CTO switch in thermostat housing.
- (2) Install coil and bracket with attaching screw.
- (3) Connect vacuum lines to switch.
- (4) Install air cleaner assembly.
- (5) Install coolant.
- (6) Purge cooling system of air.

EMISSION CONTROL MAINTENANCE

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Carburetion	4A-33
Diagnosis with Scope Analyzer	4A-33
General	4A-27

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Ignition System	4A-27
Tuneup Specifications	4A-38
U.S. Emission Control Services	4A-28

GENERAL

Proper emission control depends on overall engine performance as well as special emission control systems. The following procedures cover maintenance services listed in the U. S. Emission Control Services Chart which have not been described earlier in this section.

IGNITION SYSTEM

Spark Plugs

Spark plugs should be removed and examined for burned electrodes and dirty, fouled, cracked or broken porcelains. Plugs should be replaced at mileage intervals

recommended in the U. S. Emission Control Services Chart. Plugs with lower mileage may be cleaned under some circumstances (refer to fig. 4A-33). After cleaning, the center electrode should be filed flat with a point file. The gap must be set to 0.033 to 0.037 inch (fig. 4A-34).

U.S. Emission Control Service— Cherokee-Wagoneer-Truck Models

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-up.

COMPLETE PRECISION TUNE-UP

At 15-30-45-60-75-90,000 miles

Engine Oil Filler Cap (filter type)—clean and soak in engine oil
Exhaust Gas Recirculation Valve—inspect and clean*
Exhaust Gas Recirculation Discharge Port (six-cylinder)—inspect and clean if required
Drive Belts—inspect condition and tension and correct if required
Carburetor Air Cleaner Element—replace paper cartridge, clean polyurethane element, unless plugged or damaged, then replace
Fuel Filter Element—replace
Heat Valve (exhaust manifold) — inspect and lubricate
PCV Valve—replace
PCV Filter (six-cylinder)—clean
PCV Hoses—inspect and replace if required
Coil and Spark Plug Wires—inspect and replace if required
Spark Plugs—replace
Ignition Timing—check and set if required
Distributor Advance Mechanisms—check and correct if required
Distributor Cap and Rotor—inspect and replace if required
Idle Speed and Mixture—check and reset if required
Choke Linkage—inspect for free movement (correct if required)
Fuel System: Cap, Tank, Lines and Connections—inspect for integrity and correct if required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Air-Guard System Hoses—inspect and correct if required
TAC System—inspect and correct if required
Vacuum Fittings, Hoses and Connections—inspect and correct if required

* Not applicable to California models

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Spark Plug Condition

Refer to figure 4A-33.

Gap Bridging—(A)—May be traced to flying deposits in the combustion chamber. In a few cases, fluffy deposits may accumulate on the plugs during in-town driving; when the engine is suddenly put under heavy load, this material can melt and bridge the gap.

Scavenger Deposits—(B)—Fuel scavenger deposits shown may be white or yellow. They may appear to be harmful but this is normal appearance with certain brand fuels. Such materials are designed to change the chemical nature of deposits to lessen misfire tendencies. Notice that accumulation on the ground electrode and shell areas may be unusually heavy, but the material is easily removed. Such plugs can be considered normal in condition, and can be cleaned using standard practices.

U.S. Emission Control Service—CJ Models

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-ups.

SCHEDULED ROUTINE SERVICES

At 5-15-45-75,000 miles
Drive Belts—inspect condition and tension
At 15-45-75,000 miles
Fuel Filter Element—replace

COMPLETE PRECISION TUNE-UP

At 30-60-90,000 miles
Air-Guard System Hoses—inspect and correct if required
Carburetor Air Cleaner Element—replace
Choke Linkage—inspect for free movement (correct if required)
Coil and Spark Plug Wires—inspect and replace if required
Distributor Advance Mechanisms—check and correct if required
Distributor Cap and Rotor—inspect and replace if required
Drive Belts—inspect condition and tension and correct if required*
EGR System—inspect hoses and connections
Engine Oil Filler Cap (filter type)—clean and soak in engine oil
Fuel Filter Element—replace
Fuel System: Cap, Tank, Lines and Connections—inspect for integrity and correct if required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Heat Valve (exhaust manifold)—inspect and lubricate
Idle Speed (curb and fast) and mixture—check and reset if required
Ignition Timing—check and set if required
PCV Filter (6-cylinder)—clean
PCV Hoses—inspect and replace if required
PCV Valve—replace
Spark Plugs—replace
TAC System Hoses—inspect and correct if required
Transmission Controlled Spark Systems—inspect and correct if required
Vacuum Fittings, Hoses and Connections—inspect and correct if required

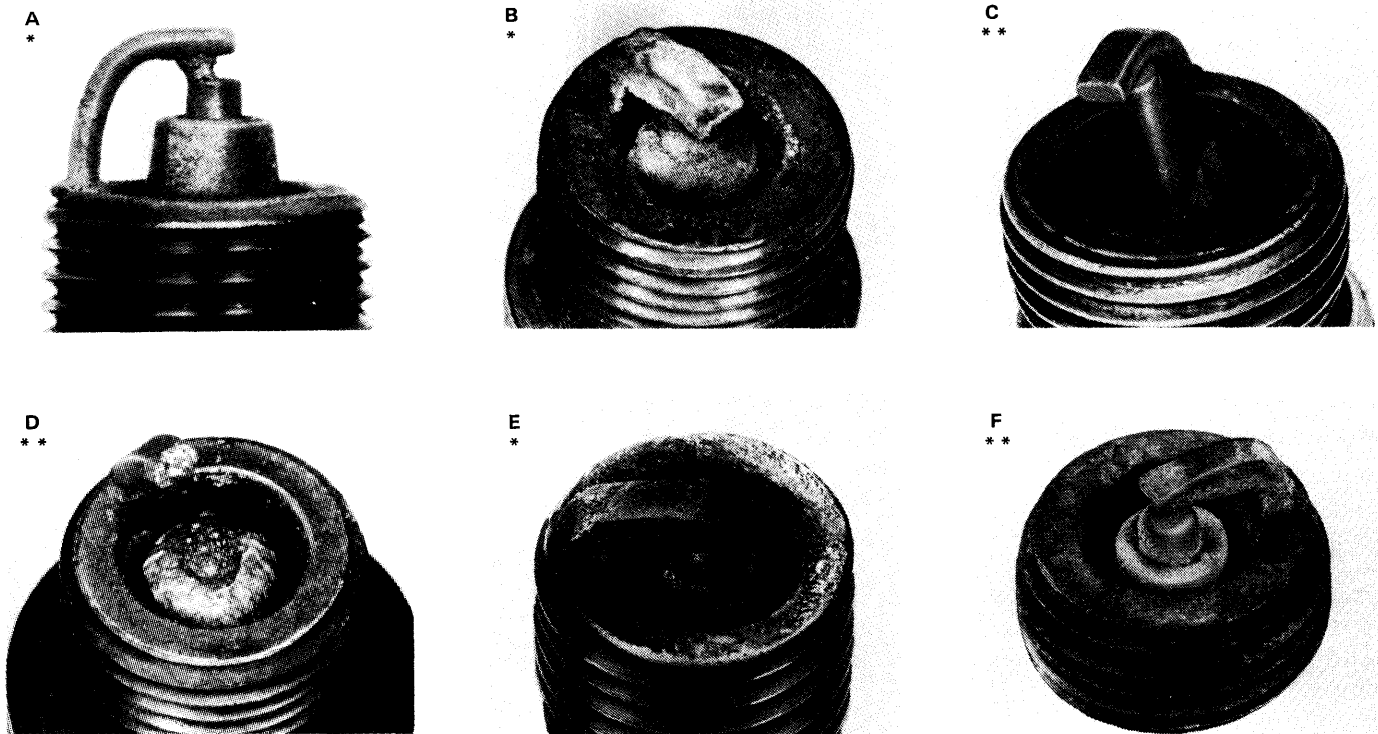
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Chipped Insulator—(C)—Usually results from bending the center electrode during regapping of the plug. Under certain conditions, severe detonation can also split insulator firing ends.

Pre-ignition Damage—(D)—Caused by excessive temperatures, produces melting of the center electrode and, somewhat later, the ground electrode. Insulators will appear relatively clean of deposits. Check for correct plug heat range, overadvanced ignition timing and similar reasons for overheating.

Cold Fouling (or Carbon Fouled)—(E)—Dry, black appearance of one or two plugs in a set. Check for sticking valves or bad ignition leads. Fouling of the entire set may be caused by a clogged air cleaner, a sticking exhaust manifold heat valve, or a faulty choke.

Overheating—(F)—Indicated by a dead white or gray insulator which appears blistered. Electrode gap wear rate will be considerably in excess of 0.001 inch per 1000 miles. This may suggest that a cooler heat range should be used; however, overadvanced ignition timing, detonation, and cooling system stoppages can also cause overheating.

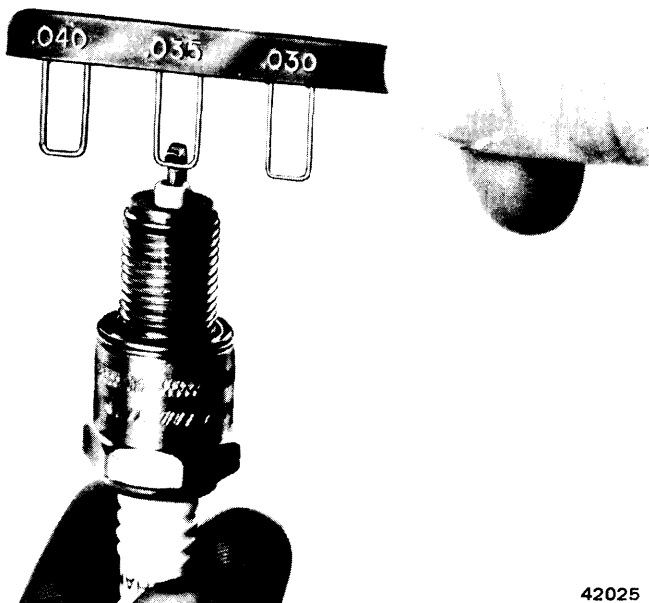


* LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED

** PLUGS WITH THIS CONDITION MUST BE REPLACED

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Fig. 4A-33 Spark Plug Conditions



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Fig. 4A-34 Spark Plug Gap Check

Spark Plug Wires

To remove wires from spark plugs, twist the boot slightly to break the seal. Grasp the rubber protector

boot and lift straight up with a steady, even pull. Do not pull on the wire itself as this will damage the wire.

To remove wires from the distributor cap or coil tower, loosen the boot first, then grasp the upper part of the boot and the wire and gently pull straight up.

Wire Test

Do not puncture the spark plug wires with a probe while performing any test. This may cause a separation in the conductor. The preferred method is to remove the suspected wire(s) and use an ohmmeter to test for resistance according to the length of the particular wire.

Resistance Values

When installing each spark plug wire or the coil high tension wire, be certain a good, tight connection is made at the spark plug, distributor cap tower, or coil tower. The protector boots at the spark plugs and distributor cap must fit tightly. A partially seated wire creates an additional gap in the circuit and the resulting spark jump will cause terminal corrosion and wire damage.

Ignition Coil

When an ignition coil is suspected of being defective, it should be checked on the vehicle. A coil may break down after it has reached operating temperature. It is

important that the coil be at operating temperature when tests are made. Perform the tests following the instructions of the test equipment manufacturer. Refer to Ignition System in Section 3—Electrical.

Resistance Values

Inches	Ohms
0 to 15	3,000 to 10,000
15 to 25	4,000 to 15,000
25 to 35	6,000 to 20,000
Over 35	8,000 to 25,000

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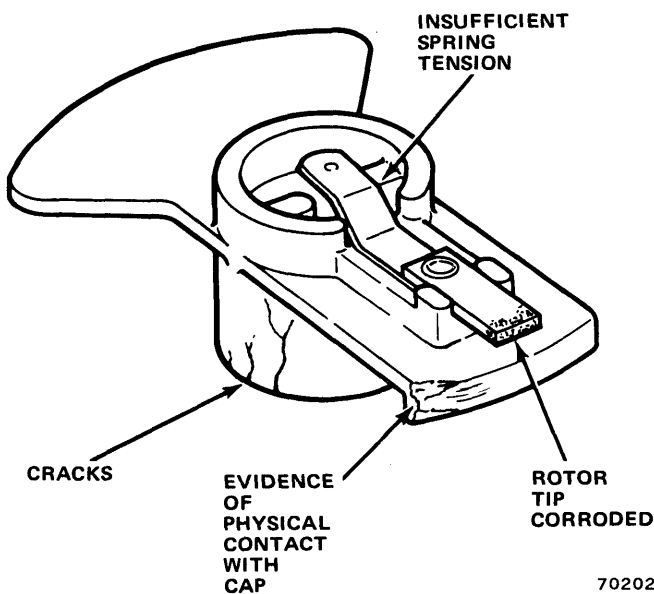
Distributor

The distributor used on all engines is the breakerless electronic type. There is no scheduled maintenance for this distributor. Refer to Section 3—Electrical for distributor service procedures.

Distributor Rotor

NOTE: Six-cylinder vehicles sold in Canada have a 5000-ohm resistance built into the rotor for additional radio noise suppression.

The rotor should be inspected visually for cracks, evidence of burning on the top of the metal strip, or evidence of mechanical interference with the cap (fig. 4A-35). If any of the above conditions are found, the rotor should be replaced. Some burning is normal on the end of the metal strip. **This should never be filed.**



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Fig. 4A-35 Rotor Inspection

Distributor Cap

The distributor cap should be removed and wiped clean with a dry rag. A visual inspection should be made for cracks, carbon runners, and corroded high tension terminals (fig. 4A-36). If any of these conditions are found, the cap should be replaced. In replacing the cap, be sure that the high tension wires are installed in the same towers from which they were removed and that they are pushed down firmly in place.

If the inserts inside the cap are excessively burned, the cap should be replaced. However the vertical face of the insert will show some evidence of burning through normal operation. The inserts should also be checked for evidence of mechanical interference with the rotor tip.

Initial Ignition Timing

A graduated degree scale located on the timing case cover is used for timing the ignition system. A milled notch on the vibration damper is used to reference the No. 1 firing position of the crankshaft with the timing marks on the scale as shown in figures 4A-37 and 4A-38.

Timing Procedure

- (1) Disconnect distributor vacuum hose.
- (2) Connect ignition timing light and properly calibrated tachometer.

NOTE: If a timing light incorporating an advance control feature is used, the control must be in the off position.

- (3) Start engine.
- (4) Adjust idle speed to 500 rpm with solenoid disconnected.
- (5) Adjust initial ignition timing to setting specified on the Tuneup Specifications (On Vehicle) Chart by loosening the distributor holddown clamp and rotating the distributor.
- (6) Verify ignition timing after tightening distributor holddown clamp.

Distributor Advance—On Tester

Distributor advance may be tested with the distributor out of the vehicle. Follow testing equipment manufacturer's instructions.

Information given in the Distributor Curves (on vehicle) charts is for on-vehicle testing. If the distributor advance is checked on a distributor tester, the information in the Distributor Curves must be converted from engine RPM to distributor RPM and from engine degrees to distributor degrees. Engine RPM must be divided by 2 to obtain distributor RPM. Engine degrees advance must be divided by 2 to obtain distributor degrees advance. For instance, if the Distributor Curve indicates 8 to 12 degrees advance at 2000 RPM, the corresponding on-tester specifications would be 4 to 6 degrees advance at 1000 RPM.

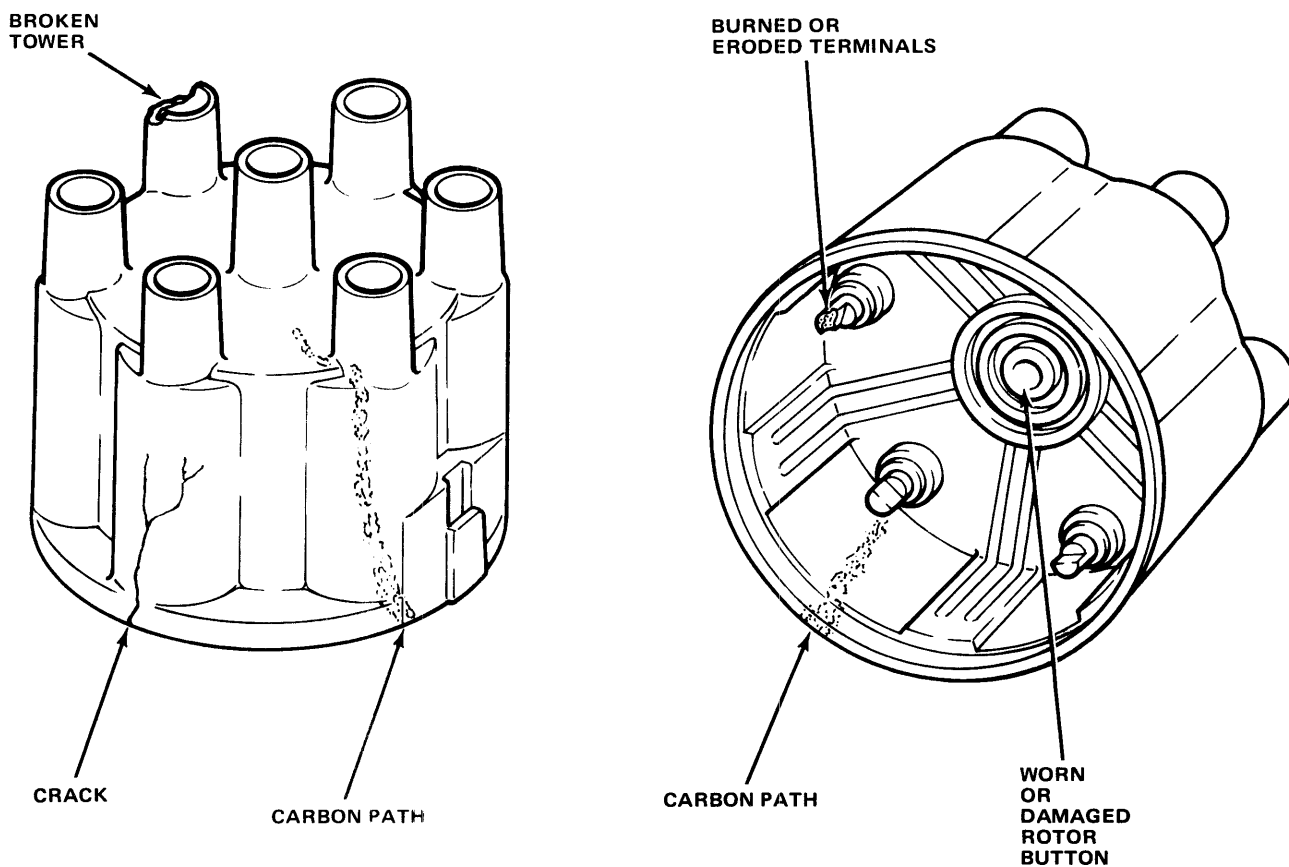


Fig. 4A-36 Distributor Cap Inspection

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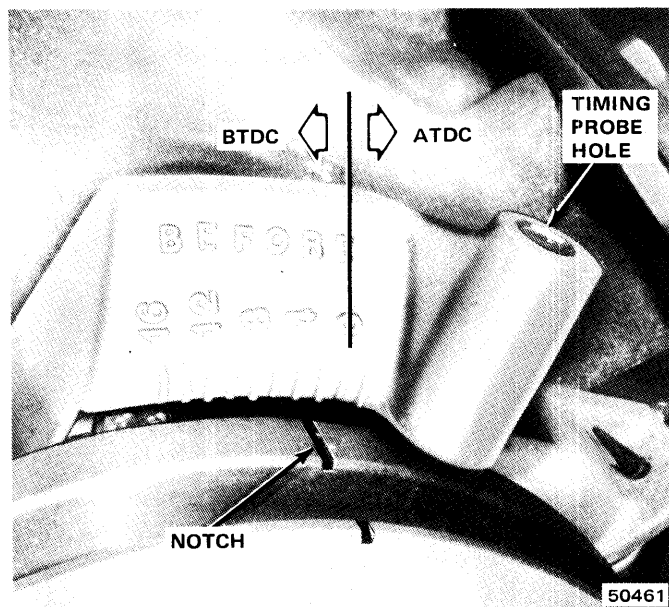


Fig. 4A-37 Timing Mark Location—Six-Cylinder

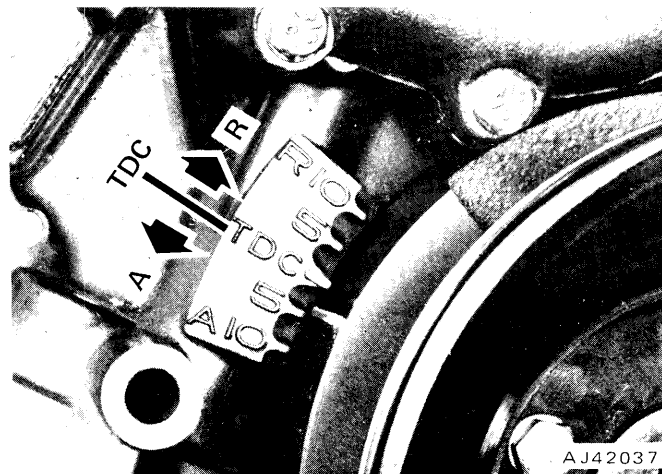


Fig. 4A-38 Timing Mark Location—V-8

Adjustable Advance Control Timing Light Procedure

(1) Disconnect the TCS solenoid vacuum valve wires.

- (2) Increase engine speed to 2000 rpm.
- (3) Turn advance control of ignition timing light until the ignition timing has returned to the initial setting.

NOTE: The degree reading on the advance meter should be as specified in the Tuneup Specification (On Vehicle) Chart.

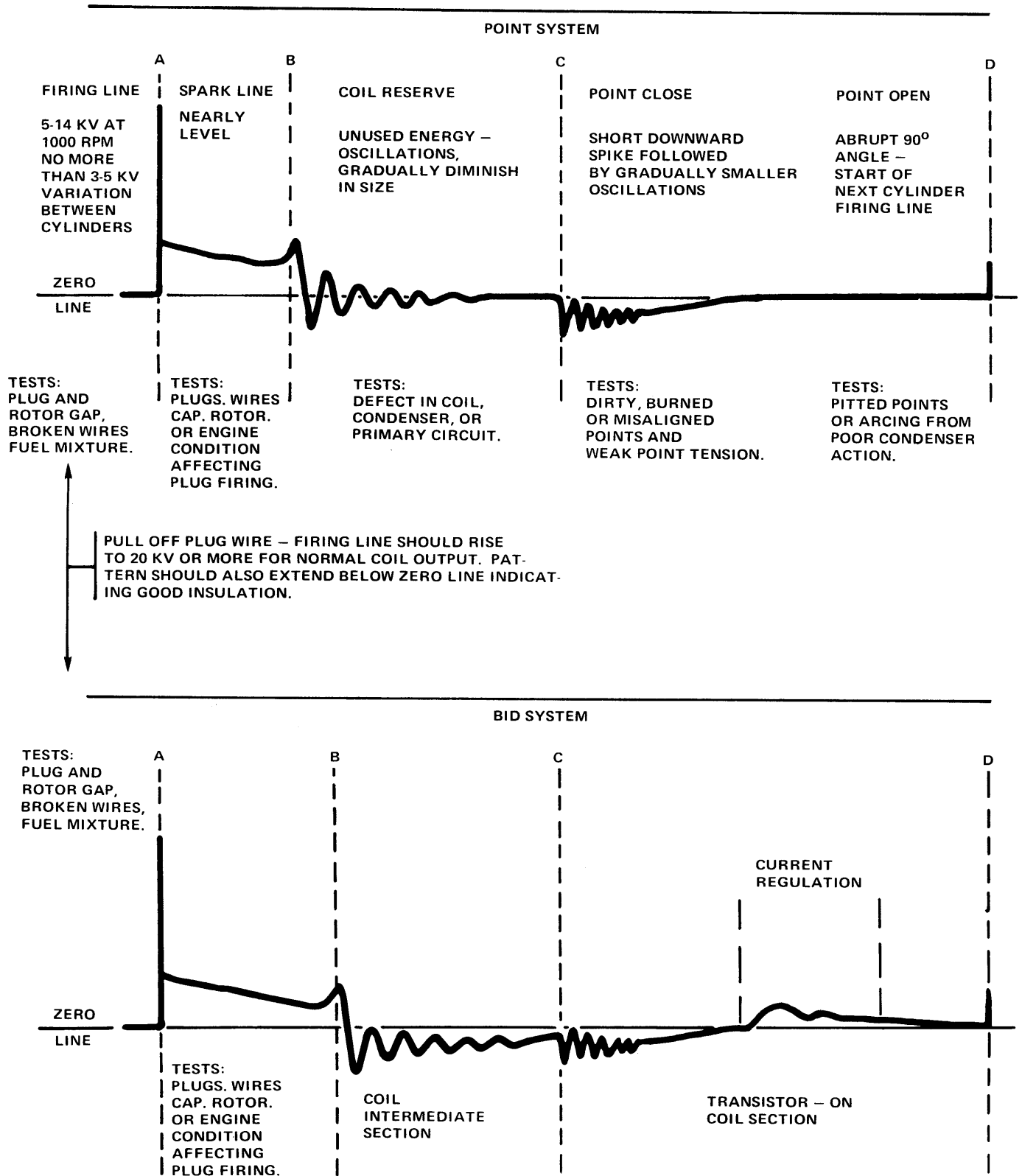


Fig. 4A-39 Diagnosis Pattern Chart

(4) If the total advance at 2000 rpm is less than specified, disconnect vacuum advance hose at distributor.

(5) Check maximum centrifugal degrees advance at engine rpm specified.

If the centrifugal advance degrees are as specified, the vacuum unit must be replaced.

DIAGNOSIS WITH SCOPE ANALYZER

The scope analyzer is an ignition tester that provides quick and accurate diagnosis of ignition system performance. All phases of the ignition cycle are shown graphically on an oscilloscope (cathode ray tube) as they occur in engine operation.

The manufacturers of scope analyzer equipment provide adequate descriptions of test procedures possible with their equipment. This section is not intended to cover all uses of scope equipment, but to point out differences in scope pattern between the conventional "point" system and the BID (Breakerless Induction Discharge) system used on Jeep vehicles.

Refer to figure 4A-39. The upper section of the chart shows a typical scope pattern of the point system from firing line to firing line and areas of the pattern significant to diagnosis.

The scope pattern (waveform) shows time duration horizontally and voltage vertically. Bearing this in mind, note the lower section of the chart which shows the typical pattern of the BID system.

Note the somewhat longer duration of the spark line shown on the BID pattern—this longer spark provides superior combustion with the leaner air-fuel mixtures now used.

The BID waveform pattern is below zero line in the coil section but otherwise is similar to that of the point system in this area.

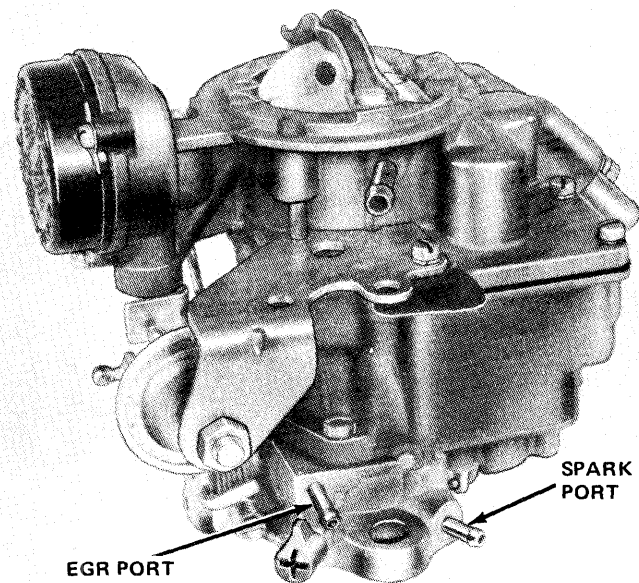
In the final "dwell" section of the scope pattern, a "worm" appears just above the zero line on the BID pattern. This wiggle is caused by the automatic current regulator built into the ECU (Electronic Control Unit) circuitry and is entirely normal. Since this section of the pattern is under electronic control, it will not vary from cylinder to cylinder as in the point system where this dwell area is controlled mechanically.

Other than the difference described, scope ignition diagnosis procedures for point and BID systems is essentially the same.

CARBURETION

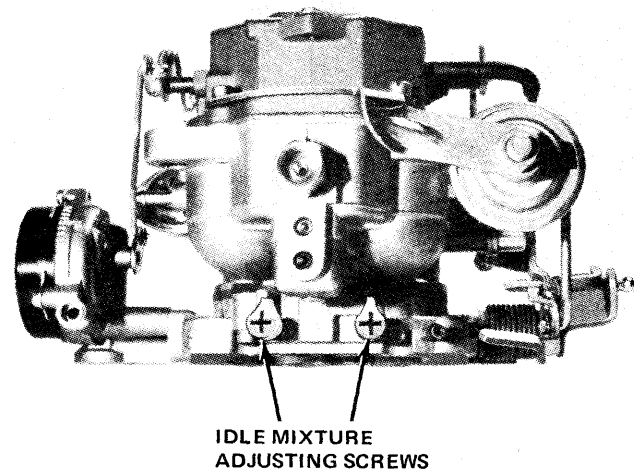
Engine Idle Speed and Mixture Setting Procedures

The engine and related systems must be performing properly prior to making carburetor idle speed and mixture adjustments. The idle speed and mixture adjustments must be made with the engine at operating temperature and air cleaner in place (fig. 4A-40, 4A-41, 4A-42 and 4A-43).



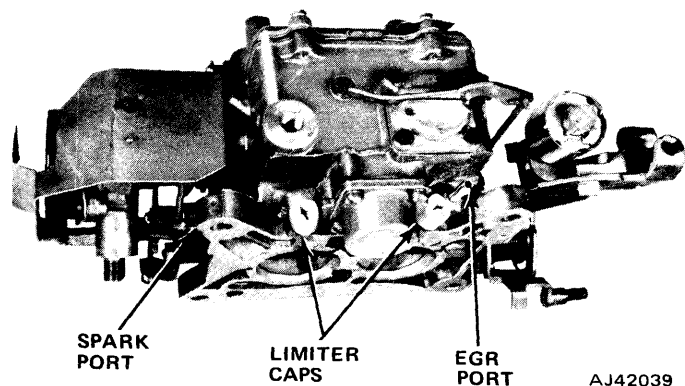
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Fig. 4A-40 Model YF Carburetor



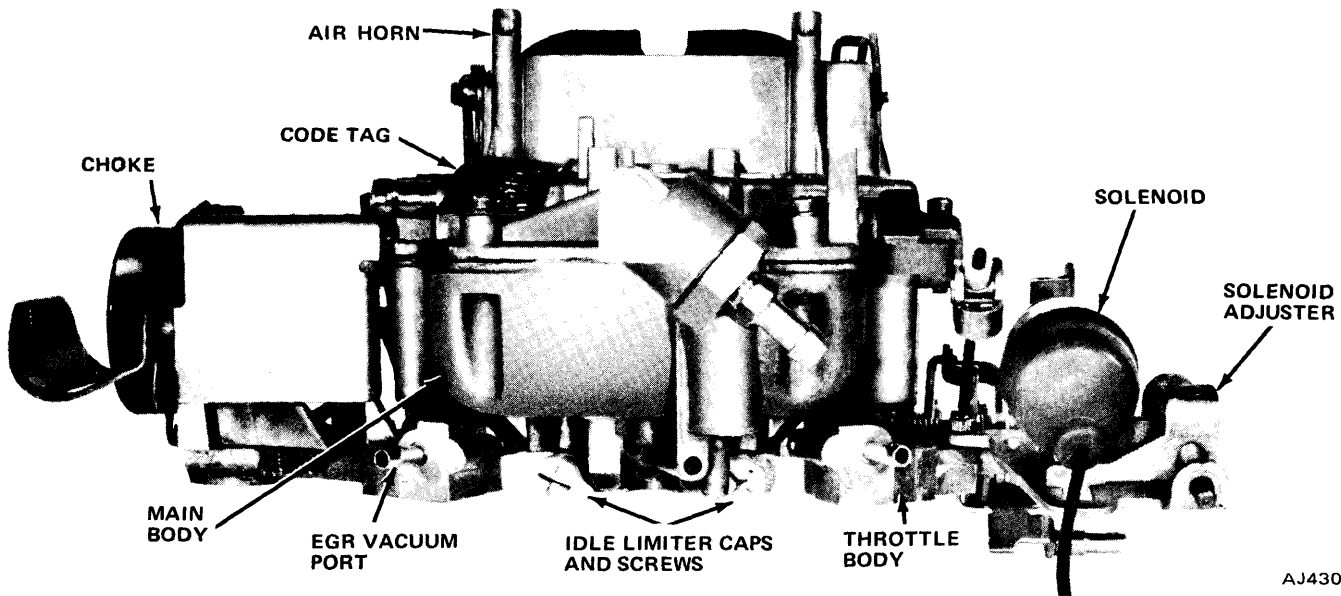
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Fig. 4A-41 Model BBD Carburetor



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Fig. 4A-42 Model 2100 Carburetor



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Fig. 4A-43 Model 4350 Carburetor

Plastic idle limiter caps are installed over the idle mixture screw(s) on all carburetors. The limiters are designed to regulate the adjustment range of the idle mixture screw(s), thereby effectively controlling the exhaust emission level at idle speeds to comply with Federal Standards for emission control. The limiter caps must be removed in order to perform the lean drop idle setting using the tachometer procedure. The infrared analyzer procedures do not normally require limiter cap removal.

Proper idle speed and mixture adjustments can be made by following a standard tachometer procedure in which the idle mixture is adjusted to a lean drop idle setting. A infrared (IR) analyzer procedure, in which the idle mixture is adjusted to obtain a specified carbon monoxide level, may be used, but only on vehicles without a catalytic converter. When following the tachometer procedure, adjustments must be made in the exact detailed sequence outlined to obtain lean drop idle settings and satisfactory idle quality.

WARNING: Set park brake firmly. Do not accelerate.

Tachometer Procedure

To compensate for fuel and temperature variations while performing the idle mixture adjustment:

- (a) Do not idle engine over three minutes at a time.
- (b) If the idle mixture adjustment is not completed within three minutes, run engine at 2000 rpm for one minute.
- (c) Recheck the idle mixture adjustment at the specified rpm and adjust as required. If the idle mixture adjustment is not completed within three minutes, repeat step (b).

- (1) Adjust idle screw(s) to the full rich stop(s). Note position of screw head slot inside limiter cap slots.

- (2) Carefully remove idle limiter cap(s) by installing a sheet metal screw in center of cap and turning clockwise. A soldering gun may also be used to cut through plastic caps. Discard the cap(s).

- (3) Reset idle screw(s) to the approximate position noted before the limiter cap(s) was removed (step 2).

NOTE: The tachometer used should have an expanded scale of 400 to 800 or 0 to 1000 rpm. The instrument should be inspected periodically and calibrated to allow not more than two percent error.

- (4) Start engine and warm to operating temperature.

- (5) Adjust idle speed to 30 rpm above rpm specified in idle speed chart.

NOTE: On all V-8 engines with automatic transmissions, the throttle-stop solenoid is used to adjust curb idle speed. Use the following procedure for idle speed adjustment.

- (a) With solenoid wire connected, loosen solenoid locknut and turn solenoid in or out to obtain specified idle rpm.

- (b) Tighten solenoid bracket.

- (c) Disconnect solenoid wire and adjust idle speed screw to obtain 500 rpm.

- (d) Connect solenoid wire.

- (6) Starting from full rich stop position (as established before limiter(s) was removed), turn mixture screw(s) clockwise (leaner) until a loss of engine rpm is indicated.

Idle Speed

	Engine	Transmission	Idle Speed *
CJ-49 Without Catalytic Converter	232	M	850
		A	850
	258	A	550
CJ-49 State With Catalytic Converter	304	M	750
		A	700
CJ-Altitude	232,258	M	600
		A	550
	304	M	750
		A	700
CJ-California	258	M	850
		A	700
	304	M	750
		A	700
Cherokee, Wagoneer, Truck—All Geographic Areas	6-Cylinder	M	650
		A	550
	8-Cylinder	M	750
		A	700

*Manual Transmission-Neutral
Automatic Transmission-Drive

70484

(7) Turn mixture screw(s) counterclockwise until the highest rpm reading is obtained at lean best idle setting. On carburetors incorporating two mixture screws, turn both screws equally unless the engine demands otherwise.

NOTE: If the idle speed changed more than 30 rpm during the mixture adjustment, reset to 30 rpm above the specified rpm and repeat the adjustment.

(8) As a final adjustment, turn mixture screw(s) clockwise until specified drop in engine rpm is obtained.

Idle Drop

	Engine	Transmission	Idle Drop
CJ-49 State With Catalytic Converter	304	M	100
		A	20
CJ-Altitude	232, 258	M	50
		A	25
	304	M	100
		A	20
CJ-California	258	M	50
		A	25
	304	M	100
		A	20
Cherokee Wagoneer, Truck—All Geographic Areas	All Engines	All Transmissions	Lean Best Idle (No Idle Drop Specified)

70485

(9) Install replacement (blue) service idle limiter cap(s) over idle mixture screw(s) with limiter cap ear(s) positioned against the full rich stop(s). Be careful not to disturb idle mixture setting while installing the cap(s). Press cap(s) firmly and squarely into place.

Infrared (IR) Analyzer Procedure—CJ Models with Six-Cylinder Engine Without Catalytic Converter

NOTE: To compensate for fuel and temperature variations while performing the idle mixture adjustment:

(a) Do not idle engine over three minutes at a time.

(b) If the idle mixture adjustment is not completed within three minutes, run engine at 2000 rpm for one minute.

(c) Recheck the idle mixture adjustment at the specified rpm and adjust as required. If the idle mixture adjustment is not completed within three minutes, repeat step (b).

NOTE: The IR analyzer to be used must be periodically inspected and calibrated to assure accurate readings.

(1) Connect IR analyzer by precisely following the instructions of the manufacturer.

(2) Start engine and allow sufficient warmup time for engine and analyzer to stabilize.

(3) Recalibrate IR analyzer before proceeding to adjust carburetor.

(4) Insert probe of analyzer at least 18 inches into tailpipe.

NOTE: The exhaust system and the test equipment must be free of leaks to prevent erroneous readings.

(5) Adjust idle speed to 30 rpm above the following specified rpm.

Six-Cylinder: Automatic—550 rpm

Six-Cylinder: Manual—850 rpm

(6) Observe CO level and compare to following table.

Engine Idle CO Level

Six-Cylinder Automatic	0.8% max.
Six Cylinder Manual	1.0% to 1.5%

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(7) If less than specified, turn screws counterclockwise 1/16 turn at a time, until specified CO reading is obtained.

(8) If greater than specified, turn screw(s) clockwise until specified CO reading is obtained.

(9) Allow ten seconds for meter to stabilize after each adjustment.

NOTE: If the idle speed changed more than 30 rpm during the mixture adjustment, reset to the specified rpm and repeat the adjustment until the specified carbon monoxide level is obtained.

Choke Linkage

All choke linkage including the fast idle cam should be checked for free movement at the mileage intervals specified in the Mechanical Maintenance Schedule.

Free carburetor linkage by applying Jeep Carburetor and Combustion Area Cleaner, or equivalent. Never use oil to lubricate carburetor linkage.

For correct choke system adjustments, refer to Fuel—Carburetion section of this manual.

Exhaust Manifold Heat Valve

An often overlooked, but highly important emission related component is the exhaust manifold heat valve. This valve can affect the gas mileage, performance, drivability and especially emission levels.

This valve is to be inspected for correct operation and lubricated with Jeep Heat Valve Lubricant, or equivalent, as outlined in the Maintenance Schedule. Refer to the Exhaust Section for service procedures.

EXHAUST SYSTEMS

	Page		Page
General	4A-36	Exhaust Manifold Heat Valve	4A-36

GENERAL

The basic exhaust system on all vehicles consists of a front exhaust pipe, muffler, and tailpipe.

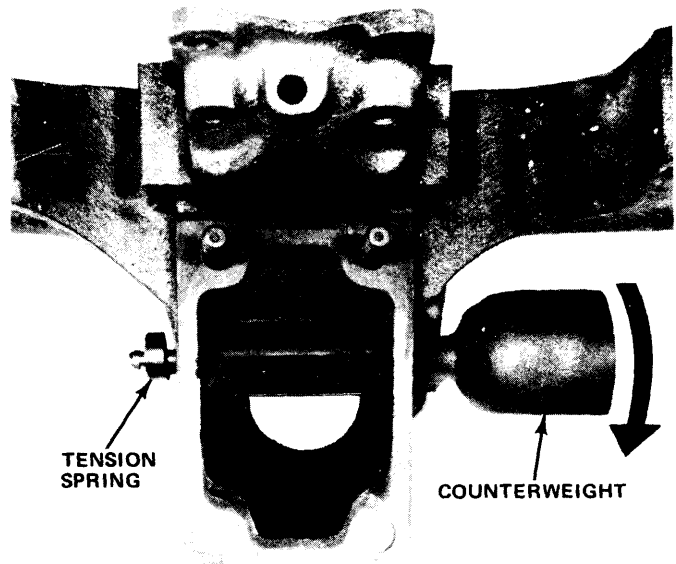
All CJ models except 49-state six-cylinder models are equipped with a catalytic converter. Cherokee, Wagoneer and Truck models are equipped with a catalytic converter in California.

The exhaust system must be properly aligned to prevent stress, leakage, and grounding. If the system grounds on any body panel, it may amplify objectionable noises originating from the engine or the body. When inspecting an exhaust system, check for cracked or loose joints, stripped bolt threads, and corrosion damage. Replace all parts that are badly corroded or damaged. Do not attempt to repair.

EXHAUST MANIFOLD HEAT VALVE

Six-Cylinder Engine

A thermostatically controlled heat valve in the exhaust manifold directs exhaust heat to the floor of the intake manifold for rapid fuel vaporization during engine warmup. The valve directs exhaust heat to the intake manifold when the counterweight is in the extreme counterclockwise position when viewed from the counterweight end (fig. 4A-44). As the engine reaches operating temperature, the thermostatic spring heats up and loses tension, allowing counterweight to turn the valve, directing heat away from the intake manifold (fig. 4A-45).



AJ43059

Fig. 4A-44 Heat Valve in Heat-On Position—Six-Cylinder

The manifold heat valve must operate freely and should be checked and lubricated with Jeep Heat Valve Lubricant, or equivalent, as outlined in the Maintenance Schedule.

Replacement

- (1) Remove and separate intake and exhaust manifolds (refer to Section 1A—Six-Cylinder Engine).
- (2) Remove manifold heat valve assembly by cutting heat valve shaft on both sides of valve.

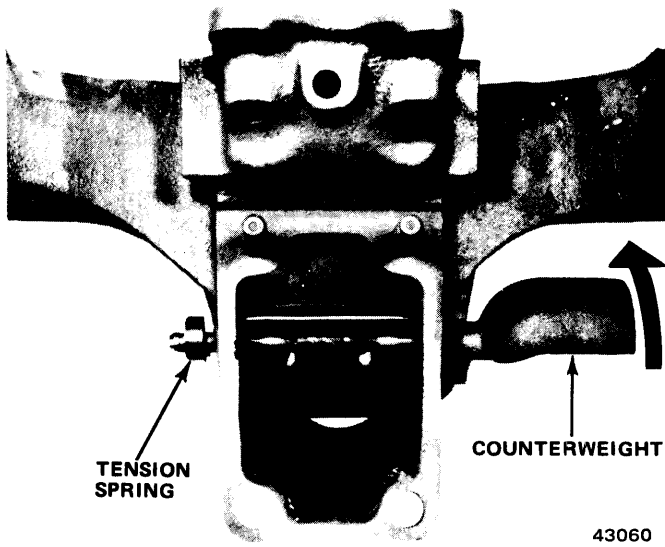


Fig. 4A-45 Heat Valve in Heat-Off Position—Six-Cylinder

- (3) Lift valve from manifold and drive out remaining shaft sections and bushings.
- (4) Install new bushings using heat valve shaft as a guide pin.
- (5) Ream out new bushings with a 5/16-inch drill bit to remove all burrs.
- (6) Position heat valve as shown in figure 4A-44 and install shaft and counterweight assembly.
- (7) Rotate counterweight until spring stop contacts bottom of manifold boss.
- (8) Align hose in valve with screw threads in shaft and install, but do not tighten retaining screw.
- (9) Close heat valve and install tension spring with hook end up and pointing away from manifold. Hook spring under support pin.
- (10) Operate heat valve several times to allow shaft to center.
- (11) Hold shaft and move valve as far as possible from counterweight. Tighten retaining screw.
- (12) Check operation of valve.
- (13) Install intake and exhaust manifolds (refer to Section 1A—Six-Cylinder Engine).

V-8 Engine

A thermostatically controlled heat valve mounted between the right exhaust manifold and exhaust pipe directs exhaust heat to the intake manifold for rapid fuel vaporization during engine warmup. The valve is closed, directing exhaust heat through the intake manifold crossover passage when the counterweight is in the horizontal position (fig. 4A-46). The exhaust heat crosses through the intake manifold and discharges into the left exhaust manifold until the engine reaches operating temperature. At this time, the thermostatic spring loses its tension and the counterweight moves downward, opening the valve and allowing the exhaust heat to discharge through the right exhaust pipe.

The manifold heat valve must operate freely and should be checked and lubricated with Jeep Heat Valve Lubricant, or equivalent, as outlined in the Maintenance Schedule.

Replacement

- (1) Disconnect and lower exhaust pipes.
- (2) Replace with manifold heat valve and gaskets.
- (3) Replace exhaust pipe gaskets.
- (4) Position exhaust pipes and connect to exhaust manifold.

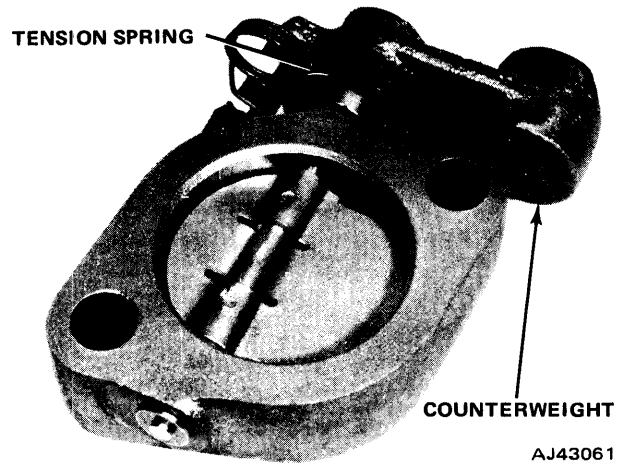


Fig. 4A-46 Heat Valve in Heat-On Position—V-8

Specifications

Accelerator Pump — Snap Throttle	
From 1000 RPM	1 to 1-1/2 AFR Enrichment
Belt Tension	
Predelivery or Belt With Previous Service	90-115 lbs.
New Belt	125-155 lbs.
Air Pump — Six Cyl. with PS (3/8-inch belt)	
Predelivery or Belt With Previous Service.	60-70 lbs.

Air Pump — Six Cyl. with PS (3/8-inch belt)	
(Continued)	
New Belt	65-75 lbs.

Cranking Vacuum — This test must have operating battery voltage, completely closed throttle valve(s), PCV valve completely closed 9 inches/min.

Jeep Tuneup Specifications—On Vehicle

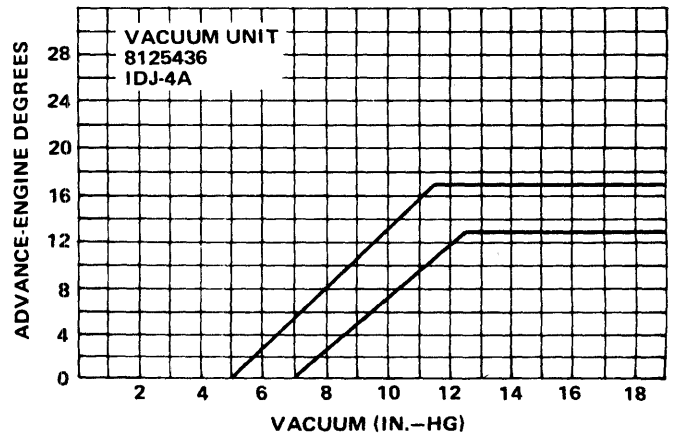
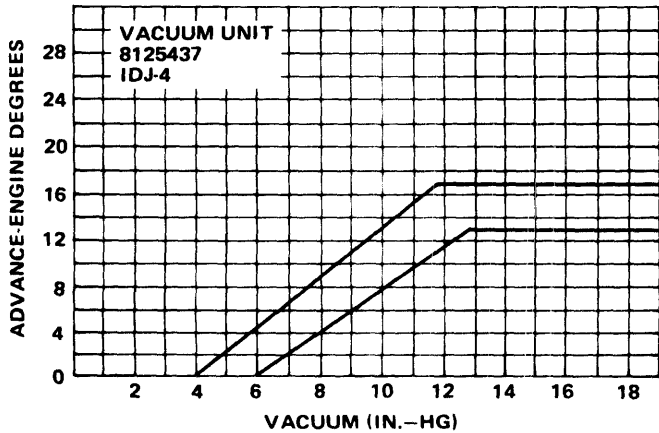
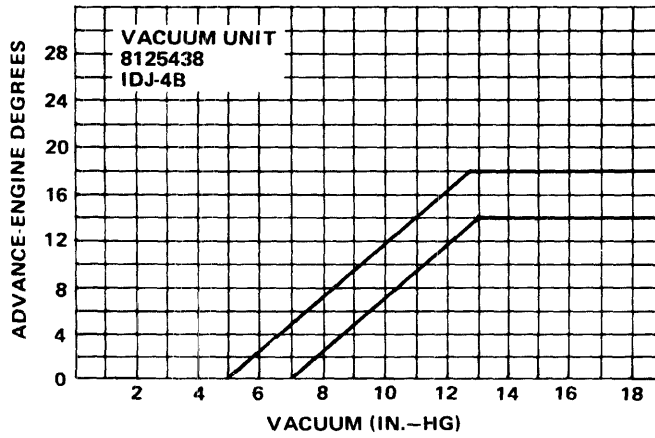
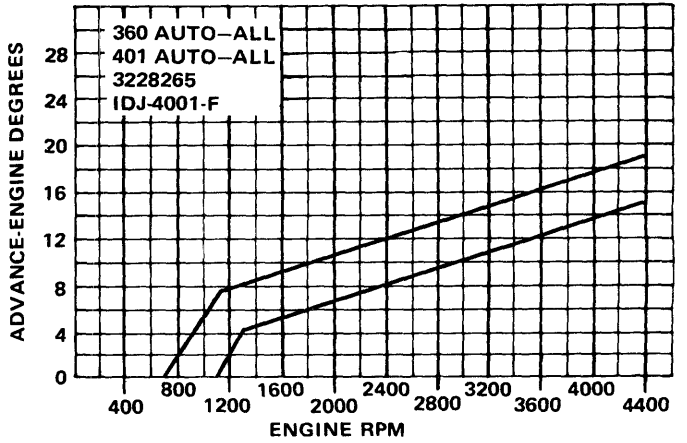
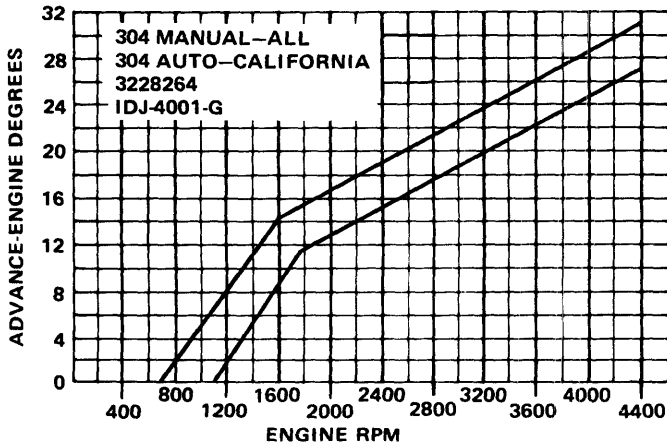
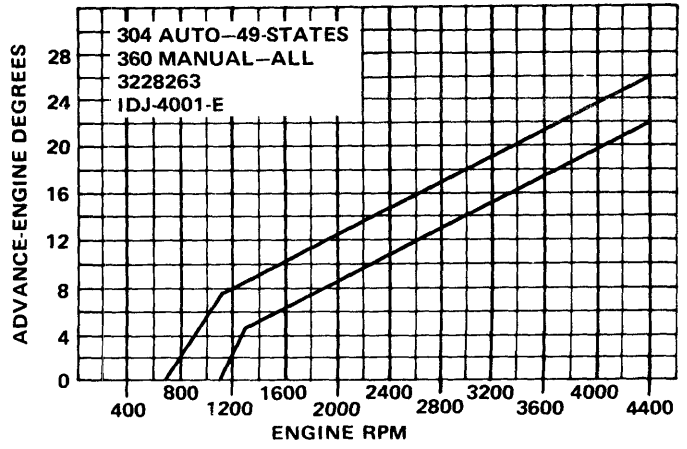
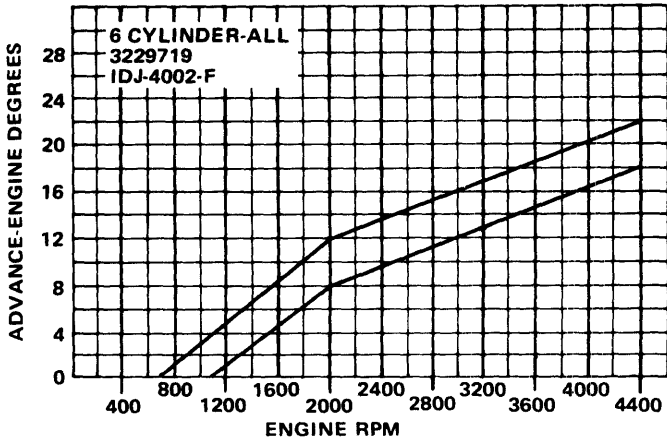
Engine CID and Carburetion	Transmission	Initial Timing at 500 RPM or Less With Vacuum Hose Disconnected and Plugged		Curb Idle Speed — RPM (Auto. in Drive, Manual in Neutral)		Distributor Model Number	Vacuum Unit Number	Total Degrees Advance at 2000 RPM	Centrifugal Advance	Spark Plug Type
		Set To	OK Range	Set To	OK Range					
232 1V	M	5° (49)	3°-7°	850 (49)	750-950	3229719 IDJ-4002-F	8125438 IDJ-4B	22°-30°	Refer to Distributor Curves	N12Y® Gap 0.033-0.037 Inch (Alternate Plug: RN12Y)
		10° (ALT) ^①	8°-12°	600 (ALT)	500-700					
258 1V	M	3° (49)	1°-5°	850 (49)	750-950					
		10° (ALT) ^②	8°-12°	600 (ALT)	500-700					
		6° (CAL)	4°-8°	850 (CAL)	750-950					
	A	8° (49)	6°-10°	550 (49)	450-650					
		10° (ALT) ^③	8°-12°	550 (ALT)	450-650					
		8° (CAL)	6°-10°	700 (CAL)	600-800					
258 2V	M	6° (49)	4°-8°	650 (49)	550-750					
	A	6° (49)	4°-8°	550 (49)	450-650					
304 2V	M	5° (ALL)	3°-7°	750 (ALL)	650-850	3228264 IDJ-4001-G	8125436 IDJ-4A	25.6°-33.6°	Refer to Distributor Curves	RN12Y Gap 0.033-0.037 Inch (Alternate Plug: N12Y)
	A	10° (49 & ALT)	8°-12°	700 (ALL)	600-800	3228263 IDJ-4001-E	8125437 IDJ-4	21.5°-29.5°		
		5° (CAL)	3°-7°			3228264 IDJ-4001-G	8125436 IDJ-4A	25.6°-33.6°		
360 2V & 4V	M	5° (49)	3°-7°	750 (49)	650-850	3228263 IDJ-4001-E	8125437 IDJ-4	21.5°-29.5°		
		5° (CAL)	3°-7°	750 (CAL)	650-850					
	A	8° (49)	6°-10°	700 (49)	600-800	3228265 IDJ-4001-F		19.7°-27.7°		
		8° (CAL)	6°-10°	700 (CAL)	600-800					
401 4V	A	8° (49)	6°-10°	700 (49)	600-800					
		8° (CAL)	6°-10°	700 (CAL)	600-800					

- ① When operated below 4000 feet, Set-To 8°, OK Range 6°-10°
- ② When operated below 4000 feet, Set-To 6°, OK Range 4°-8°
- ③ When operated below 4000 feet, Set-To 8°, OK Range 6°-10°
- ④ RN12Y for Canadian Six-Cylinder

NOTE: Timing and idle specifications are given for:

- 49-State Applications (49)
- Altitude Compensation Applications (ALT)
- California Applications (CAL)

Distributor Curves—On Vehicle



Emission Components—CJ Models

49 State Vehicles

Engine CID and Venturis	Series	Trans.	Air Guard	Cat. Con.	EGR	EGR CTO Temp.	BPS	FTVC	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid	Dashpot
232 1V 258 1V	CJ-5, CJ-7	M3	●	—	●	115°	—	●	●	M	—	●	160°	●	—	●	—
	CJ-7	A	●	—	●	115°	—	●	●	M	—	●	160°	●	—	—	—
258 1V	CJ-5, CJ-7	M4	●	—	●	115°	—	●	●	M	—	●	160°	●	—	●	—
304 2V	CJ-5, CJ-7	M3	●	●	●	115°	—	●	●	V	—	—	—	—	—	—	●
	CJ-7	A	●	●	●	115°	—	●	●	V	—	—	—	—	—	●	—

Altitude Vehicles

232 1V 258 1V	CJ-5, CJ-7	M	●	●	●	115°	—	●	●	M	—	●	160°	●	—	—	—
	CJ-7	A	●	●	●	115°	—	●	●	M	●	●	160°	●	—	—	—
304 2V	CJ-5, CJ-7	M	●	●	●	115°	—	●	●	V	—	●	160°	—	●	—	—
	CJ-7	A	●	●	●	115°	—	●	●	V	●	●	160°	—	●	●	—

California Vehicles

258 1V	CJ-5, CJ-7	M	●	●	●	115°	—	●	●	M	—	—	—	●	—	●	—
	CJ-7	A	●	●	●	115°	—	●	●	M	●	●	160°	●	—	●	—
304 2V	CJ-5, CJ-7	M	●	●	● ^①	115°	5.0	●	●	V	●	●	160°	—	—	—	●
	CJ-7	A	●	●	●	115°	—	●	●	V	●	●	160°	—	—	●	—

① Non-Integral Type Back-Pressure Sensor

Trans. — Transmission Type (manual or automatic)
 Cat. Conv. — Catalytic Converter
 EGR — Exhaust Gas Recirculation
 BPS — Back Pressure Sensor
 PCV — Positive Crankcase Ventilation

FTVC — Fuel Tank Vapor Control
 TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)
 TCS — Transmission Controlled Spark
 ● — On all models in series specified

Emission Components—Cherokee, Wagoneer and Truck

49-State Vehicles

Engine CID and Venturis	Series	Trans.	AIR Guard	Cat. Con.	EGR	EGR CTO Temp.	FTVC	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid	Dashpot	Throttle Modulator
258 2V	Cherokee Truck	M	—	—	●	160°	—	●	M	—	●	160°	—	—	—	—	—
	Cherokee Truck	A	—	—	●	160°	—	●	M	—	●	160°	—	—	—	—	—
360 2V	Cherokee Truck	M	●	—	●	160°	—	●	V	—	●	160°	—	—	—	—	●
	Cherokee Wagoneer Truck	A	●	—	●	160°	—	●	V	—	●	160°	—	—	●	—	—
360 4V	Cherokee Truck	M	●	—	● ^①	160°	—	●	V	—	●	160°	—	—	—	—	●
360 4V 401 4V	Cherokee Wagoneer Truck	A	●	—	● ^①	160°	—	●	V	—	●	160°	—	—	●	—	—

California Vehicles

360 4V	Cherokee Truck	M	●	●	● ^②	160°	●	●	V	—	●	160°	●	—	—	—	—	●
360 4V 401 4V	Cherokee Wagoneer Truck	A	●	●	● ^②	160°	●	●	V	—	●	160°	●	—	●	—	—	●

① Delay Valve

② Integral Back-Pressure/EGR Valve

Trans. — Transmission Type (manual or automatic)

Cat. Conv. — Catalytic Converter

EGR — Exhaust Gas Recirculation

BPS — Back Pressure Sensor

PCV — Positive Crankcase Ventilation

FTVC — Fuel Tank Vapor Control

TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)

TCS — Transmission Controlled Spark

● — On all models in series specified

