

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.

Nationwide Federal Emission Standards and the standards which apply in California differ. This necessitates a number of differences between emission con-

trol systems on vehicles built for sale in California and Nationwide except California.

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) Restricted choke vacuum and hot air passages.	(2) Clean passages.
	(3) Improper fuel level.	(3) Adjust float level.
	(4) Dirty, worn or faulty needle valve and seat.	(4) Repair as necessary.
	(5) Float sticking.	(5) Repair as necessary.



Service Diagnosis (Continued)

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

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) Defective TCS system.	(2) Test TCS System; repair as necessary.
	(3) Faulty distributor centrifugal advance.	(3) Check centrifugal advance and repair as necessary.
	(4) Faulty distributor vacuum advance.	(4) Check vacuum advance and 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) Clogged vacuum passages.	(9) Clean passages.
	(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) Worn distributor shaft.	(16) Replace shaft.
	(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) Incorrect valve timing.	(20) Check valve timing and repair as necessary
	(21) Intake manifold restricted.	(21) Pass chain through passages.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
MISFIRE AT ALL SPEEDS	(1) Faulty spark plug(s).	(1) Clean or replace spark plug(s).
	(2) Faulty spark plug cable(s).	(2) Replace as necessary.
	(3) Faulty distributor cap or rotor.	(3) Replace cap or rotor.
	(4) Faulty coil.	(4) Test coil and replace as necessary.
	(5) Primary circuit shorted or open intermittently.	(5) Trace primary circuit and repair as necessary.
	(6) Leaking engine valve(s).	(6) Check cylinder leakdown rate or compression and repair as necessary.
	(7) Faulty hydraulic tappet(s).	(7) Clean or replace tappet(s).
	(8) Faulty valve spring(s).	(8) Inspect and test valve spring tension, repair as necessary.
	(9) Worn lobes on camshaft.	(9) Replace camshaft.
	(10) Vacuum leak.	(10) Check manifold vacuum and repair as necessary.
	(11) Improper carburetor settings.	(11) Adjust carburetor.
	(12) Fuel pump volume or pressure low.	(12) Replace fuel pump.
	(13) Blown cylinder head gasket.	(13) Replace gasket.
	(14) Intake or exhaust manifold passage(s) restricted.	(14) Pass chain through passages.
POWER NOT UP TO NORMAL	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor rotor.	(2) Replace rotor.
	(3) Worn distributor shaft.	(3) Replace shaft.
	(4) Incorrect spark plug gap.	(4) Adjust gap.
	(5) Faulty fuel pump.	(5) Replace fuel pump.
	(6) Incorrect valve timing.	(6) Check valve timing and repair as necessary.
	(7) Faulty coil.	(7) Test coil and replace as necessary.
	(8) Faulty ignition.	(8) Test cables and replace as necessary.
	(9) Leaking engine valves.	(9) Check cylinder leakdown rate or compression and repair as necessary.
	(10) Blown cylinder head gasket.	(10) Replace gasket.
	(11) Leaking piston rings.	(11) Check compression and repair as necessary.



Service Diagnosis (Continued)

Condition	Possible Cause	Correction
INTAKE BACKFIRE	(1) Improper ignition timing. (2) Faulty accelerator pump discharge. (3) Improper choke operation. (4) Defective EGR CTO (5) Defective TAC unit. (6) Lean fuel mixture.	(1) Adjust timing. (2) Repair as necessary. (3) Repair as necessary. (4) Replace EGR CTO (5) Repair as necessary. (6) Check float level or manifold vacuum for vacuum leak.
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 (YF Model Carburetor or 4350 Model 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. (10) Restricted air cleaner.	(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. (10) Clean or replace air cleaner.

AIR GUARD SYSTEM

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GENERAL

This system incorporates a belt driven air pump, diverter (bypass) valve, air injection manifold(s), air injection tubes 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 and through injection tubes 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. 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).

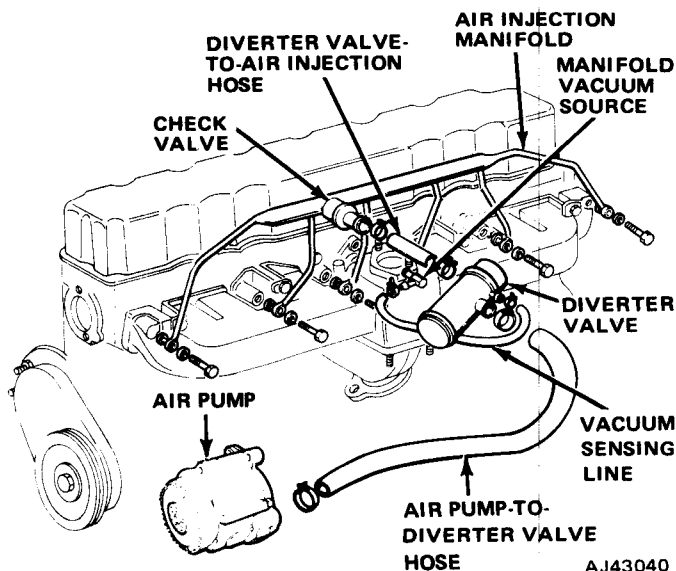


Fig. 4A-1 Air Guard System—Six-Cylinder

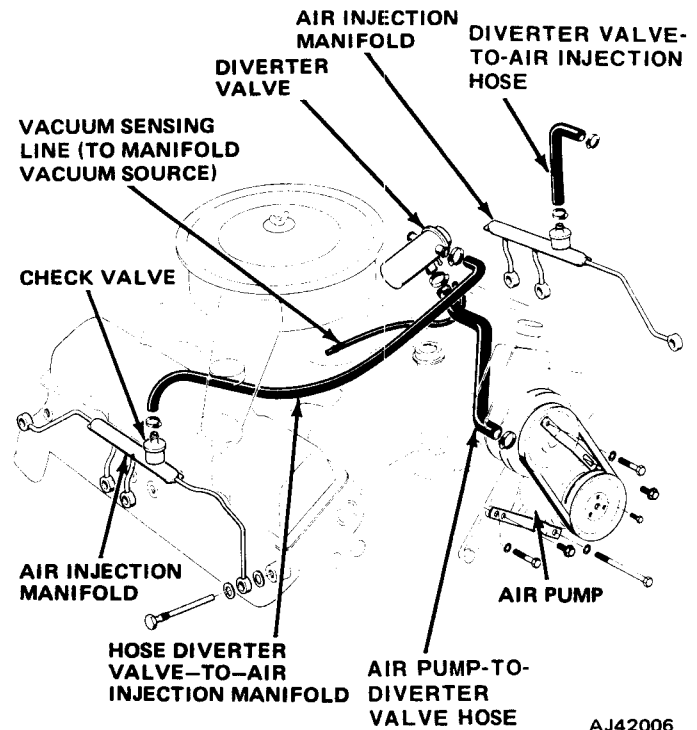


Fig. 4A-2 Air Guard System—V-8

The pump is designed to be relatively service free. The only serviceable item is the filter fan assembly. 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

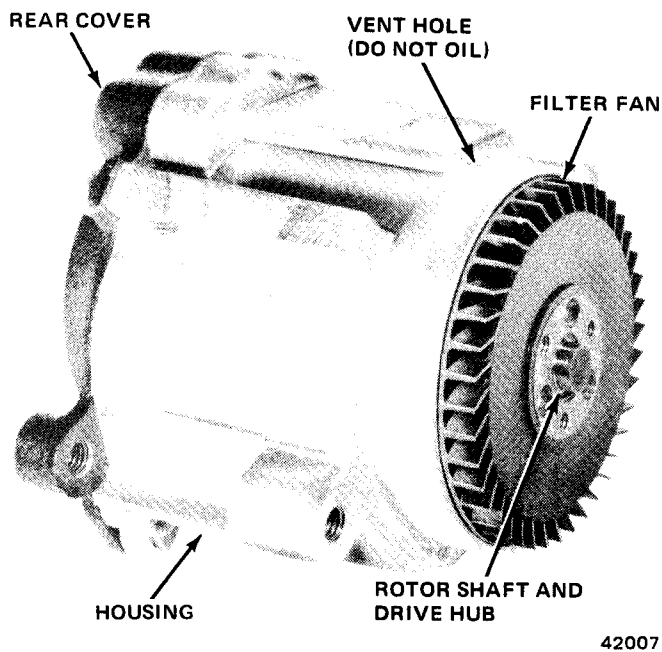


Fig. 4A-3 Air Pump

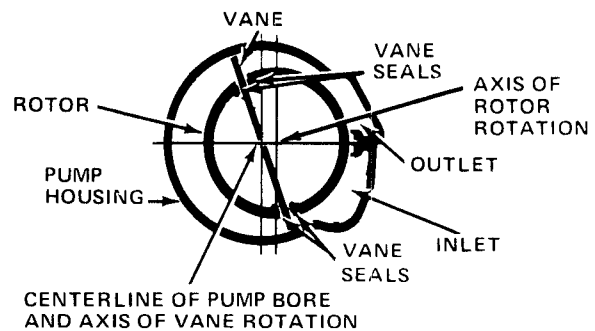
into the housing correctly position the end cover which is fastened by four bolts.

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.

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.



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Fig. 4A-4 Air Pump Operation

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; but 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.
- Attempt to lubricate.

- Clean centrifugal filter.
- Replace filter by driving or hammering in position.
- Remove drive hub when replacing 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.

Fan Replacement

Pry outer disc loose and remove remaining portion as illustrated in figure 4A-5.

NOTE: It is almost impossible to remove the fan without destroying it. Be careful to prevent fragments from entering the air intake hole. Do not attempt to remove the metal drive hub.

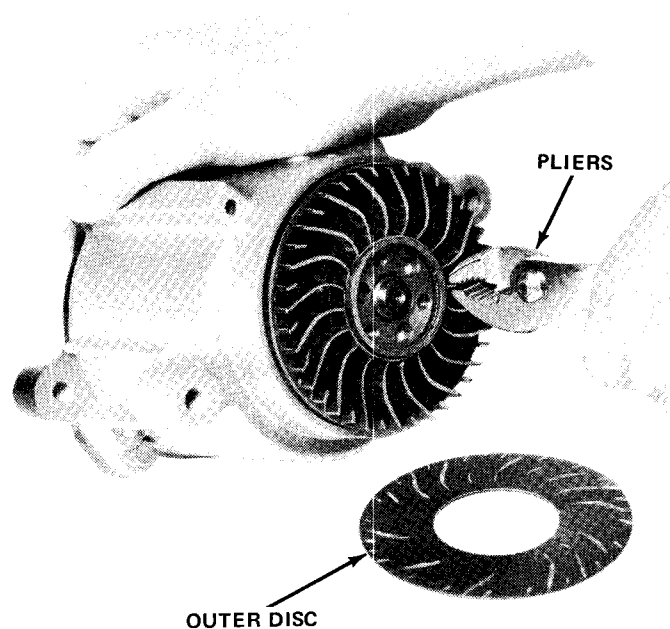


Fig. 4A-5 Centrifugal Filter Fan Removal

Install new filter fan into position by using pulley and bolts as tools.

Draw fan down evenly by alternately tightening bolts. Be sure that outer edge of fan slips into housing. A slight amount of interference with housing bore is normal.

NOTE: Do not attempt to install a fan by hammering or pressing it on.

After a new fan is installed, it may squeal upon initial operation until its outside diameter lip has worn in. This may require 20 to 30 miles of operation.

Exhaust Tube Replacement

Grasp exhaust tube in a vise or with suitable pliers and pull out with a twisting motion.

NOTE: Do not clamp the pump body in a vise.

Support pump as shown in figure 4A-6.

Insert new exhaust tube into hole and tap into place

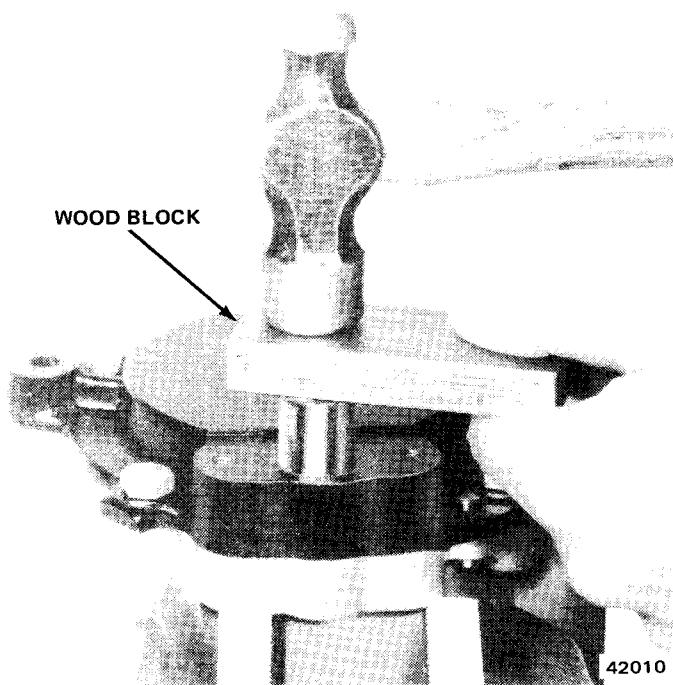


Fig. 4A-6 Exhaust Tube Installation

using a block of wood until approximately 7/8 inch of tube extends above the cover.

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-7). 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).

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. If air does not flow or if backfire occurred, 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.

- (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 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. Installation entails reconnecting the hoses and vacuum line.

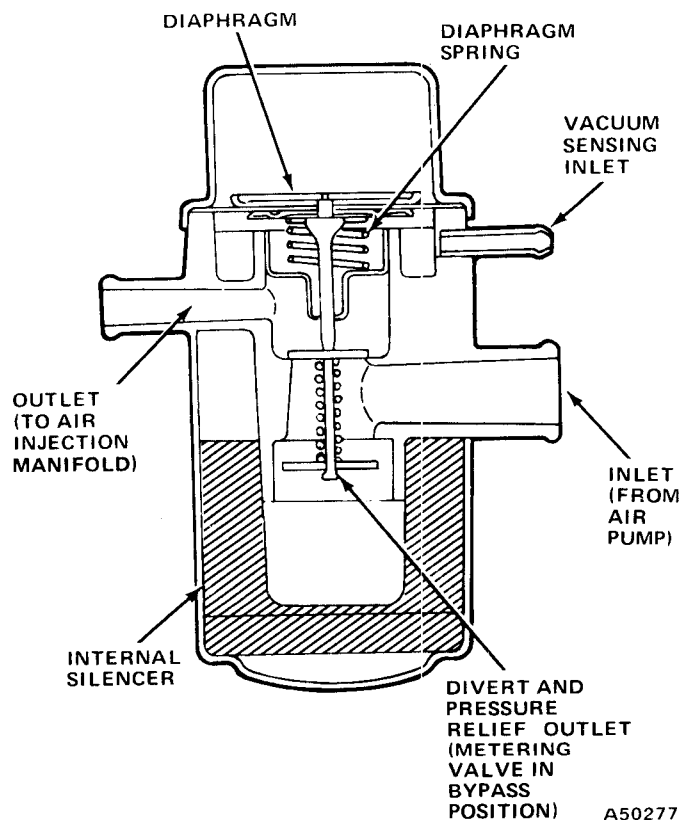


Fig. 4A-7 Diverter Valve (V-8 Shown)

AIR INJECTION MANIFOLDS AND TUBES

The air injection manifold(s) is constructed of cold rolled steel with a zinc plating and distributes air from the pump to each of the injection tubes.

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 air injection tubes project into the exhaust ports, directing air into the vicinity of the exhaust valve seats. The injection tubes, which are made of stainless steel, are inserted through the distribution tubes of the air injection manifold and threaded into the exhaust manifold.

Air injection tubes are used for all cylinders except No. 7 on V-8 engines. Two different length injection tubes are used on six-cylinder engines. The shorter tubes are used for No. 3 and No. 4 cylinders.

Removal—Six-Cylinder

NOTE: *Intake and exhaust manifold assembly must be removed to prevent bending or damaging the air distribution manifold during removal.*

(1) Remove intake and exhaust manifold assembly. Refer to Section 1A—Six-Cylinder Engines.

(2) Position manifold in vise and remove injection tubes and sealing gaskets from each cylinder exhaust port.

Installation—Six-Cylinder

(1) Install new sealing gaskets on injection tubes and air injection manifold.

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

(3) Position injection tube in exhaust manifold openings.

NOTE: *Two different length injection tubes are used on six-cylinder engines. The shorter length injection tubes must be inserted into cylinders 3 and 4.*

(4) Install intake and exhaust manifold assembly. Refer to Section 1A—Six-Cylinder Engine.

Removal—V-8

(1) Disconnect air delivery hose at check valve.

(2) Loosen injection tubes.

(3) Remove air injection manifold and injection tubes as an assembly.

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

(4) Remove injection tubes and sealing gaskets from air injection manifold.

Installation—V-8

(1) Install injection tubes through the air injection manifold openings using a new sealing gasket at either side of each opening.

(2) Assemble air injection manifold and injection tubes to exhaust manifold. Tighten tubes 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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GENERAL

The EGR (Exhaust Gas Recirculation) system used on all vehicles reduces the formation of oxides of nitrogen (NO_x) 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.

In 1976 Jeep models, the same EGR system is used by all CJ-5 and -7 models, and all California Cherokees, Wagoneers, and Trucks. It consists of a diaphragm-actuated flow control valve (EGR valve), a coolant temperature override switch (EGR CTO), an exhaust back-pressure sensor and connecting hoses (fig. 4A-8 and 4A-9).

Nationwide (except California) Cherokees, Wagoneers, and Trucks are equipped with the same system but do not use the back-pressure sensor. In those units, the EGR valve bolts directly to the manifold and the outer (E) port of the CTO switch connects directly to the EGR valve.

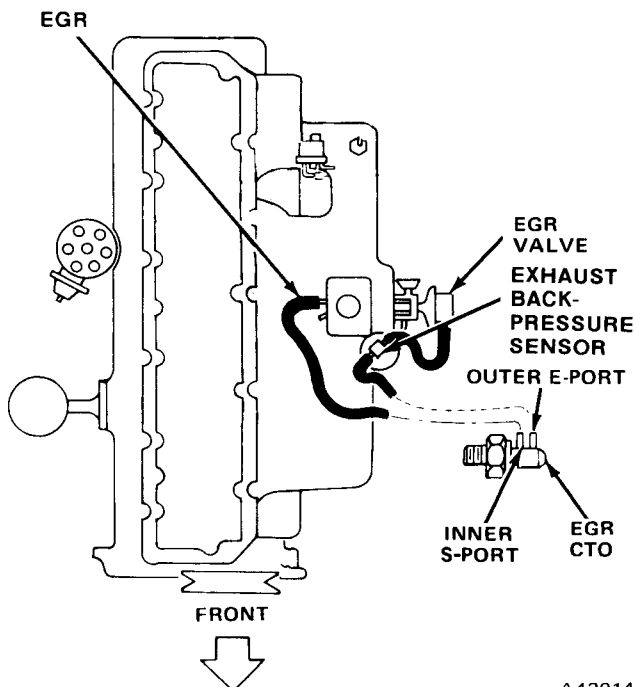


Fig. 4A-8 EGR System—Six-Cylinder

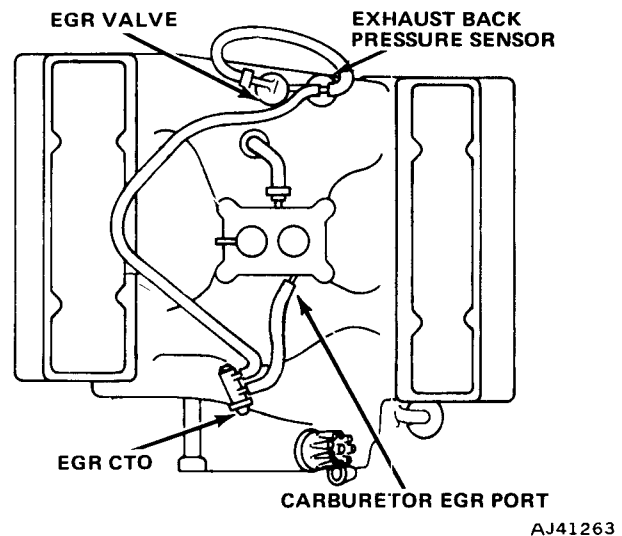


Fig. 4A-9 EGR System—V-8

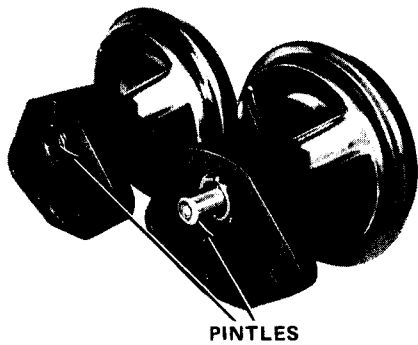
The EGR CTO switch prevents EGR action until engine temperature reaches a preset level, and the back-pressure sensor permits EGR action only at increased engine loads, thereby improving driveability.

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 back-pressure sensor is used, the EGR valve mounts on the spacer which is an integral part of the back-pressure sensor.

EGR valves are calibrated by the use of differently shaped pintles (fig. 4A-10). The valve is normally held closed by a spring located above the diaphragm (fig. 4A-11). 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.

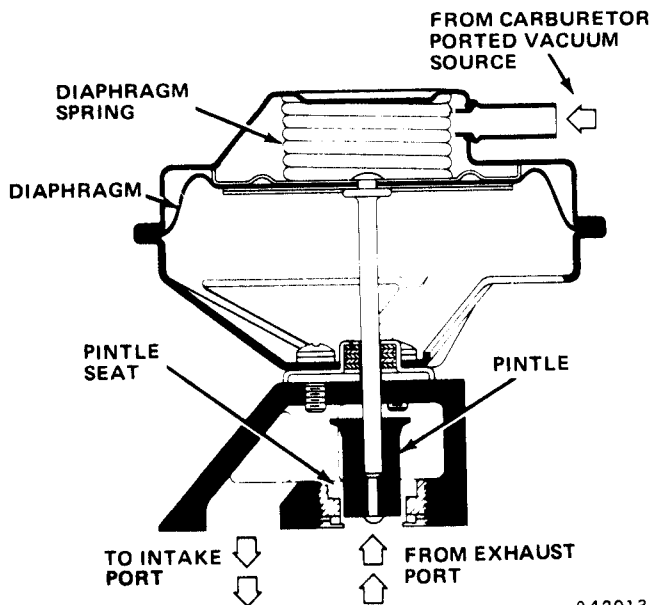
When vacuum overcomes the diaphragm spring pressure, a pintle within the valve is lifted off its seat and exhaust gas, which reaches the EGR valve through special passages, is metered into the intake manifold. Exhaust gas is drawn from the exhaust crossover passage in V-8 engines, from an area near the heat riser in six-cylinder engines.



PINTLES

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Fig. 4A-10 EGR Valve Pintles



A42013

Fig. 4A-11 EGR Valve

EGR Valve Test

With the engine at operating temperature and curb idle, manually depress the EGR valve diaphragm. This should cause an immediate engine speed drop of approximately 200 rpm, 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 chambers and the probable difficulty is a plugged passage between the EGR valve and the intake manifold.

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

(1) Install a tee in the EGR vacuum signal line near EGR valve and connect vacuum gauge to tee.

(2) With engine at operating temperature, place your fingers lightly against EGR valve diaphragm and slowly accelerate the engine.

(3) Note vacuum indicated when the diaphragm first begins to move. Refer to EGR Valve Vacuum Signal Values tables.

(4) Continue accelerating engine and note vacuum required to completely depress diaphragm. If there is evidence of leakage, replace EGR valve.

EGR Valve Vacuum Signal Values

Vendor Part Number (Located on Valve)	AMC Part Number	Vacuum Required (Inches)	
		Open Start	Open (Max.)
7040176	3219052	2.8 to 3.2	7.0
7043589	3225951	1.8 to 2.2	5.0
17050471	3223980	1.8 to 2.2	5.5
17050472	3223981	1.8 to 2.2	5.0
7030881	3218739	2.9 to 3.2	9.0

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 exhaust back-pressure assembly, if used, should extend toward the left side on V-8 engines, toward the front of the car on six-cylinder 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 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-8 and 4A-9).

(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.

Removal—Six-Cylinder

(1) Drain coolant from radiator.

(2) Disconnect vacuum lines.

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

(3) Using 7/8-inch open-end wrench, remove 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.

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

(5) Using 7/8-inch open-end wrench, remove 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

Exhaust back-pressure sensors are used on all Jeep CJ models and on all vehicles sold in California. 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.

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 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

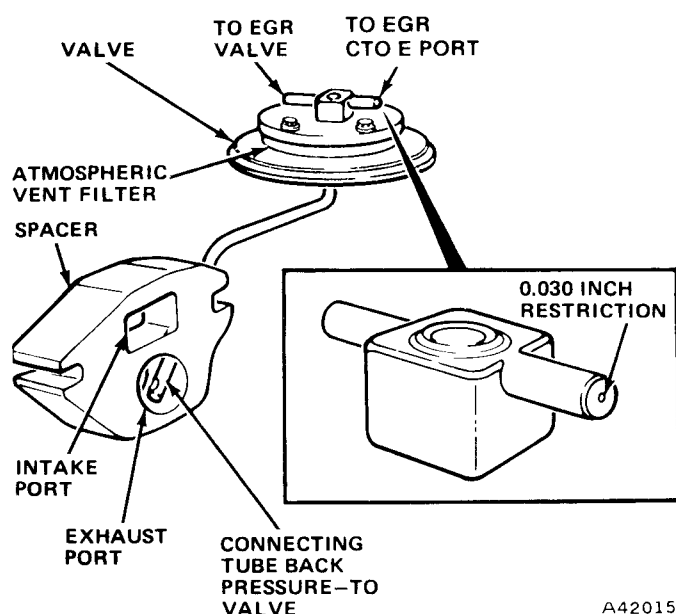


Fig. 4A-12 Exhaust Back-Pressure Sensor Six-Cylinder Shown

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 new 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 and toward the front of the vehicle on six-cylinder engines.

- (2) Install new 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.

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

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.

All heavy-duty California vehicles use the exhaust back-pressure sensor assembly without a restrictor plate.

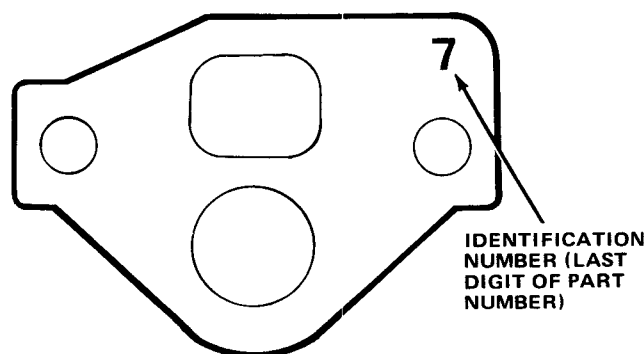


Fig. 4A-13 Restrictor Plate

EGR DELAY VALVE

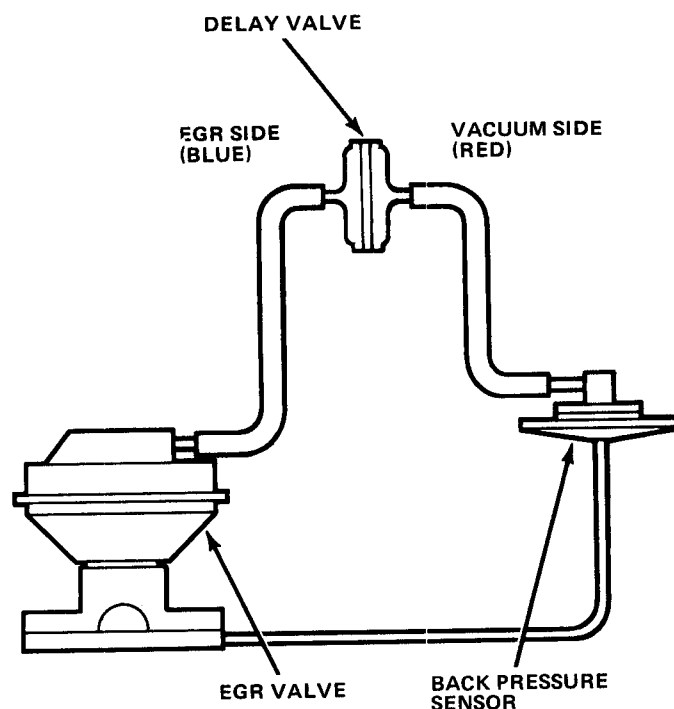
An EGR delay valve is used on models equipped with 360/401 CID engines and 4V carburetor. The delay valve is installed between the EGR valve and back-pressure sensor (fig. 4A-14) and delays the vacuum signal to the EGR valve to prevent stumble or hesitation on initial acceleration. The delay valve is color coded to prevent improper installation. The red side of the valve connects to the back-pressure sensor and the blue side connects to the EGR valve.

Delay Valve Test

Bypass the back-pressure sensor when performing this test as the sensor has a bleed which may give false readings.

- (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 vacuum 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.



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Fig. 4A-14 EGR Delay Valve

CATALYTIC CONVERTER

	Page		Page
Converter Operation.....	4A-16	General.....	4A-16
Catalyst Replacement Procedure.....	4A-17		

GENERAL

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

To avoid confusion, all CJ models are fitted with a fuel filler neck restrictor (refer to Fuel—Carburetion section) which admits only the smaller nozzles used for unleaded fuel.

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, present as a fine coating on beads of alumina.

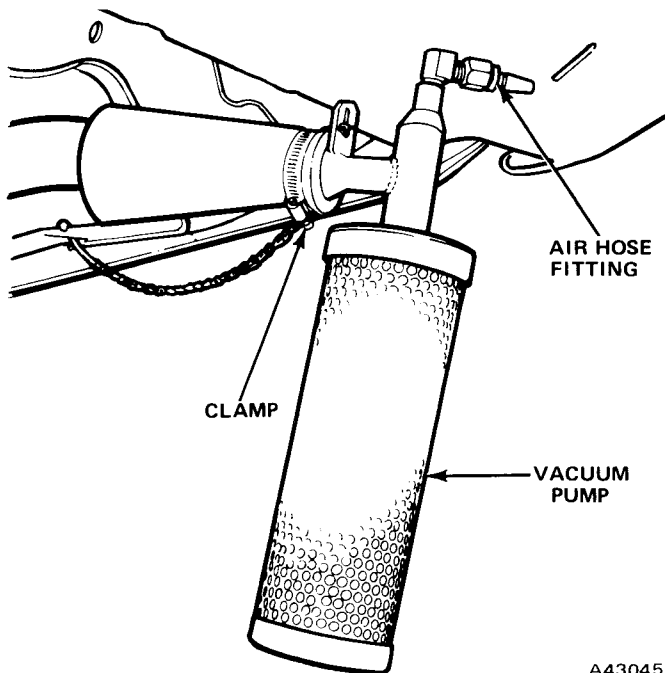
The temperature of the converter during this chemical reaction is somewhat higher than that of exhaust gases as they leave the engine, but insulation keeps the outside skin of the converter at about the same temperature as the muffler. Due to its solid mass, however, the catalytic converter stays hot much longer than the muffler.

The catalytic converter body is stainless steel which is designed to last the life of the car. Excessive heat can result in bulging or other distortion, but excessive heat is not the fault of the converter—the vehicle has

a carburetor or ignition problem permitting unburned fuel to enter the converter, producing excessive heat. If a converter is heat damaged, the ignition or carburetor problem 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

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



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Fig. 4A-15 Vacuum Pump

(7) Connect shop air hose to fitting on vibrator. Catalyst beads will fall into can for approximately 10 minutes.

(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.

NOTE: *If any beads come out of the tailpipe, the converter is defective and must be replaced.*

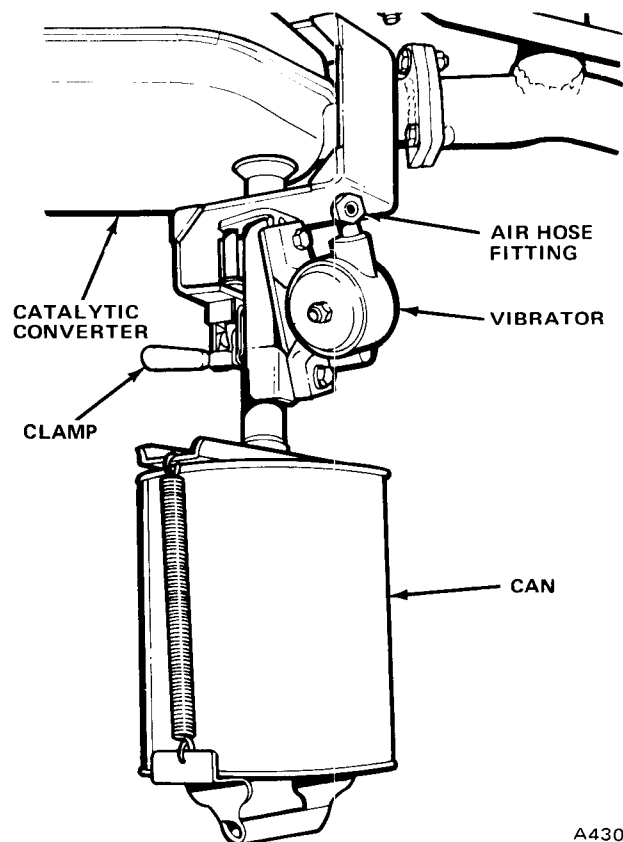
(11) When converter is full, remove shop air hose from vibrator and remove vibrator from converter.

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.



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Fig. 4A-16 Vibrator Tool

FUEL TANK VAPOR EMISSION CONTROL SYSTEM

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Fuel Tank Filter	4A-18
Fuel Tank Filler Cap	4A-18

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Fuel Vapor Storage Canister	4A-19
Liquid Check Valve	4A-19
Maintenance	4A-19

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). All other Nationwide vehicles do not have vent lines since they do not use a closed vent system.

FUEL TANK FILTER

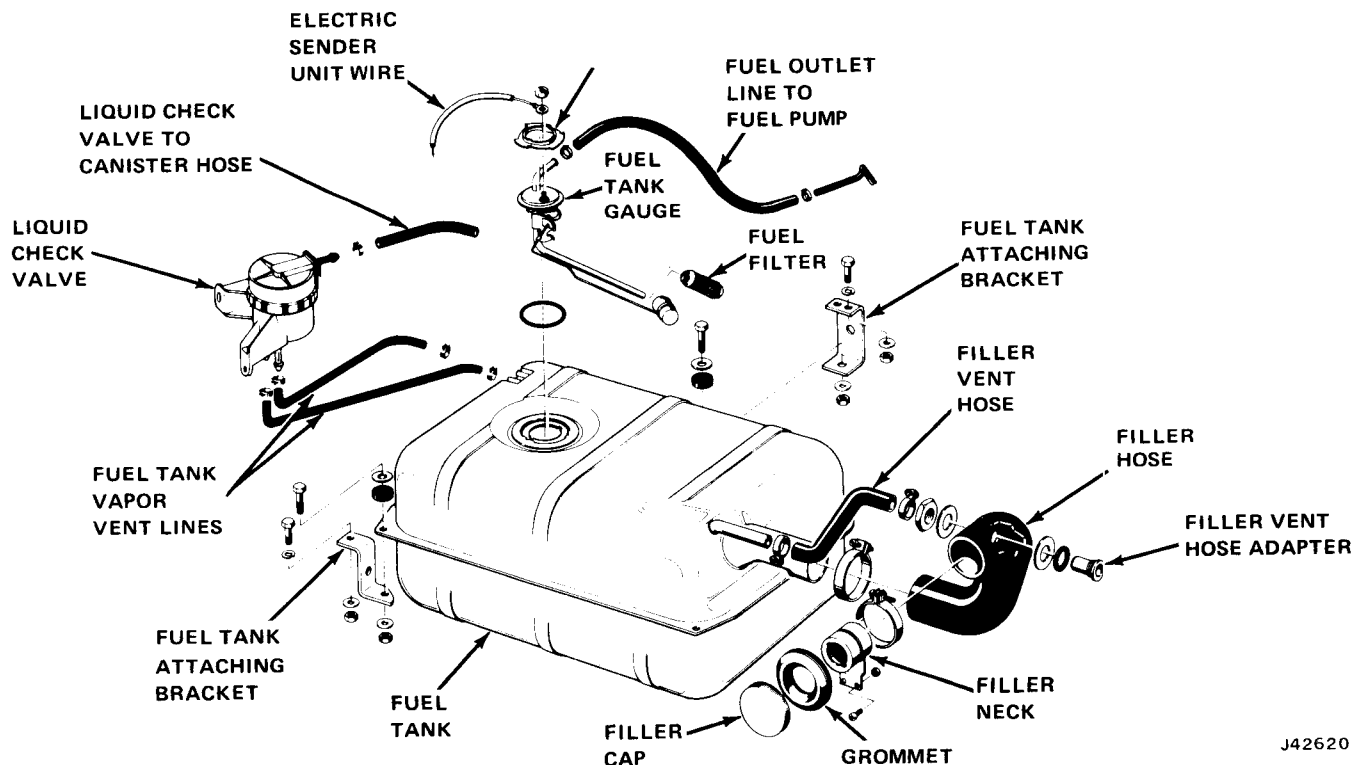
All vehicles use a woven Saran sleeve-type fuel filter which is attached to the end of the fuel outlet tube inside the fuel tank. This filter is rated at 65 micron and repels water. Under normal conditions it requires no maintenance or service.

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.

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

All other Nationwide vehicles use an externally vented cap.



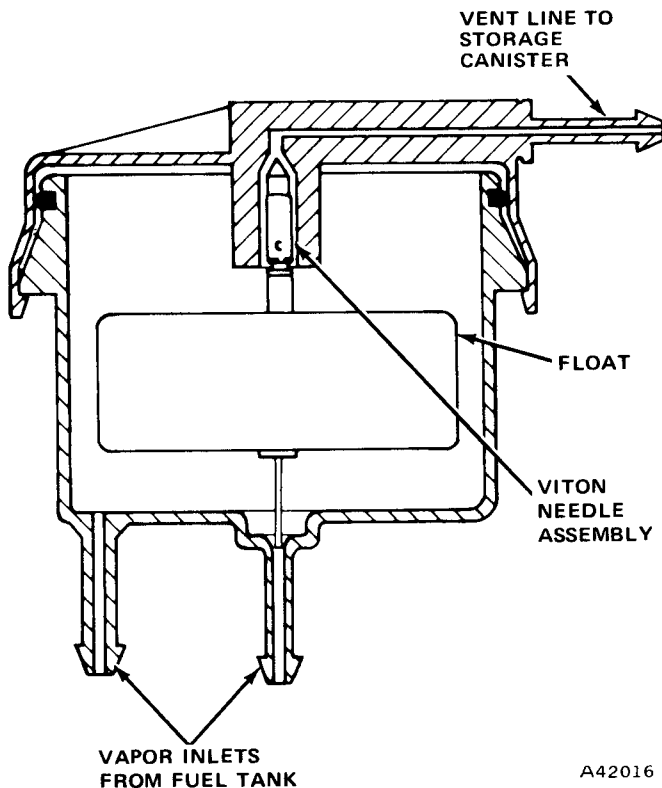
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Fig. 4A-17 Fuel Tank Vapor Emission System (Typical)

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; thereby 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.



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

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-19).

In 1976, 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

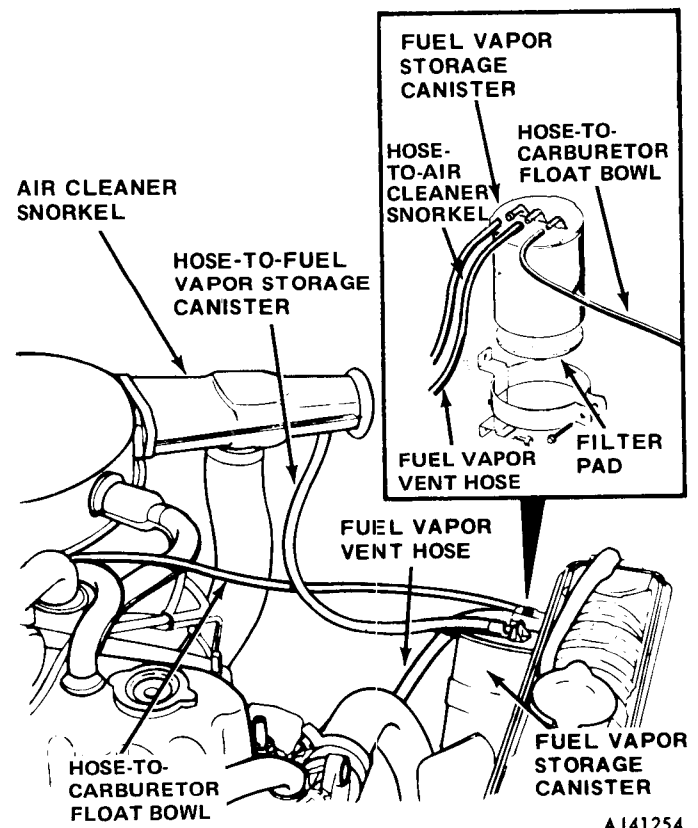
from the canister. The amount of vapor drawn is relative to air velocity passing through the air cleaner snorkel. The canister on six-cylinder engines and V-8 engines with 4V carburetors has three hose connections: one for the fuel tank vapor line, one for the carburetor float bowl, and one hose connected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

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.

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



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Fig. 4A-19 Fuel Vapor Storage Canister—Six-Cylinder Shown



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. It should be replaced at 15,000-mile intervals on Cherokee, Wagoneer, and Truck models and 30,000 miles on CJ models as prescribed in the Mechanical Maintenance Schedule, located in Section B of this manual.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

	Page
General	4A-20
PCV Air Inlet Filter	4A-21

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PCV Valve Flow Chart	4A-22
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-20). The oil filler cap is closed in this system to prevent any crankcase vapors from entering the atmosphere.

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-21). 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-22).

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.

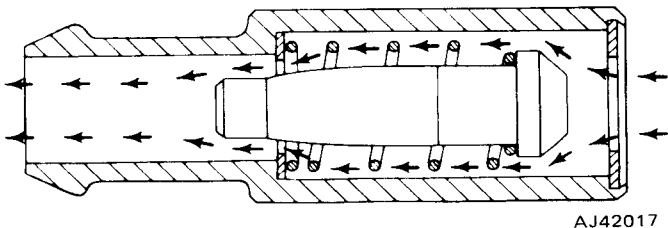


Fig. 4A-20 Positive Crankcase Ventilation Valve Flow

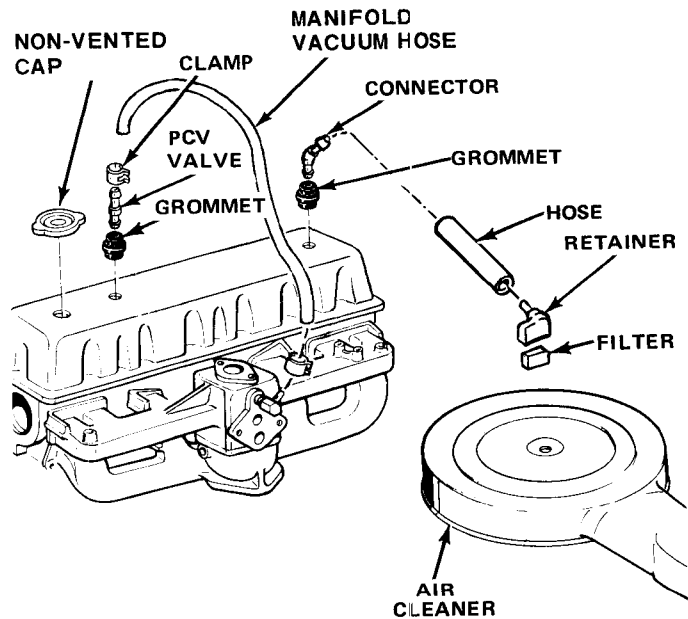


Fig. 4A-21 PCV System—Six-Cylinder

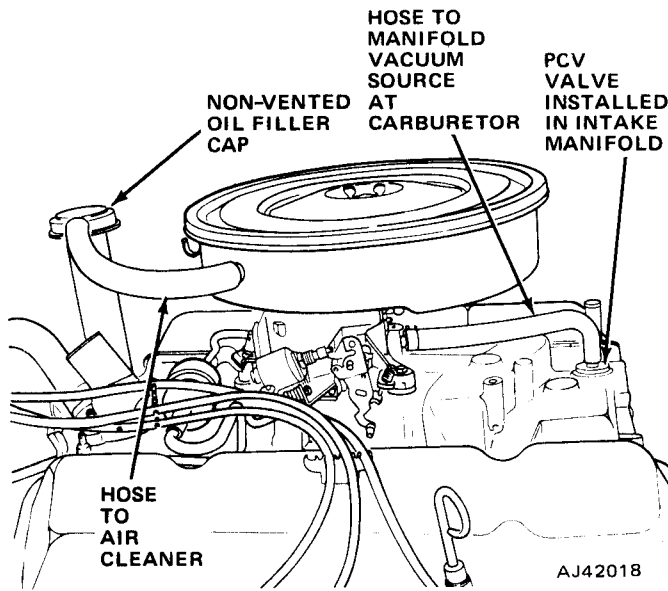


Fig. 4A-22 PCV System—V-8

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.

The PCV valve must be replaced at 15,000-mile intervals on Cherokee, Wagoneer, and truck models and 30,000-mile intervals on CJ models as 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-23).

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.

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

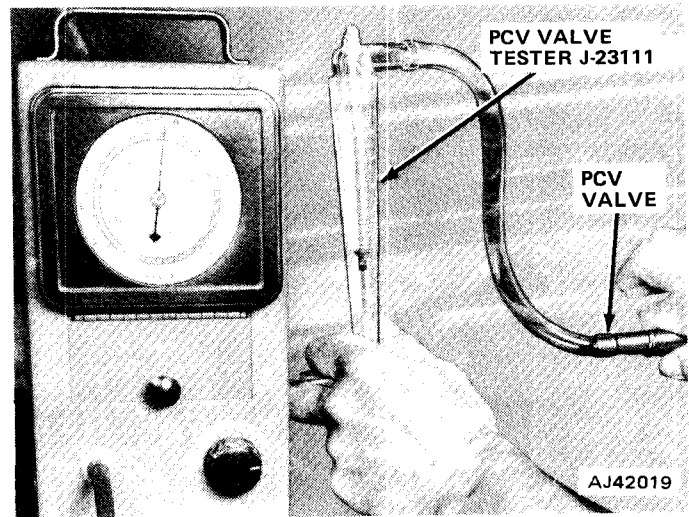


Fig. 4A-23 PCV Valve Test

PCV VALVE FLOW CHART

ENGINE MANIFOLD VACUUM (In. Hg.)	Air Flow (CFM)	
	Black Valve	Silver Valve
20	1.35-1.65	1.3-1.7
18	1.35-1.65	1.3-1.7
16	1.35-1.65	1.3-1.7
14	1.35-1.65	1.3-1.7
12	1.35-2.2	1.3-1.7
10	1.8 -2.9	1.3-1.7
8	2.5 -3.5	1.3-1.7
6	2.9 -4.0	1.3-1.7
3	3.3 -4.4	1.7

PCV AIR INLET FILTER MAINTENANCE

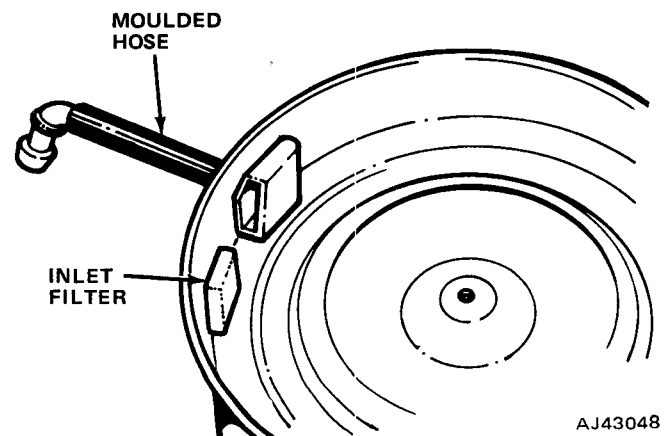


Fig. 4A-24 PCV Air Inlet Filter—Six-Cylinder

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-24). 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.

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-25).

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, 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.

TAC Operational Test—Six-Cylinder

(1) Remove air cleaner top half and immerse snorkel in cold water, making certain thermostat unit is covered.

(2) Place a thermometer in water and observe the temperature while heating water slowly.

NOTE: With water temperature at 105°F 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.

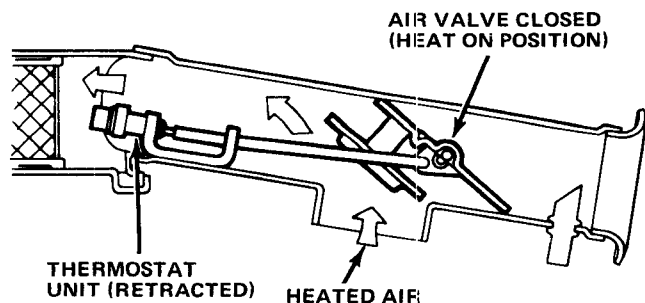
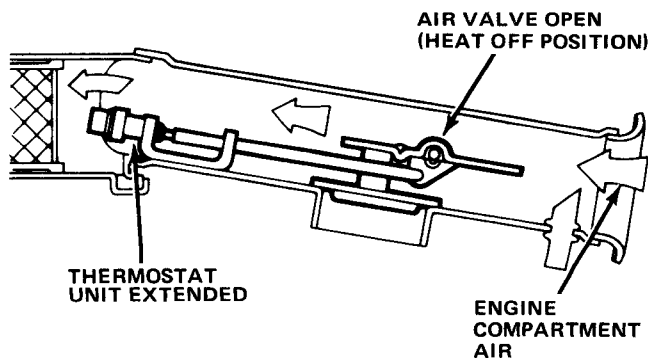


Fig. 4A-25 TAC System—Six-Cylinder

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-26).

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, vacuum motor linkage disconnected, vacuum

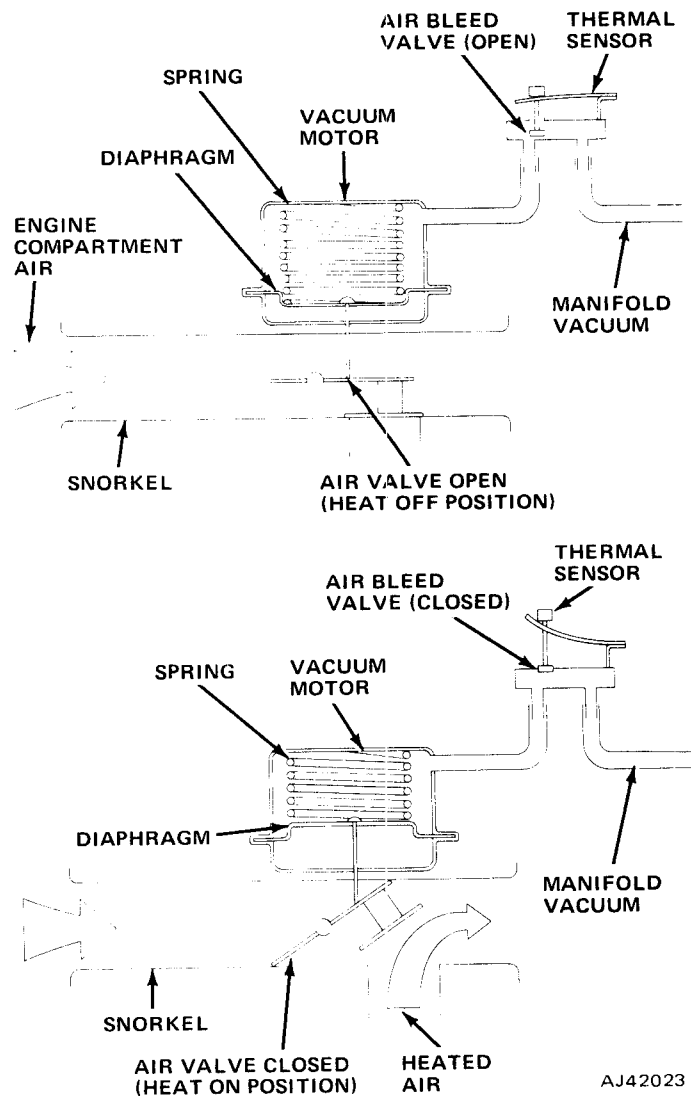


Fig. 4A-26 TAC System—V-8

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 Nationwide and 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-27).

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.

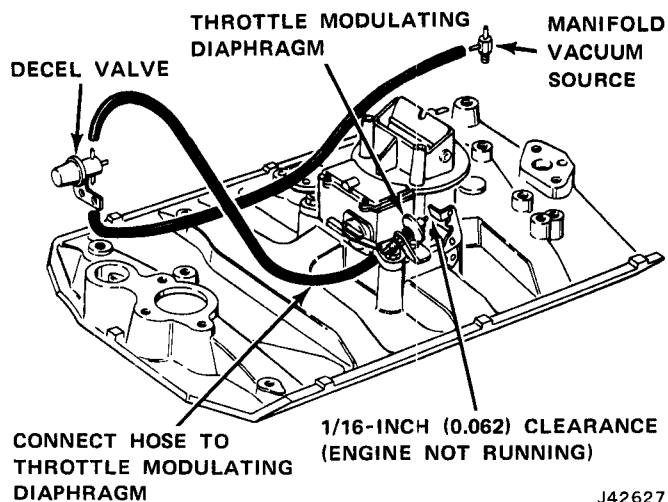


Fig. 4A-27 Vacuum Throttle Modulating System

TRANSMISSION CONTROLLED SPARK (TCS) SYSTEM

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Solenoid Control Switch	4A-24
Solenoid Vacuum Valve	4A-24

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-28 and 4A-29). This system is used only on California CJ models.

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 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 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 in relation to vehicle speed or gear range. At speeds above 32 to 36 mph

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(automatic transmission) or high gear (manual transmission), the switch opens and breaks the ground circuit to the solenoid vacuum valve.

At speeds under 32 to 36 mph (automatic transmission) or lower gear ranges (manual transmission), the switch is closed and completes the ground circuit to the solenoid vacuum valve.

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 firewall. The switch is operated by speedometer cable rpm. The cable attaches to both ends of the switch. At 32 to 36 mph (533 to 599 cable rpm), the switch will open the ground circuit.

TCS TEST

A vacuum gauge, probe-type test lamp, and a jumper wire are used to check the operation of the TCS system.

- (1) Turn ignition switch on.
- (2) Disconnect wire connector from solenoid vacuum valve.
- (3) Connect wire lead of test lamp to ground.

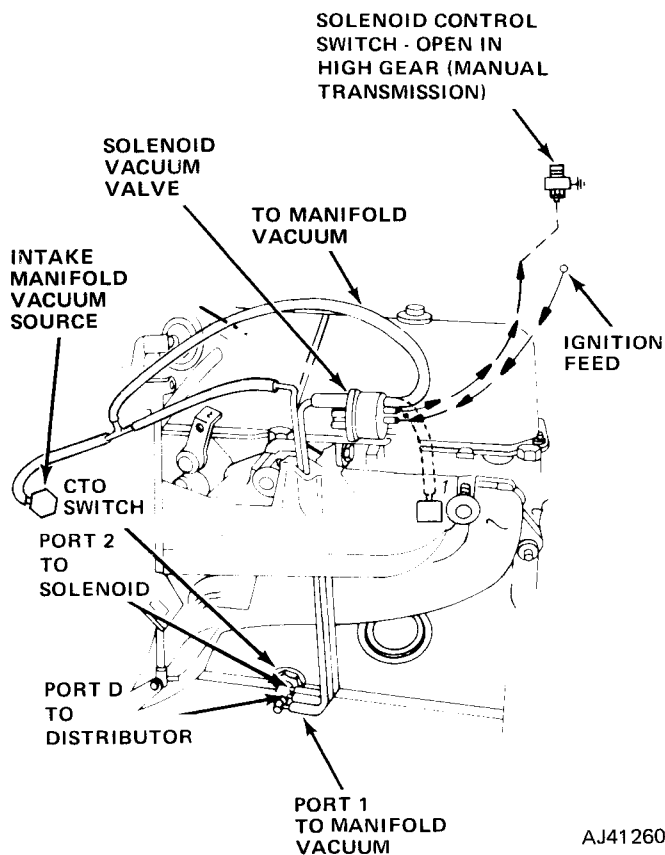


Fig. 4A-28 TCS System—Six-Cylinder

(4) Touch probe end of test lamp to each terminal of connector. Test lamp should light at one of the terminals; if not, ignition feed portion of TCS system is defective.

(5) Connect wire lead of test lamp to battery positive post.

NOTE: Manual transmission equipped vehicles must be in neutral to begin step (6).

(6) Touch probe end of test lamp to solenoid vacuum valve ground wire terminal at connector (opposite the terminal which caused test lamp to light in step (4) (Test No. 1). Test lamp should light; if not, use the following procedure.

(a) Disconnect wire at solenoid control switch.

(b) Using a jumper wire, connect one end to switch wire connector and other end to ground (Test No. 2).

(c) If test lamp lights when solenoid control switch wire is grounded with jumper wire, solenoid control switch is defective. If test lamp does not light, solenoid control switch wire is defective.

(7) Disconnect vacuum line from vent side of solenoid vacuum valve.

(a) Using a vacuum gauge, connect gauge to solenoid vacuum valve where hose was disconnected.

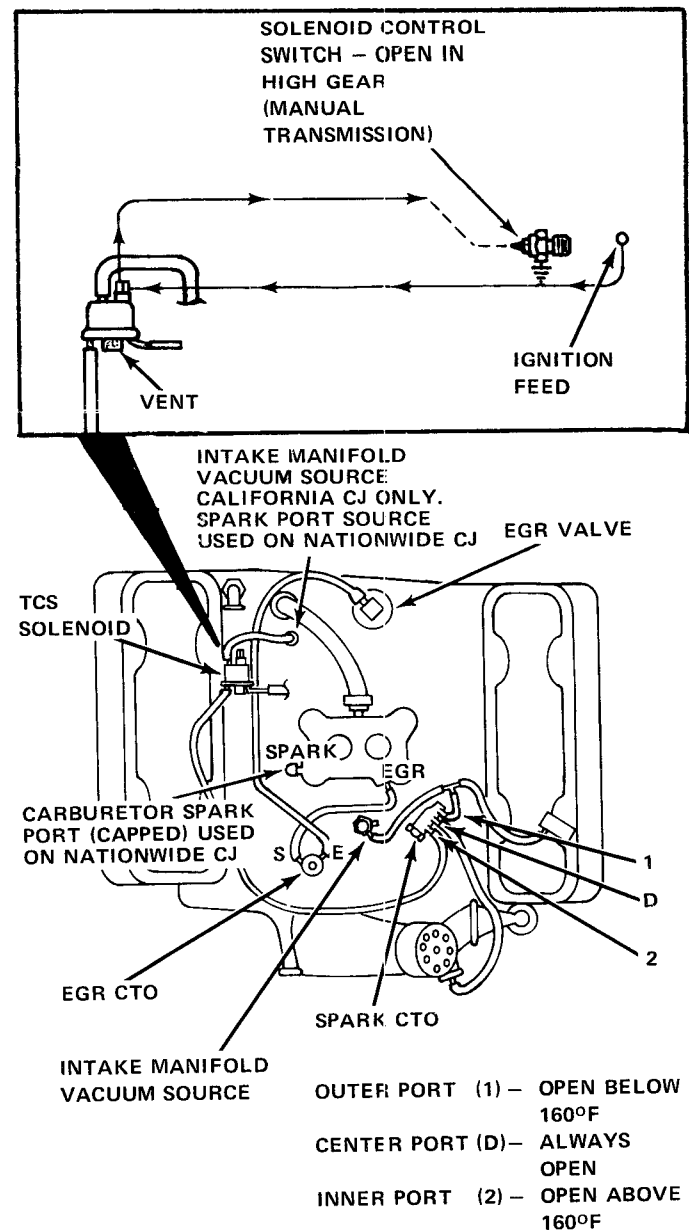


Fig. 4A-29 TCS System—V-8

(b) Start engine. With solenoid vacuum valve attached, no vacuum should be indicated; otherwise, replace solenoid vacuum valve.

(c) Disconnect wires from solenoid vacuum valve. Ported vacuum should be indicated; if not, replace solenoid vacuum valve.

(8) Manual transmission equipped:

(a) Place gear selector in high gear.

(b) Test lamp should go out; if not, solenoid control switch is defective.

(9) Automatic transmission equipped:

(a) Raise and support vehicle so that rear wheels are free to rotate.

(b) Disconnect solenoid control switch wire. Connect wire lead of test lamp to solenoid control

switch wire male connector. Touch probe end of test lamp to switch wire female connector (Test No. 3).

(c) Start engine. Test lamp should light; if not, solenoid control switch is defective.

(d) Slowly accelerate engine 32 to 36 mph, test lamp should go out. If test lamp goes out at a speed outside of this range, switch should be replaced.

NOTE: With decreasing speed, the solenoid control switch will close the ground circuit at 22 to 28 mph (366 to 466 cable rpm). Make tests while increasing speed or accelerating engine only.

(10) Stop engine.

(11) Reconnect wire connector to solenoid control switch and lower vehicle.

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 driveability 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 thereby routed to the distributor vacuum advance diaphragm (fig. 4A-31).

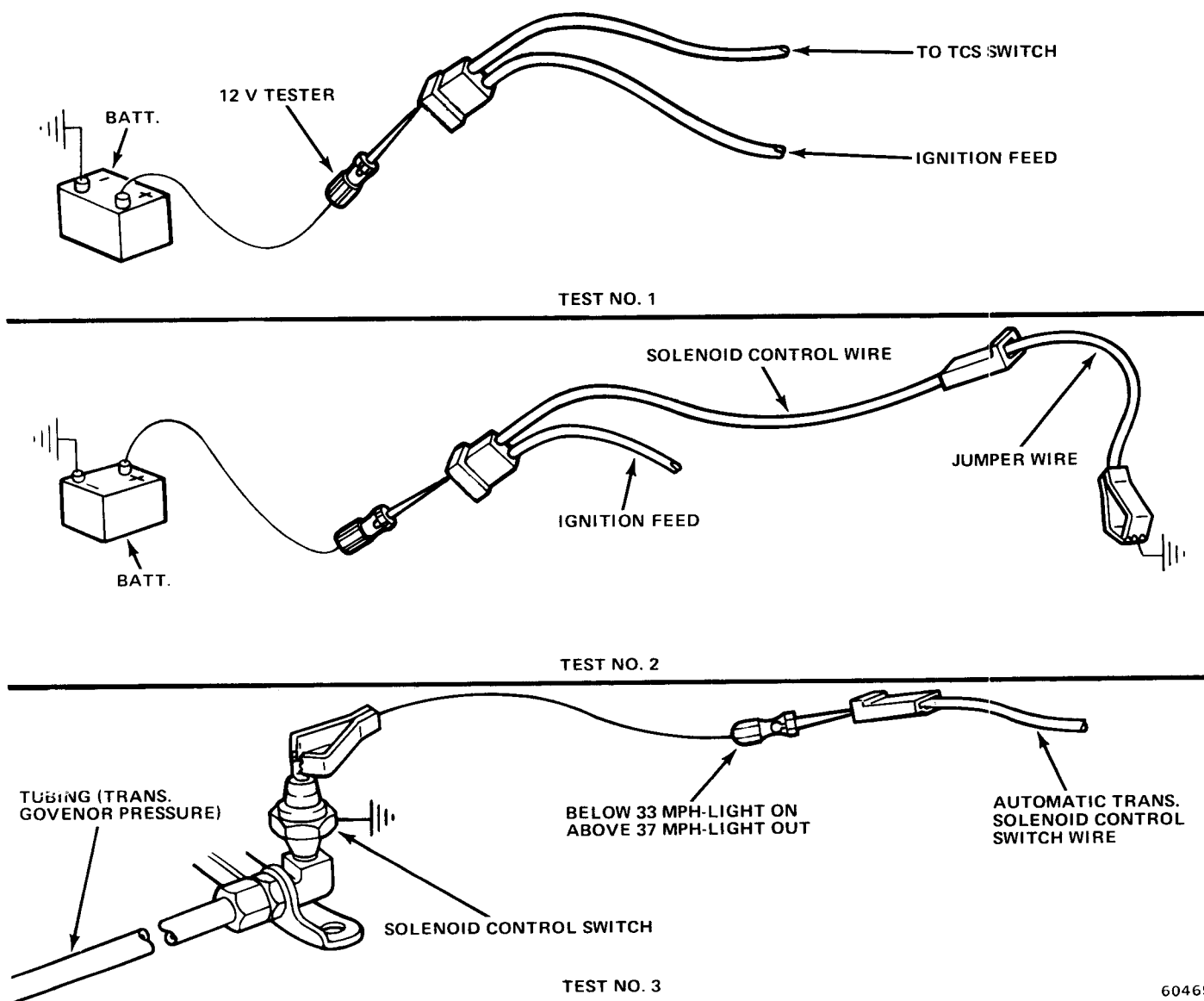
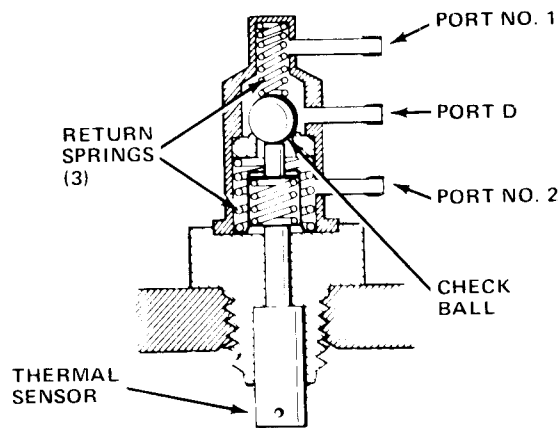


Fig. 4A-30 TCS System Test



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Fig. 4A-31 Spark CTO

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.

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; otherwise, replace CTO.

(9) Reconnect vacuum lines to CTO.

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) Drain coolant from radiator.

(2) Connect vacuum lines to switch.

(3) Install coolant.

Removal—V-8 Engine

(1) Drain coolant from radiator.

(2) Remove air cleaner 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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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.



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.

SCHEDULED ROUTINE SERVICES

At 5-10-20-25-35-40-50-55-65-70-80-85-95-100,000 miles

Heat Valve (exhaust manifold)—inspect and lubricate

Drive Belts—inspect condition and tension and correct if required

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

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

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-32). 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-33).

Spark Plug Condition

Refer to figure 4A-32.

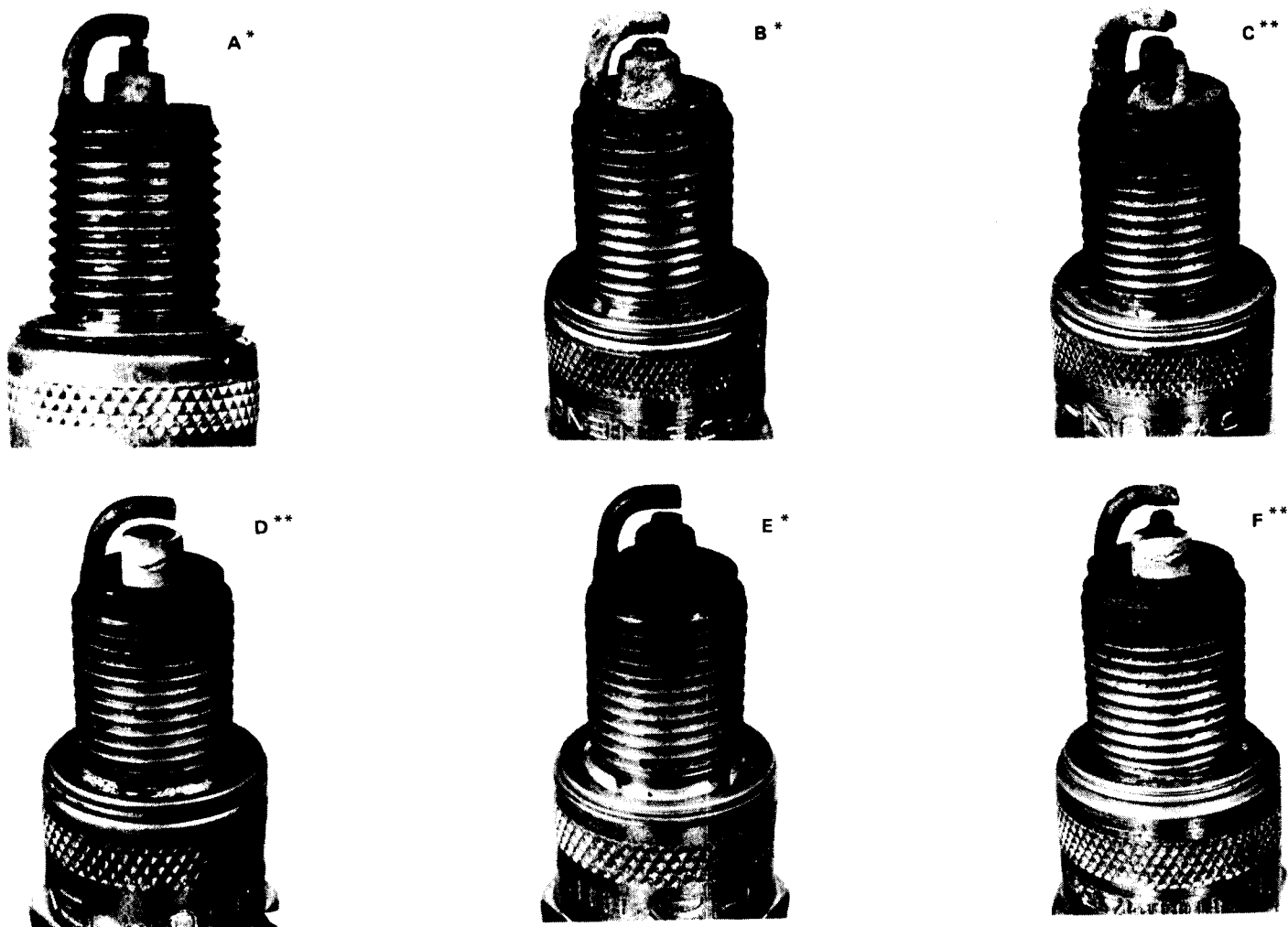
Gap Bridging—(A)—May be traced to flying deposits in the combustion chamber. In a few cases,

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.

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.



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* LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED
 **REPLACE

Fig. 4A-32 Spark Plug Conditions

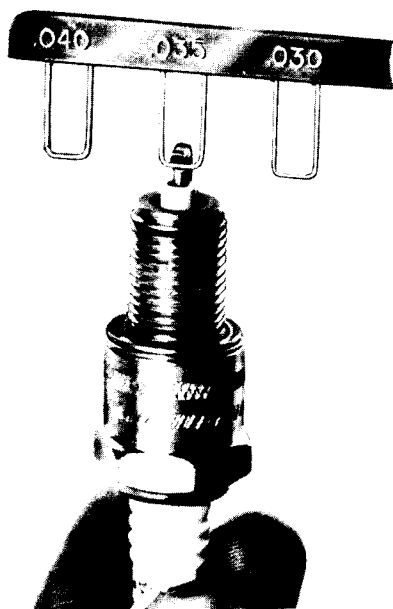


Fig. 4A-33 Spark Plug Gap Check

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.

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.

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

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.

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

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. 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.**

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. 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 chain 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-34 and 4A-35.

Timing Procedure

- (1) Disconnect distributor vacuum hose.
- (2) Connect an ignition timing light and a 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.
- (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 Test Procedure

NOTE: *Distributor advance may also be tested with the distributor out of the vehicle. Follow testing equipment manufacturer's instructions. Refer to Distributor Specifications (On Distributor Tester).*

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.

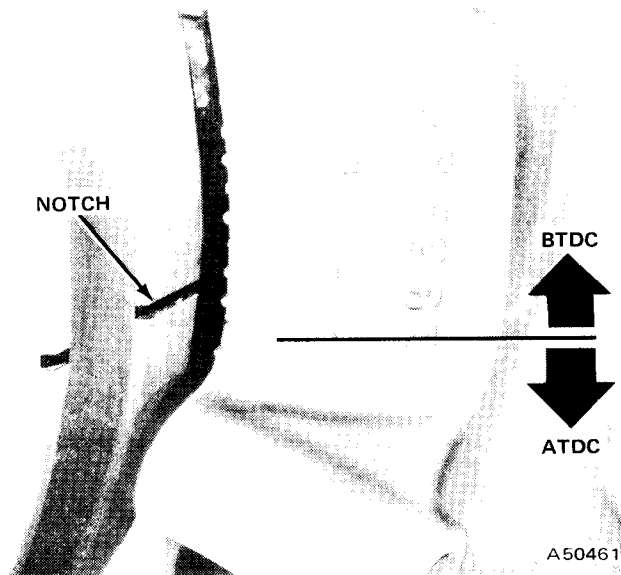


Fig. 4A-34 Timing Mark Location—Six-Cylinder

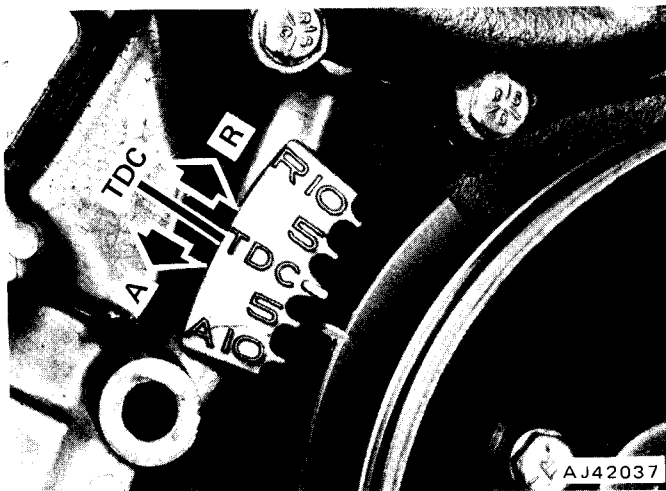


Fig. 4A-35 Timing Mark Location—V-8

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

Scope Diagnosis Pattern Chart

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.

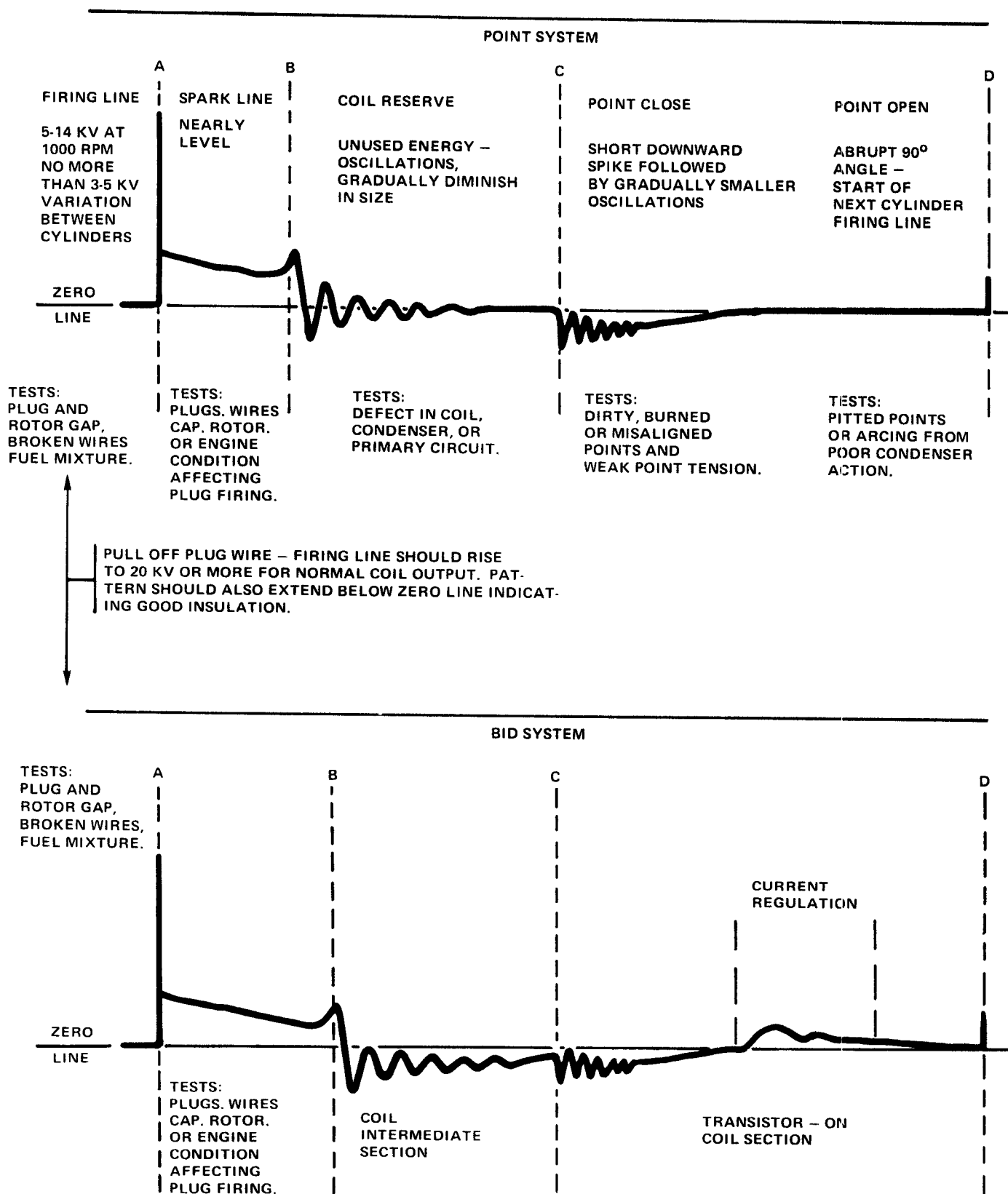
Other than the difference described, scope ignition diagnosis procedures for point and BID systems is essentially the same.

CARBURETION

Engine Idle Speed and Mixture Setting Procedures

The engine and related systems must be performing properly prior to marking 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-37, -38, and -39).

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.



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Fig. 4A-36 Diagnosis Pattern Chart

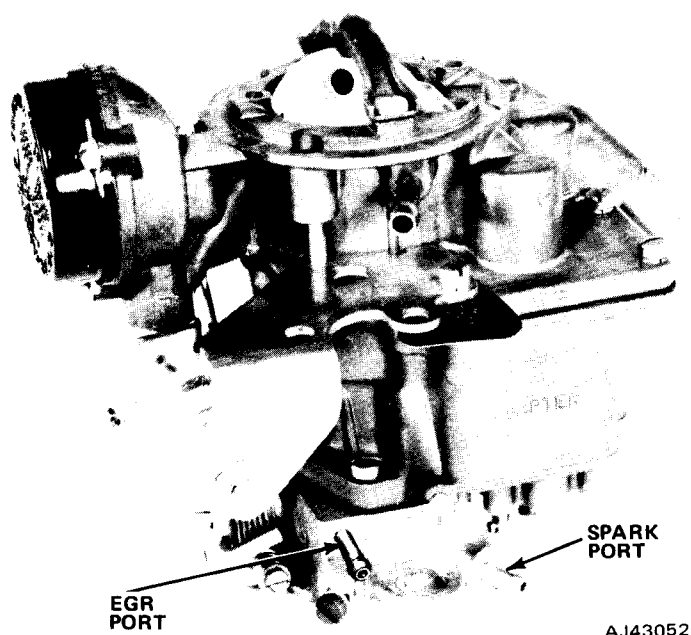


Fig. 4A-37 Model YF Carburetor

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.

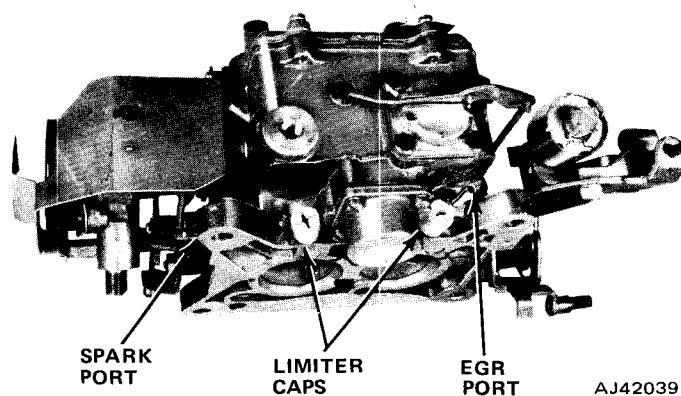


Fig. 4A-38 Model 2100 Carburetor

Tachometer Procedure

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.

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. Discard the cap(s).

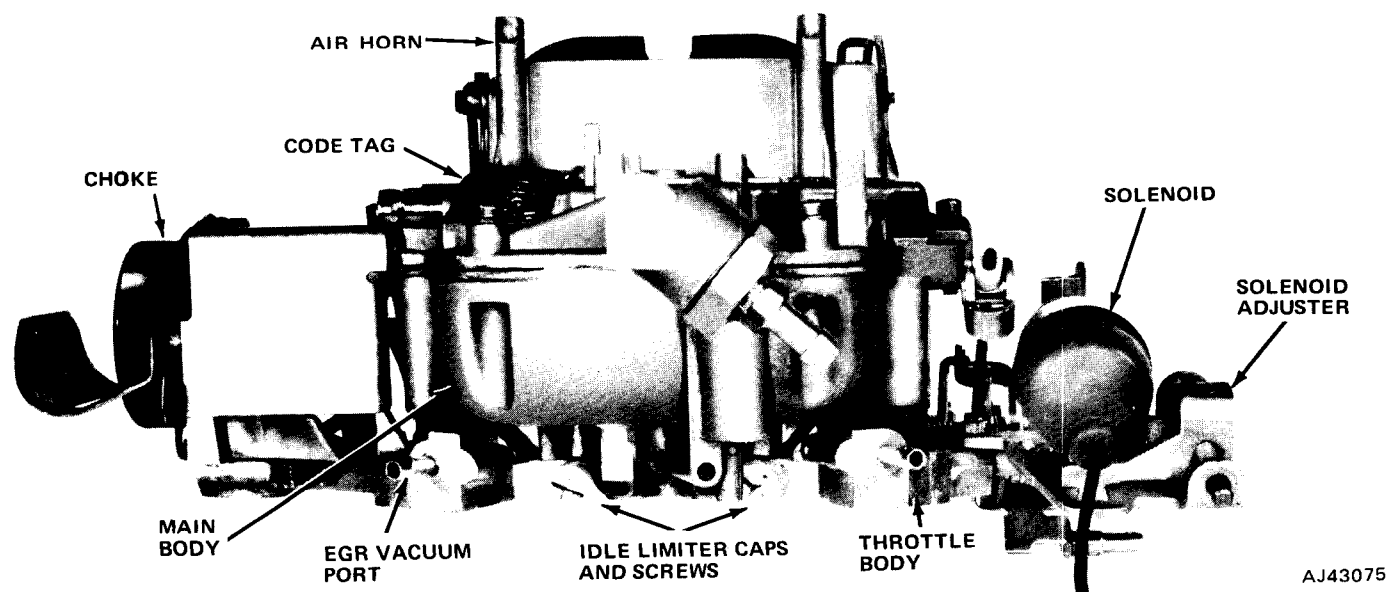


Fig. 4A-39 Model 4350 Carburetor

(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 to 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 the following specified rpm.

- **Six-Cylinder:** Automatic—550 rpm in drive—Nationwide, 700 rpm in Drive (California).
- **Six-Cylinder:** Manual—600 rpm in neutral—CJ Models, 650 rpm in Neutral, Cherokee, Wagoneer, Truck.
- **V-8 Engine:** Automatic—700 rpm in drive
- **V-8 Engine:** Manual—750 rpm in neutral

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 curb idle speed screw to obtain 500 rpm.

(d) Connect solenoid wire.

Engine	Transmission	RPM Drop
232-258	Manual W/Catalytic Converter	50 rpm
258	Automatic W/Catalytic Converter	25 rpm
CJ V-8's	Manual	100 rpm
CJ V-8's	Automatic	20 rpm
Cke, Wag, Trk, V-8 and 6-cylinder	All	Lean best idle

(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.

(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.

(9) Install new (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 in Drive

Six-Cylinder: Manual—600 rpm

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

Engine Idle CO Level

Six-Cylinder Automatic.....1.0% max
Six-Cylinder Manual.....1% to 2%

(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.

Dashpot Adjustment

Six-cylinder vehicles without the throttle stop solenoid are equipped with a dashpot assembly. For required adjustment, refer to Section 4—Fuel—Carburetion.

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, driveability and especially emission levels.

This valve is to be inspected for correct operation and lubricated with Jeep Heat Valve Lubricant, or equivalent, every 5000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models. Refer to the Exhaust section for service procedures.

EXHAUST SYSTEMS

	Page		Page
General	4A-35	Exhaust Manifold Heat Valve	4A-35

GENERAL

The basic exhaust system on all vehicles consists of a front exhaust pipe, muffler, and tailpipe. Refer to figures 4A-40, 4A-41, 4A-42, and 4A-43 for exhaust system components.

All CJ models with V-8 engines are equipped with a catalytic converter.

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 en-

gine warmup. The valve is closed, directing exhaust heat to the intake manifold when the counterweight is in the extreme counterclockwise position when viewed from the counterweight end (fig. 4A-46). As the engine reaches operating temperature, the thermostatic spring heats up and loses tension, allowing counterweight to open the valve (fig. 4A-47).

The manifold heat valve must operate freely and should be checked and lubricated every 5,000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models with Jeep Heat Valve Lubricant, or equivalent.

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.

(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.

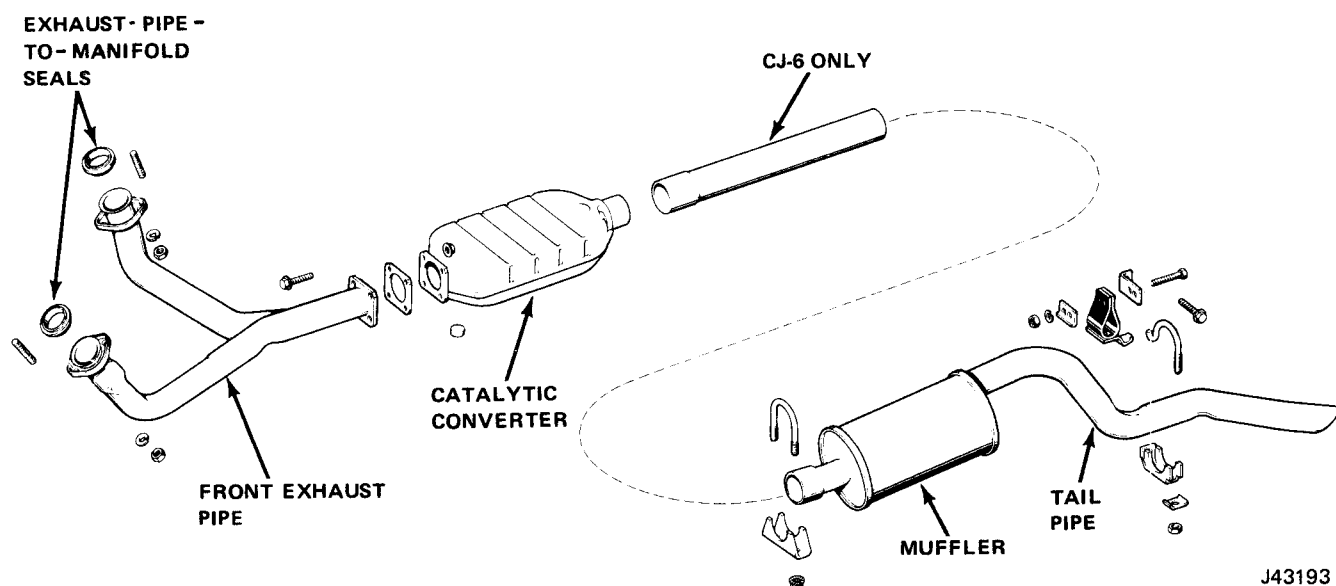


Fig. 4A-40 Exhaust System—CJ-5/CJ-7—V-8 Engine

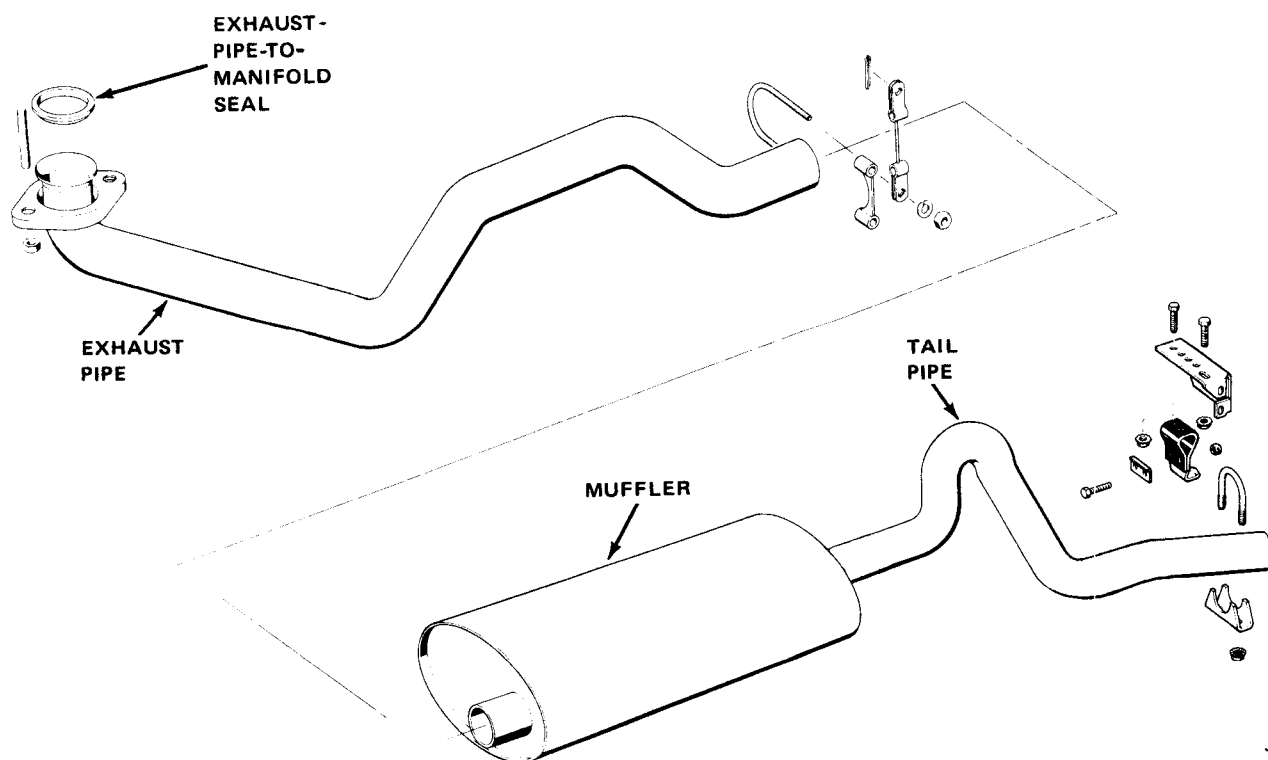
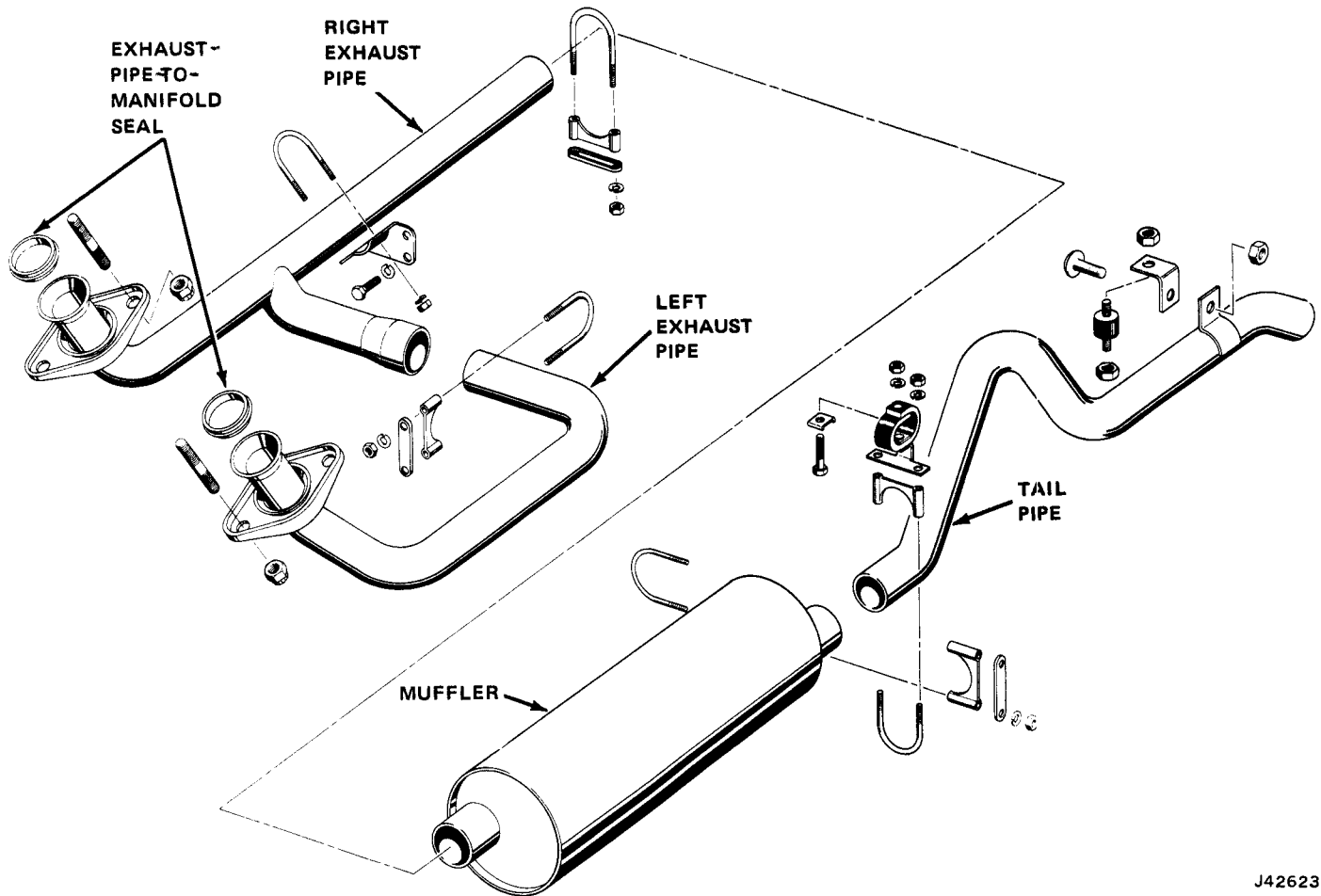
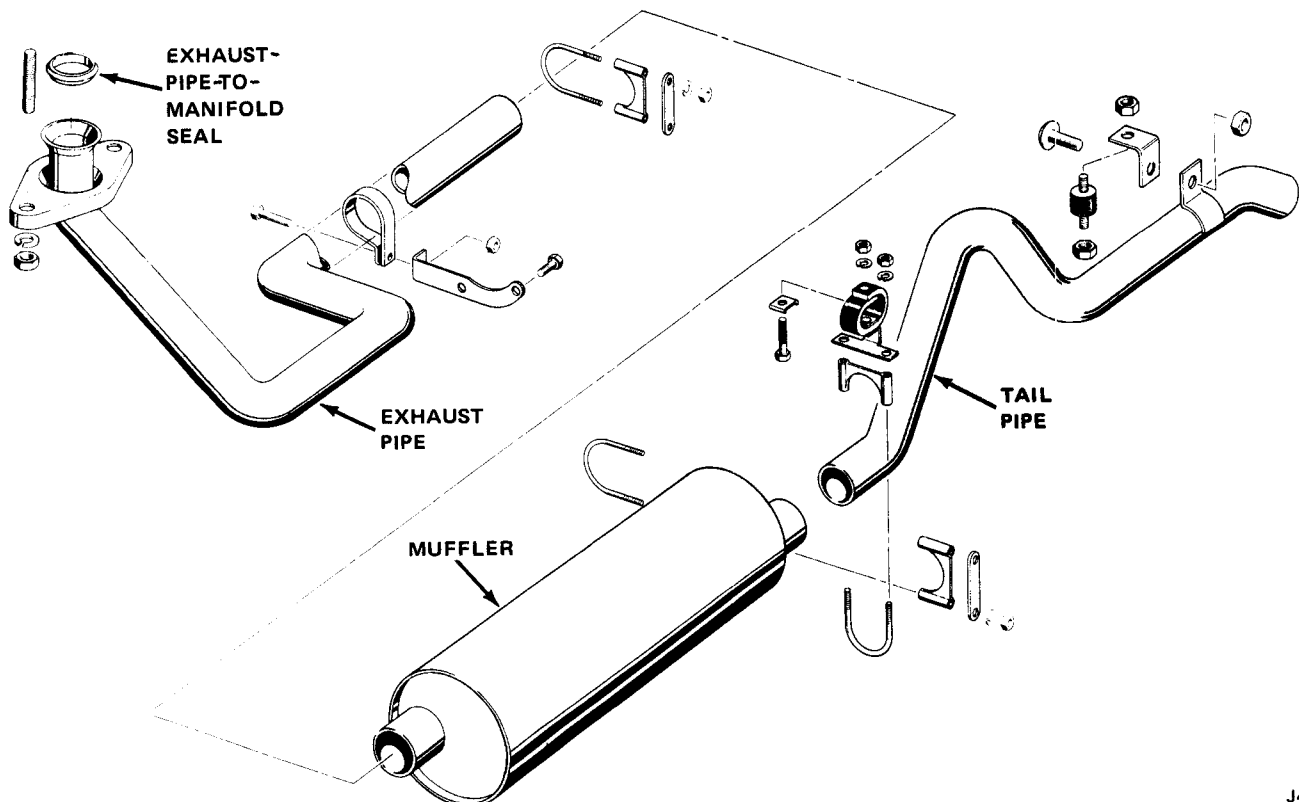


Fig. 4A-41 Exhaust System—CJ-5/CJ-7—Six-Cylinder Engine



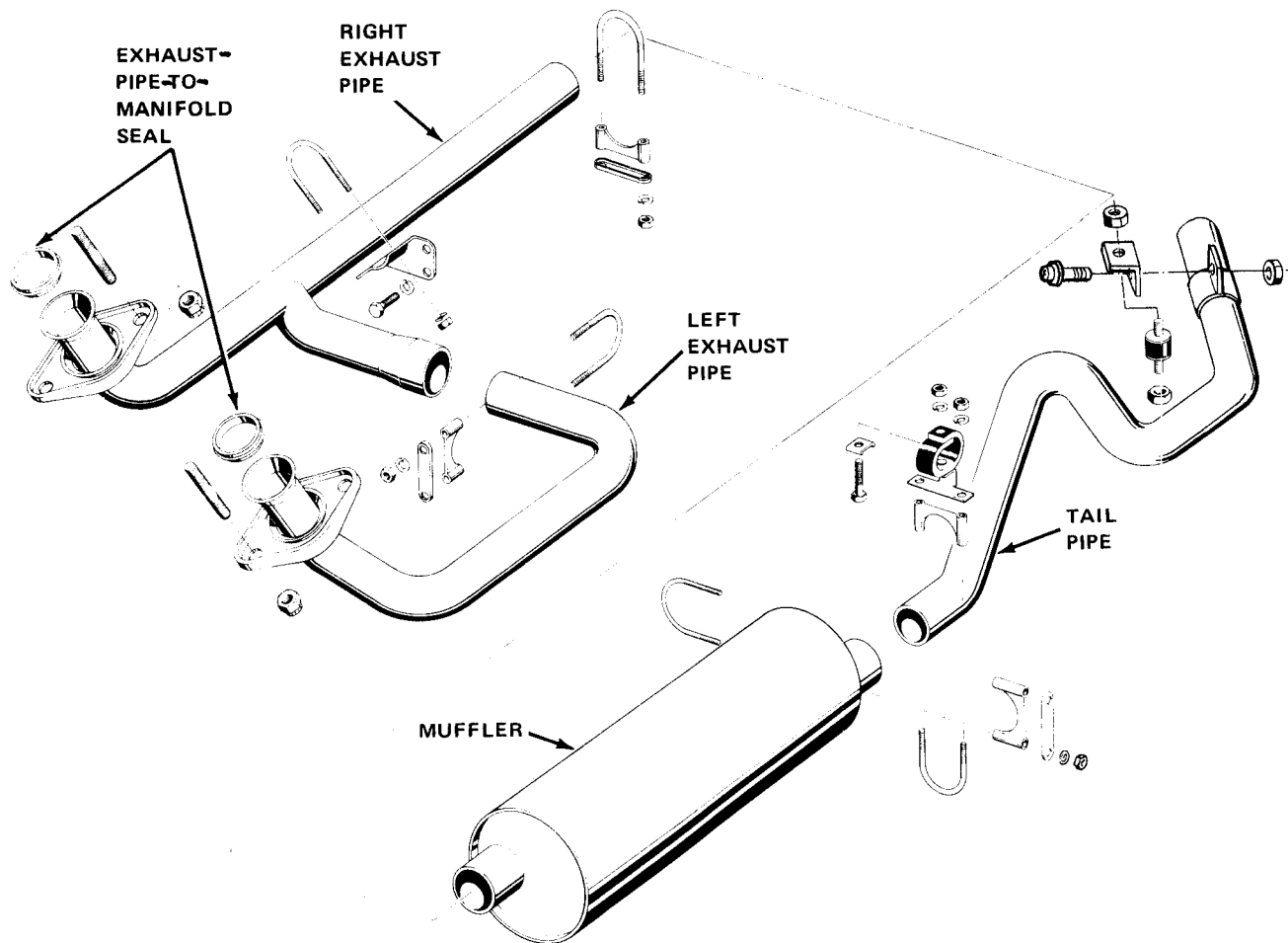
J42623

Fig. 4A-42 Exhaust System—Truck—V-8 Engine



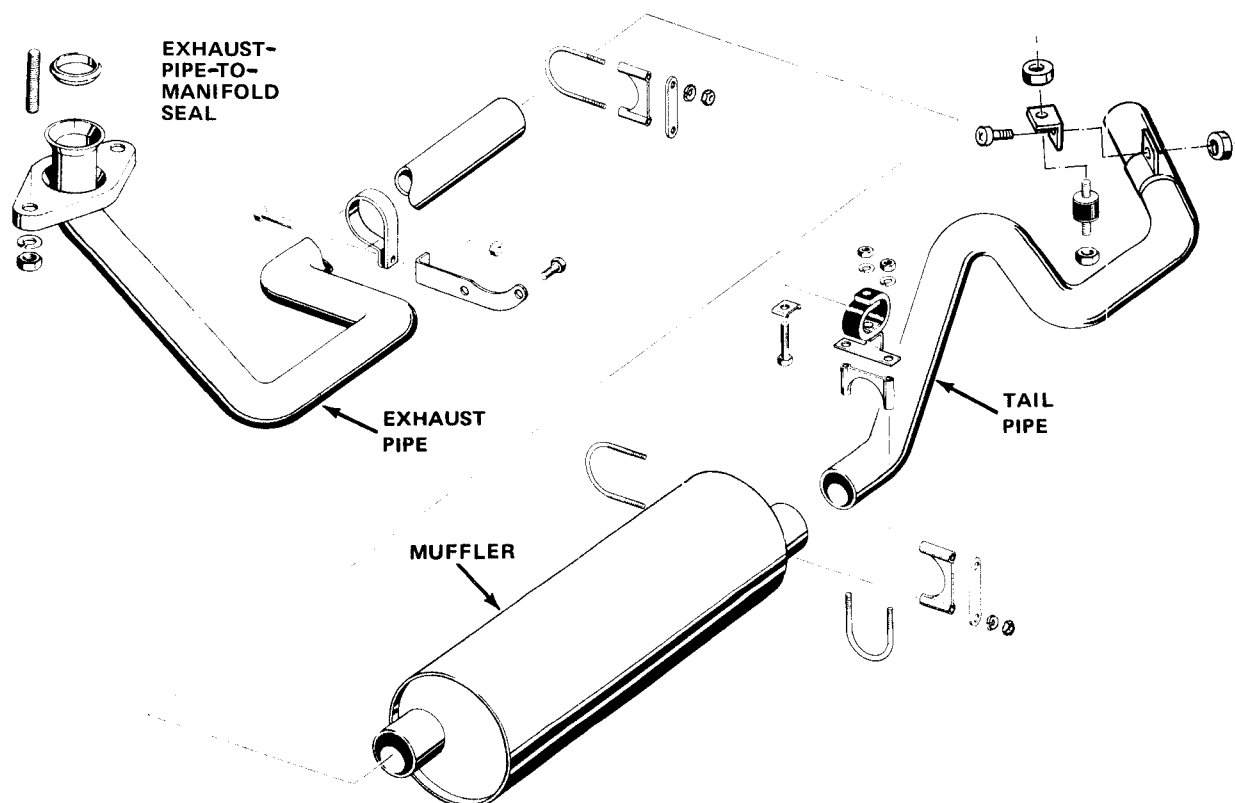
J42621

Fig. 4A-43 Exhaust System—Truck—Six-Cylinder Engine



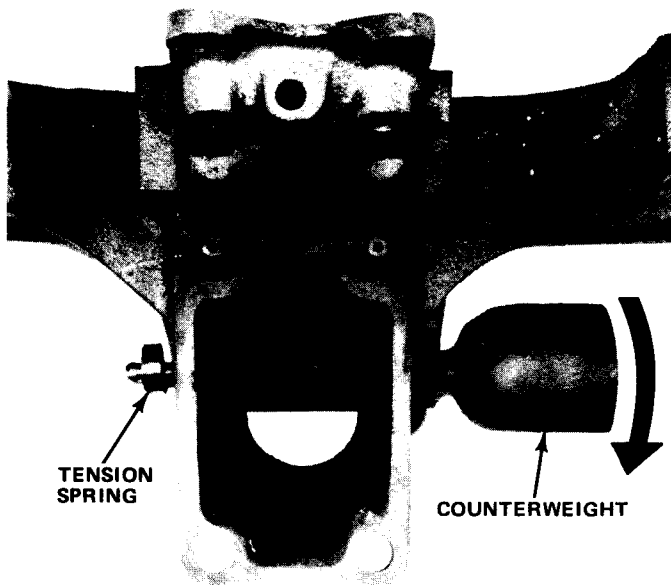
J43190

Fig. 4A-44 Exhaust System—Cherokee-Wagoneer—V-8 Engine



J43189

Fig. 4A-45 Exhaust System—Cherokee-Wagoneer—Six-Cylinder Engine



AJ43059

Fig. 4A-46 Heat Valve in Closed Position—Six-Cylinder

(6) Position heat valve as shown in figure 4A-46 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.

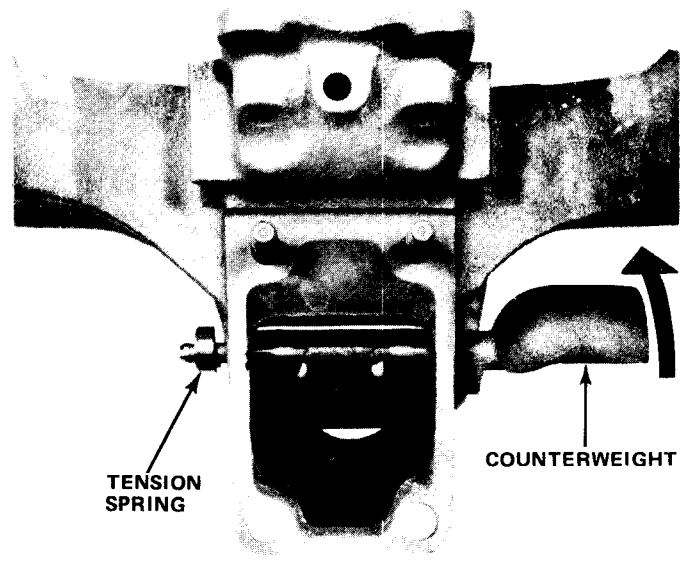
(11) Hold shaft and move valve as far as possible from counterweight. Tighten retaining screw.

(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-48). 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.



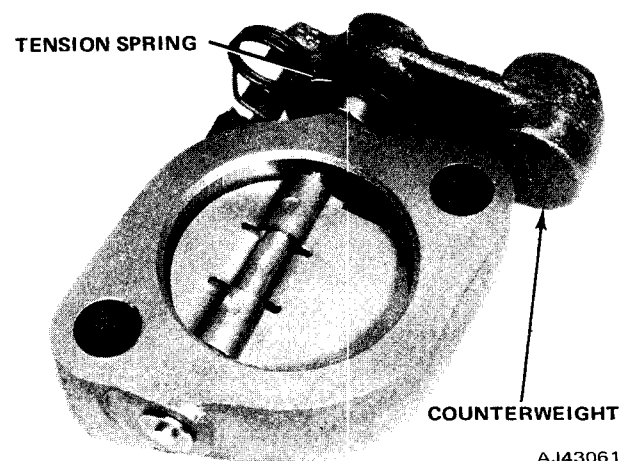
43060

Fig. 4A-47 Heat Valve in Open Position—Six-Cylinder

The manifold heat valve must operate freely and should be checked and lubricated every 5,000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models with Jeep Heat Valve Lubricant, or equivalent.

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.



AJ43061

Fig. 4A-48 Exhaust Manifold Heat Valve—V-8



Jeep Tuneup Specifications (On Vehicle)

Engine CID	Transmission	Initial Timing @700 RPM Or Less With Vacuum Hose Disconnected		Curb Idle Speed RPM		Distributor Model Number	Vacuum Unit Number	Total Advance @2000 RPM ②	Centrifugal Advance		Spark Plugs
		Set-To	OK Range	Set-To	OK Range				Degrees	RPM	
232	Manual	8°	6°-10°	600	500-700	3227331	8125438	22°-30°	0 - 0.3 4.0 - 8.0 8.0 - 12.0 9.3 - 13.3	1000 1500 2000 3000	N12Y GAP .033- .037 Inch
258	Auto	8°	6°-10°	550 ① 700 Calif.	450-650 600-800	3227331	8125438	22°-30°	0 - 0.8 4.0 - 8.0 8.0 - 12.0 9.3 - 13.3	1000 1500 2000 3000	
	Manual	6°	4°-8°	600 ③ 600 Calif.	500-700 500-700						
304	Auto	10°	8°-12°	700 ①	600-800	3228263	8125437	21.4°-29.5°	0 - 5.6 5.6 - 9.7 8.4 - 12.5 14.1 - 18.7	1000 1500 2000 3000	
	Manual	5°	3°-7°	750	650-850	3228264	8125436	25.6°-33.6°	0 - 4.8 6.8 - 12.8 12.6 - 16.6 18.6 - 22.6	1000 1500 2000 3000	
304 Calif.	Auto	5°	3°-7°	700 ①	600-800	3228264	8125436	25.6°-33.6°	0 - 4.8 6.8 - 12.8 12.6 - 16.6 18.6 - 22.6	1000 1500 2000 3000	
	Manual			750	650-850						
360/401	Auto	8°	6°-10°	700 ①	600-800	3228265	8125437	19.6°-27.6°	0 - 5.4 4.8 - 8.8 6.6 - 10.6 10.2 - 14.2	1000 1500 2000 3000	
	Manual	5°	3°-7°	750	650-850	3228263	8125437	21.4°-29.5°	0 - 5.6 5.6 - 9.7 8.4 - 12.5 14.1 - 18.7	1000 1500 2000 3000	
360/401 Calif.	Auto	5°	3°-7°	700 ①	600-800	3228265	8125437	19.6°-27.6°	0 - 5.4 4.8 - 8.8 6.6 - 10.6 10.2 - 14.2	1000 1500 2000 3000	
	Manual			750	650-850						

1 Idle to be set with transmission in drive and parking brake applied. Do not accelerate engine.

2 Disconnect TCS wires at Solenoid Vacuum Valve.

NOTE: Air Conditioning must be off for final idle setting.

3 650 with OK Range of 550-750 for Cherokee & Truck.

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.

60709

Distributor Specification (On Distributor Testor)

Distributor Model Number	Vacuum Unit Number	Distributor Degrees and RPM			
		Centrifugal Advance		Vacuum Advance (Inches of Mercury)	Vacuum Advance Degrees
		Degrees	RPM		
3227331	8125438 (IDJ-4B)	0 - 0.4	500	5.0 - 7.0 Start 10.0 12.6 Max	0 - 2.3 3.4 - 5.7 7.0 - 9.0
		2.0 - 4.0	750		
		4.0 - 6.0	1000		
		4.65 - 6.65	1500		
		5.25 - 7.25	2200		
3228263	8125437 (IDJ-4)	0 - 2.8	500	4.0 - 6.0 Start 10.0 12.7 Max	0 - 2.2 3.9 - 6.6 6.5 - 8.5
		2.8 - 4.85	750		
		4.2 - 6.25	1000		
		7.05 - 9.05	1500		
		11.0 - 13.0	2200		
3228264	8125436 (IDJ-4A)	0 - 2.4	500	5.0 - 7.0 Start 10.0 12.5 Max	0 - 2.7 3.5 - 6.7 6.5 - 8.5
		3.4 - 6.4	750		
		6.3 - 8.3	1000		
		9.3 - 11.3	1500		
		13.5 - 15.5	2200		
3228265	8125437 (IDJ-4)	0 - 2.7	500	4.0 - 6.0 Start 10.0 12.7 Max	0 - 2.2 3.9 - 6.6 6.5 - 8.5
		2.4 - 4.4	750		
		3.3 - 5.3	1000		
		5.1 - 7.1	1500		
		7.5 - 9.5	2200		

60705

**1976 CJ Model Emission Control Systems
Application Chart**

Jeep Model	CJ 5/7				CJ 7			
Model Code	83 & 93				93			
Engine CID	232/258		304		258		304	
Transmission	Manual				Automatic			
Emission Control System	NW	Cal	NW	Cal	NW	Cal	NW	Cal
Air Guard		•	•	•		•	•	•
BPS	•	•	•	•	•	•	•	•
Catalytic converter		•	•	•		•	•	•
EGR	•	•	•	•	•	•	•	•
EGR CTO	115°	115°	115°	115°	115°	115°	115°	115°
FTVEC	•	•	•	•	•	•	•	•
Fuel Return	•	•	•	•	•	•	•	•
PCV	•	•	•	•	•	•	•	•
Spark CTO				160°		160°		160°
TAC	•	•	•	•	•	•	•	•
TCS				•		•		•
CHBPV			•	•			•	•
Solenoid						•	•	•

Air Guard - Air Injection System

BPS - Back-Pressure Sensor

CHBPV - Choke Heat Bypass Valve

EGR - Exhaust Gas Recirculation

EGR CTO - Exhaust Gas Recirculation Coolant Temperature
Override Switch

Fuel Return - Fuel Vapor Return System

FTVEC - Fuel Tank Vapor Emission System

PCV - Positive Crankcase Ventilation System

Spark CTO - Spark Coolant Temperature Override Switch

TAC - Thermostatically Controlled Air Cleaner

TCS - Transmission Controlled Spark System

NW - Nationwide Application Except California

Cal. - California only

• - On all Models Specific

60707

1976 Cherokee, Wagoneer, Truck, Emission Control Systems Application Chart

Jeep Model	Cherokee										Wagoneer						Truck									
Model Code	16 and 17										14 and 15						25 and 45				25,45,46					
Engine CID	258		360 2V		360 4V				401		360 2V	360 4V		401		258		360 2V		360 4V				401		
Transmission	M	A	M	A	M		A		A		A	A		A		M	A	M	A	M		A		A		
Emission Control System	NW		NW		NW	Cal.	NW	Cal.	NW	Cal.	NW	NW	Cal.	NW	Cal.	NW	NW		NW		NW	Cal.	NW	Cal.	NW	Cal.
Air Guard			•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	
BPS						•		•		•			•		•						•		•		•	
EGR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
EGR CTO	← 160° →																									
FTVEC						•		•		•			•		•						•		•		•	
Fuel Return	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
PCV	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Spark CTO	← 160° →																									
TAC	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
VTM			•		•	•		•					•					•		•	•		•			
SDV					•	•	•	•	•	•		•	•	•	•					•	•	•	•	•	•	
CHBPV			•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	
Solenoid				•		•	•	•	•	•	•	•	•	•	•			•		•	•	•	•	•	•	

Air Guard - Air Injection System
 BPS - Back-Pressure Sensor
 CHBPV - Choke Heat Bypass Valve
 EGR - Exhaust Gas Recirculation
 EGR CTO - Exhaust Gas Recirculation Coolant Temperature Override.
 FTVEC - Fuel Tank Vapor Emission Control System
 Fuel Return - Fuel Vapor Return System
 PCV - Positive Crankcase Ventilation System
 SDV - Signal Delay Valve

Spark CTO - Spark Coolant Temperature Override Switch
 TAC - Thermostatically Controlled Air Cleaner
 VTM - Vacuum Throttle Modulator
 M - Manual Transmission
 A - Automatic Transmission
 NW - Nationwide application Except California
 Cal. - California only
 • - On all Models Specified

TECHNICAL BULLETIN REFERENCE

[illegible]