

ENGINES



EXHAUST GAS RECIRCULATION SYSTEM

GENERAL

SEE
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NOTES

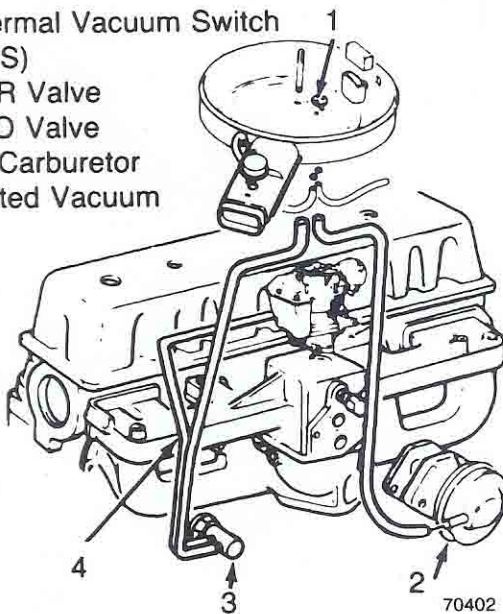
The exhaust gas recirculation (EGR) system consists of a diaphragm-actuated exhaust flow control valve (EGR valve), coolant temperature override (CTO) valve, thermal vacuum switch (TVS), connecting hoses and a forward delay valve.

CAUTION: Do not disconnect the vacuum hose or cause the EGR valve to be inoperative for an extended period of time because preignition could cause piston burning and/or scuffing.

EGR VALVE

The EGR valve is mounted on the side of the intake manifold.

1. Thermal Vacuum Switch (TVS)
2. EGR Valve
3. CTO Valve
4. To Carburetor Ported Vacuum



Functional Tests

The condition of the exhaust system may affect EGR system operation.

Excessive back-pressure caused by exhaust system restrictions may create driveability problems. Refer to Exhaust Systems for Restricted Exhaust System Diagnosis.

Leaks in the exhaust system may decrease back-pressure enough to prevent proper EGR system operation. This will increase undesirable exhaust emissions.

Visually inspect the exhaust system if leaks are suspected.

Opening Test

With the engine at normal operating temperature and at curb idle speed, rapidly open and close the throttle.

The throttle should be opened sufficiently to allow the engine speed to reach 1500 rpm.

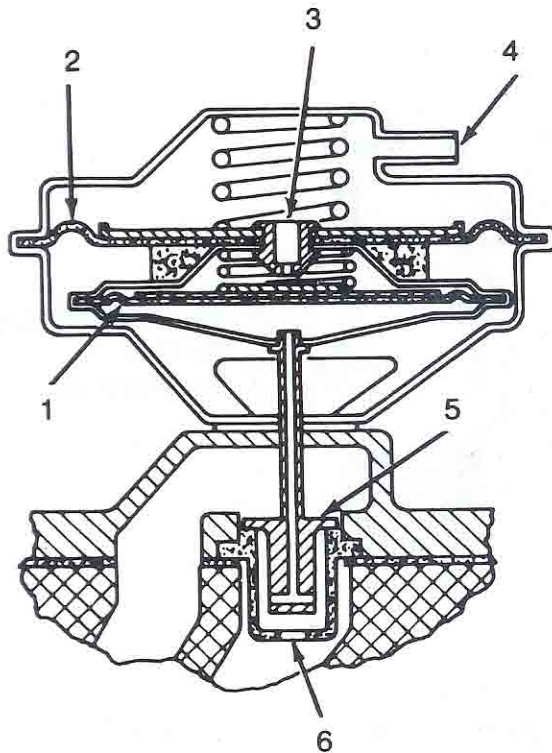


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A distinct movement should be noticed in the EGR valve control diaphragm (1).



1. Control Diaphragm
2. Power Diaphragm
3. Vent Valve
4. Vacuum Hose Nipple
5. Pintle
6. Control Flow Area

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If the diaphragm does not move, the probable causes are:

- a defective vacuum hose to the EGR valve

- a defective EGR valve diaphragm
- a defective back-pressure sensor diaphragm

Inspect the vacuum hoses for air leaks.

EGR Valve Closing Test

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

With the engine at normal operating temperature and at curb idle speed, manually depress the EGR valve diaphragm.

This should cause an immediate drop in engine rpm and indicate that the EGR valve has been properly preventing the flow of exhaust gas to the intake manifold at idle speed.

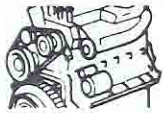
If there is no change in engine rpm and the engine is idling properly, exhaust gases are not reaching the combustion chamber.

The probable malfunction is a restricted passage between the EGR valve and the intake manifold.

If the engine idles improperly and rpm is not greatly affected by depressing the EGR valve diaphragm, the EGR valve is not preventing the flow of exhaust gases to the intake manifold.

There is either a fault in the vacuum hoses, improper hose connection or the valve is defective.

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Replacement

Removal

- Remove the air cleaner assembly.
- Identify, tag and disconnect the vacuum hoses.
- Remove the EGR valve retaining nuts from the manifold.
- Remove the EGR valve, gaskets and restrictor plate or spacer, if equipped.
- Discard the gasket and clean the mating surface.

Installation

- Install the EGR valve and a replacement gasket. If the restrictor plate is used, place it between the two replacement gaskets.
- Install the retaining nuts and tighten.
- Connect all the vacuum hoses.
- Replace the air cleaner assembly.

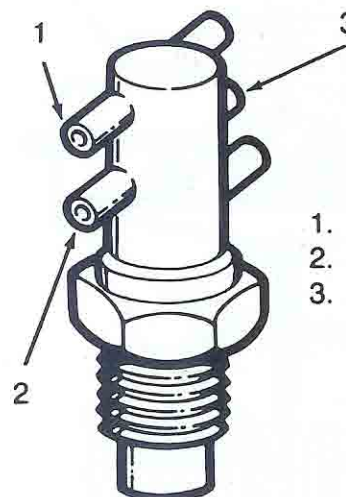
EGR SYSTEM CTO VALVE

The EGR system CTO valve is located in the coolant passage at the left front side of the intake manifold.

The dual-function valve is also used for distributor vacuum advance control.

The outer port (1) connects by a hose to ported vacuum at the carburetor.

The inner port (2) connects by a hose to the EGR thermal vacuum switch (TVS).



- 1. To Ported Vacuum
- 2. To TVS
- 3. To Distributor

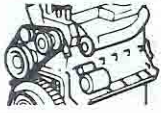
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When the coolant temperature is below the calibrated rating of the CTO valve, there is no vacuum applied to the EGR valve.

For six-cylinder engines, the CTO valve starts to open at 46°C (115°F) and at 57°C (135°F) for four-cylinder engines.

NOTE: The temperature ratings are nominal values and the actual valve opening temperature will vary slightly from unit to unit.

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EXHAUST GAS RECIRCULATION SYSTEM



Functional Test

NOTE: The engine coolant temperature must be 5.6°C (10°F) below the calibrated opening temperature of the valve.

Inspect the vacuum hoses for air leaks and correct the routings/connections.

Disconnect the hose at the TVS and connect it to a vacuum gauge.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Operate the engine at approximately 1500 rpm. No vacuum should be indicated on the gauge. If vacuum is indicated, replace the CTO valve.

Operate the engine until the coolant temperature exceeds 46°C (115°F) for six-cylinder engines and 57°C (135°F) for four-cylinder engines.

Accelerate the engine at 1500 rpm. Carburetor ported vacuum should be indicated on the vacuum gauge. If not, replace the CTO valve.

NOTE: Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

Drain the coolant from the radiator.

Identify, tag and disconnect the vacuum hoses from the valve.

Use an open-end wrench to remove the valve from the intake manifold.

Installation

Install the replacement dual-function CTO valve in the intake manifold.

Connect the vacuum hoses.

Fill the cooling system and purge any air from the system.

Test the operation of the valve. Refer to Chapter C – ELECTRICAL for information concerning the distributor vacuum advance CTO valve test.

EGR SYSTEM THERMAL VACUUM SWITCH

The thermal vacuum switch (TVS) is located in the air cleaner and functions as an on-off switch controlled by air cleaner intake air temperature.

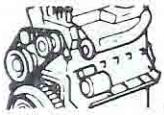
The TVS controls the vacuum between the EGR system CTO valve and the EGR valve.

Removal

WARNING: Serious personal injury can result if the cooling system pressure is not released and hot coolant drained before removing the valve.

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Personal injury can result if the cooling system pressure is not released and hot coolant drained before removing the valve.



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EXHAUST GAS RECIRCULATION SYSTEM

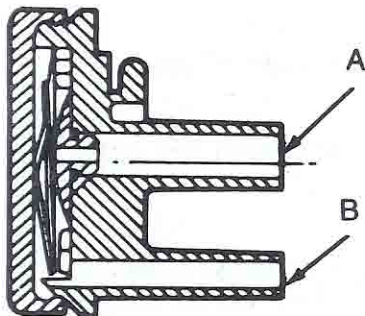


At air temperatures below 4° - 13°C (40° - 55°F), the TVS prevents vacuum from opening the EGR valve, which prevents EGR operation. This improves cold engine driveability.

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NOTE: The temperature ratings are nominal values and the actual switching temperature will vary slightly from unit to unit.

NOTE: A TVS is also used for other engine related systems to control operations that require air cleaner intake air to be at the proper temperature before system operation is activated.



A - To EGR - CTO Valve
B - To EGR Valve

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Functional Test

Cool the air cleaner intake air below the TVS calibrated temperature, 4°C (40°F).

Disconnect the vacuum hoses from the TVS and connect a vacuum pump to the inner port.

Apply vacuum to the TVS. Vacuum should be maintained by TVS check valve. If vacuum is not maintained, replace the TVS.

Start the engine and warm the air cleaner intake air to above 13°C (55°F). Vacuum should not be maintained. If vacuum is maintained by TVS, replace it.

Replacement

Removal

Remove the air cleaner.

Remove the vacuum hoses from the TVS.

Remove the retaining clip(s) attaching the TVS to the air cleaner.

Remove the TVS.

Installation

Install the TVS in the air cleaner.

Install the retaining clip(s).

Install the vacuum hoses.

Install the air cleaner.



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EGR SYSTEM FORWARD DELAY VALVE

The EGR system forward delay valve is used with certain four-cylinder engines. It is located between the EGR TVS and the EGR valve. Refer to the Vacuum Diagram for the exact location.

Its purpose is to modify the initial vacuum applied to the EGR valve by delaying the full vacuum force.

With a gradual vacuum applied to the EGR valve, a harsh, sudden activation of the EGR system is avoided.

The black side of the valve must always be installed toward the EGR vacuum source.

Functional Test

Apply a constant vacuum of 34 kPa (10 in. Hg) to the black side of the delay valve.

Connect one end of a 61 cm (24 in) section of vacuum to the vacuum gauge and the other end to the colored side of the delay valve.

Observe the time in seconds for the gauge pointer to move from 0 - 27 kPa (0 - 8 in. Hg) vacuum.

The minimum and maximum time for each valve type to reach 27 kPa (8 in. Hg) is listed in the Forward Delay Valve Test chart.

Forward Delay Valve Test

COLOR	PART NUMBER	TIME IN SEC.	
		MIN.	MAX.
BLK/GRAY	323 5261	10	±2
BLK/BROWN	323 7293	20	±4
BLK/WHITE	323 1379	63.5	±13.5
BLK/YELLOW	323 1118	100	±20
BLK/PURPLE	323 6284	4	±0.8
BLK/GREEN	323 0422	200	±40
BLK/ORANGE	323 9134	2	±0.5

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NOTE: When testing a delay valve, care must be exercised to prevent oil or dirt from entering the valve because this will impair its functioning.

Replace the delay valve if the functional test indicated it to be defective. Otherwise, install the delay valve in its original position.

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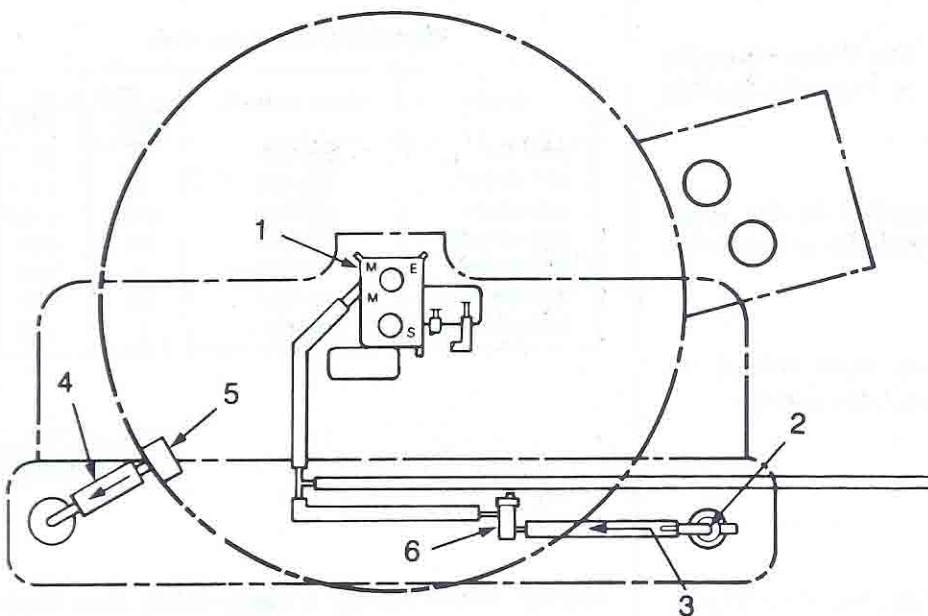


POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

GENERAL

The PCV system consists of an air inlet filter, a flow-control (PCV) valve plus associated hoses, and a PCV solenoid. The air inlet filter is located inside the the air cleaner housing.

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- 1. Carburetor
- 2. PCV Valve
- 3. PCV Air Out
- 4. PCV Air In
- 5. PCV Filter
- 6. PCV Solenoid

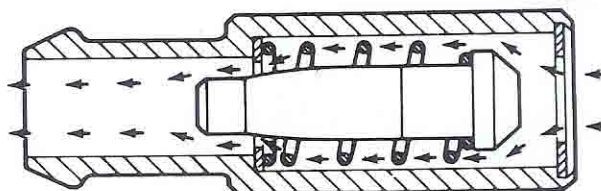
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PCV VALVE FUNCTIONAL TEST

Test the valve at idle speed for the correct flow rate (l/s or cfm).

The engine intake manifold vacuum level must be at least 47.28 kPa (14 in. Hg).

When determining the vacuum level, connect the vacuum gauge to a fitting that is as centrally located as possible on the intake manifold.

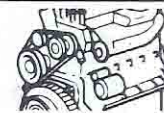


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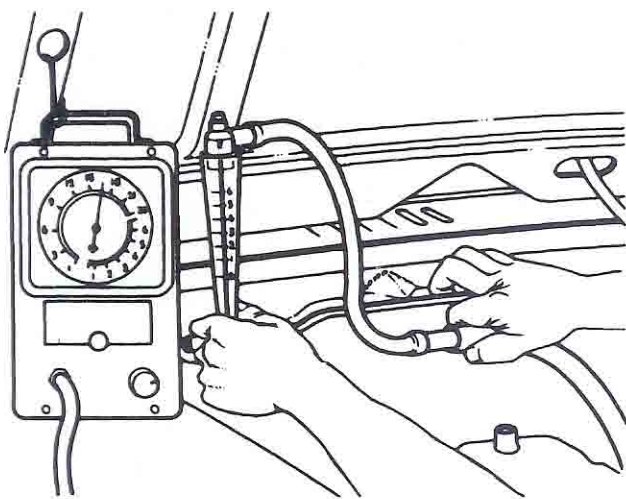
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



Remove the valve from the grommet in the cylinder head cover.

Connect the plastic hose of PCV Valve Tester J-23111 to the valve.

NOTE: Hold the PCV valve in a horizontal position and tap lightly during the test. Hold the tester in a vertical position.



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WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and allow it to idle. Observe the flow rate (l/s or cfm). Refer to PCV Valve Flow Rate chart.

PCV Valve Flow Rate

Engine Manifold Vacuum in kPa (Hg.)	Air Flow Liters/Second (CFM)
54 (16) 50.66 (15)	0.0 - 0.094 (0.0 - 0.2)
37 (11) 20.26 (6)	0.424 - 0.943 (0.9 - 2.0)
17 (5) 10.13 (3)	0.708 - 1 - 1.18 (1.5 - 2.5)

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With a low vacuum level, it may be necessary to load the engine while testing the flow rate.

Replace the valve if the airflow rate is either above or below the specification. Ensure the correct PCV valve is used for replacement.

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POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

PCV AIR INLET FILTER MAINTENANCE

Perform the air inlet filter maintenance at the intervals specified in the Maintenance Schedule.

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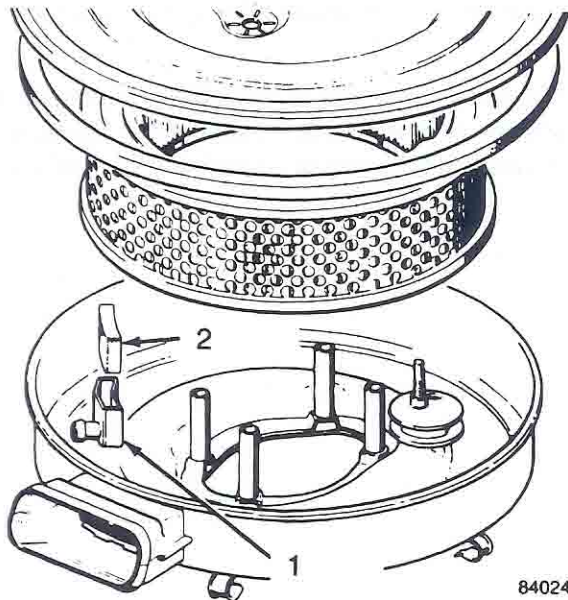
Replacement

The polyester, nonwoven felt PCV air filter is located in the filter retainer in the air cleaner housing.

Rotate the retainer (1) and remove the retainer and filter (2) from the air cleaner housing.

Replace or clean the filter and retainer in kerosene.

Install the filter and retainer in the air cleaner housing.



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TAC SYSTEM



GENERAL

The thermostatically controlled air cleaner (TAC) system provides heated air for the carburetor during engine warm-up.

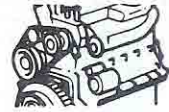
The TAC system is comprised of a heat stove that partially encloses the exhaust manifold, a heated air tube, a special air cleaner assembly equipped with a thermal switch, a reverse delay valve, a check valve and a vacuum motor and air valve assembly.

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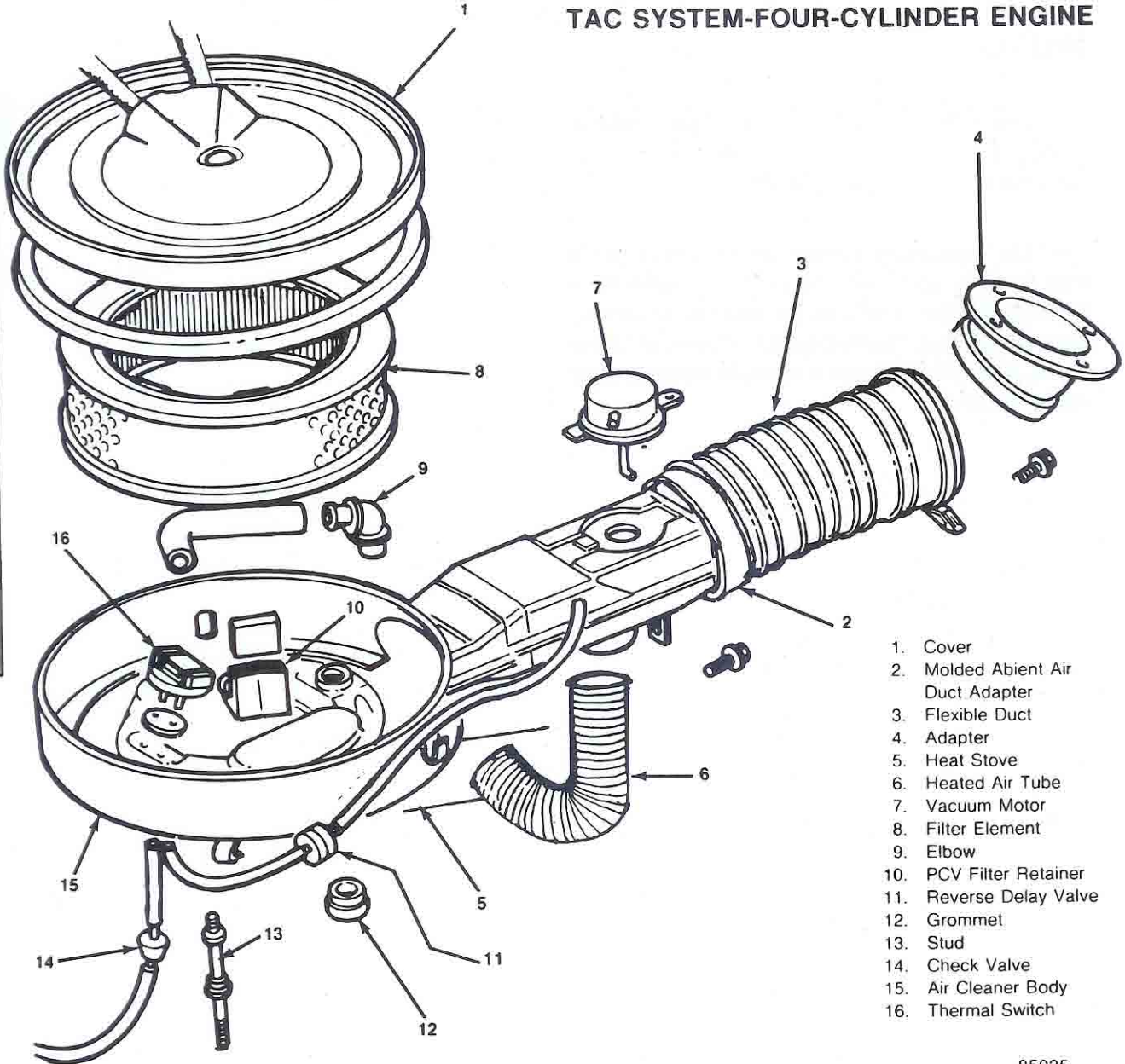
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TAC SYSTEM



TAC SYSTEM-FOUR-CYLINDER ENGINE

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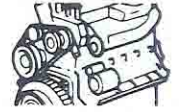
1. Cover
2. Molded Ambient Air Duct Adapter
3. Flexible Duct
4. Adapter
5. Heat Stove
6. Heated Air Tube
7. Vacuum Motor
8. Filter Element
9. Elbow
10. PCV Filter Retainer
11. Reverse Delay Valve
12. Grommet
13. Stud
14. Check Valve
15. Air Cleaner Body
16. Thermal Switch

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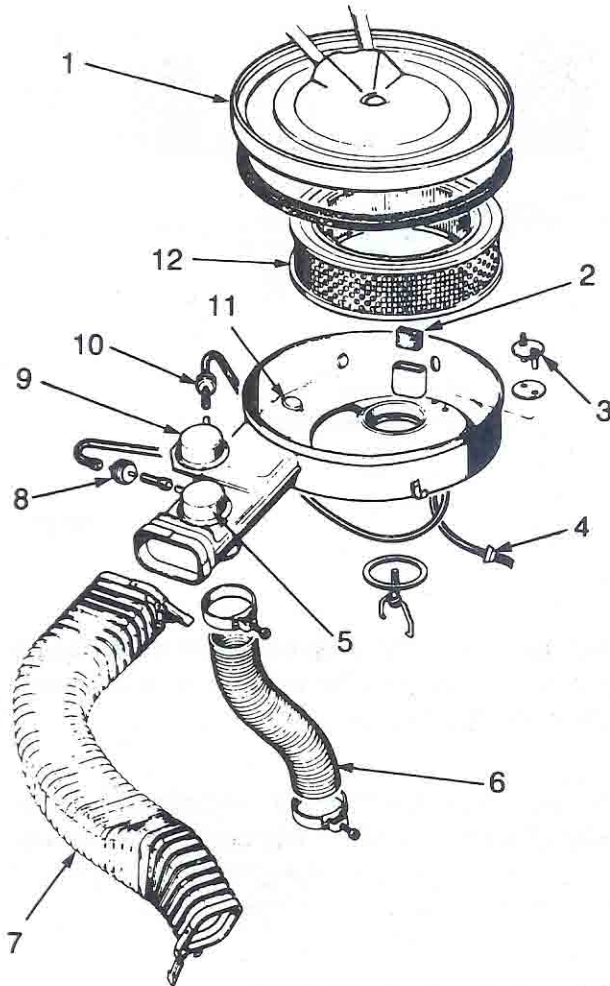


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TAC SYSTEM



TAC SYSTEM – SIX-CYLINDER ENGINE



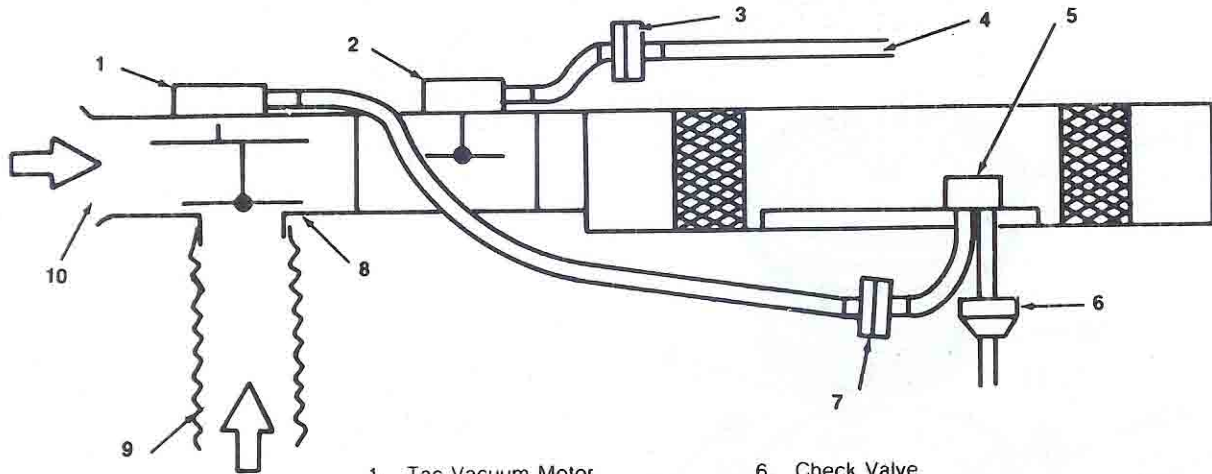
1. Air Cleaner Cover
2. PCV Valve Filter
3. Thermal Switch
4. Check Valve
5. Vacuum Motor
6. Heated Air Tube
7. Ambient Air Duct
8. Reverse Delay Valve
9. Trap Door Assembly
10. Reverse Delay Valve
11. Thermal Vacuum Switch
12. Filter Element

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TAC SYSTEM



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|---------------------------|------------------------|
| 1. Tac Vacuum Motor | 6. Check Valve |
| 2. Trap Door Vacuum Motor | 7. Reverse Delay Valve |
| 3. Reverse Delay Valve | 8. Air Valve |
| 4. Vacuum Source | 9. Heated Air |
| 5. Thermal Switch | 10. Ambient Air |

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TAC SYSTEM FUNCTIONAL TESTS

Air Valve Vacuum Motor Functional Test

With the engine off, detach the ambient air duct at the air cleaner and observe the position of the air valve. It should be fully open to incoming ambient air (heat in the OFF position).

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and observe the position of the air valve. It should be fully closed to incoming ambient air (heat in the ON position).

Depress the throttle rapidly (1/2-3/4-position) and release. The air valve should briefly remain stationary and then move toward the heat OFF position and back to heat ON position.

Loosely attach the ambient air duct to the air cleaner and warm the engine to the normal operating temperature.

Remove the ambient air duct and observe the air valve. It should be either fully open to ambient air or at a mixture position that provides the correct inlet air temperature to the carburetor.

Stop the engine and connect the ambient air duct to the air cleaner.

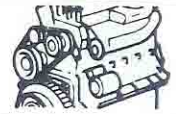
If the air valve does not function as described in the test, inspect for:

- a mechanical bind in the snorkel
- vacuum hoses being disconnected
- air leaks either at the vacuum motor, thermal switch, reverse delay valve, check valve, intake manifold or vacuum hoses



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TAC SYSTEM



If the air valve manually operates freely and no hose disconnections or air leaks are detected, connect a hose from the intake manifold vacuum source directly to the vacuum motor and start the engine.

If the air valve closes, either the thermal switch, reverse delay or check valve is defective and must be replaced. If the air valve does not close, replace the vacuum motor.

Replacement

CAUTION: The heated air tube is connected to the air cleaner snorkel by a clamp. If the duct is not detached prior to air cleaner removal, the tube and stove may be damaged.

Remove the air cleaner.

Disconnect the vacuum hoses from the air valve motor, thermal switch and trap door motor, if equipped.

Remove the rivet attaching the air valve vacuum motor to the snorkel.

Lift the motor, tilt it to one side to disconnect the motor linkage from the air valve assembly and remove the motor.

Insert the replacement vacuum motor linkage into the air valve assembly and position it in the snorkel.

Attach the motor to the snorkel with a rivet.

NOTE: Ensure that the rivet does not interfere with the movement of the air valve. Correct as necessary.

Connect the vacuum hoses. Install the air cleaner assembly and test for proper operation of the TAC system.

Thermal Switch Functional Test

Disconnect the vacuum hoses from the thermal switch.

Connect the vacuum pump and vacuum gauge to the switch.

Apply 47 kPa (14 in. Hg) vacuum to the switch.

With the switch below 5°C (40°F), vacuum should be maintained.

Heat the switch to above 13°C (55°F). The air vent valve should open and decrease the vacuum to zero.

Replace the switch if defective.

NOTE: The temperatures listed above are nominal switching values.

Replacement

CAUTION: The heated air tube is attached to the snorkel by a clamp. If the tube is not detached prior to air cleaner removal, the heated air tube and heat stove may be damaged.

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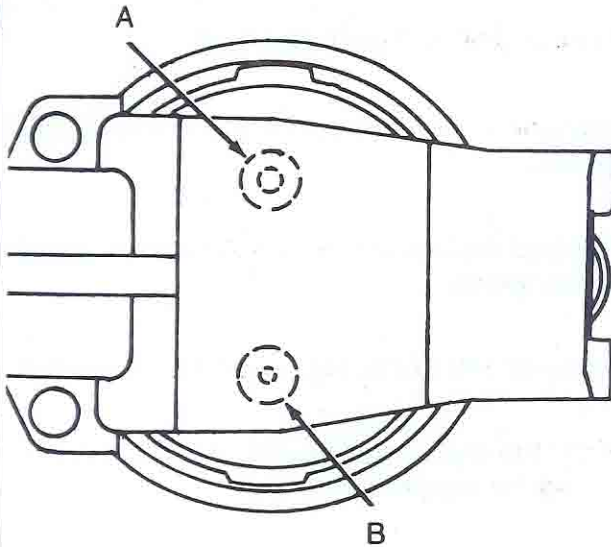
TAC SYSTEM



Remove the air cleaner housing.

Disconnect the hoses from the switch.

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A - To Vacuum Motor
B - To Vacuum Source

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Pry the tabs up on the switch retaining clip. Remove the clip, gasket and switch from the air cleaner housing. Note the position of the switch for installation reference.

Install a replacement switch and gasket assembly in the air cleaner.

Press the retainer clip on the hose nipple connectors.

Connect the vacuum hoses and install the air cleaner housing on the engine.

Test for proper operation of the TAC system.

AIR CLEANER TRAP DOOR

Vehicles equipped with six-cylinder engines have air cleaners with spring-loaded trap doors to close-off the air cleaner/carburetor when the engine is inoperative.

Functional Tests

With the engine off, remove the air cleaner cover and observe the position of the trap door (1). It should be closed.

Remove the vacuum hose from the intake manifold vacuum source and apply an external vacuum of approximately 6.8 - 13.5 kPa (2 - 4 in. Hg). The trap door should open.

If the door does not open, apply vacuum directly to the vacuum motor (2) on air cleaner intake duct.

If the door does not open, inspect for binding/distortion and adjust as necessary.

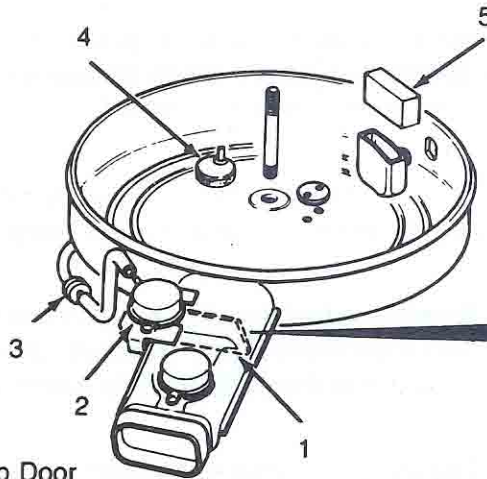
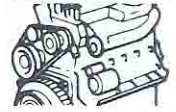
Replace the motor if the door swings freely.

If the door opens during the step above, inspect the vacuum hose for obstruction, cracks and kinks. Correct as necessary and retest.

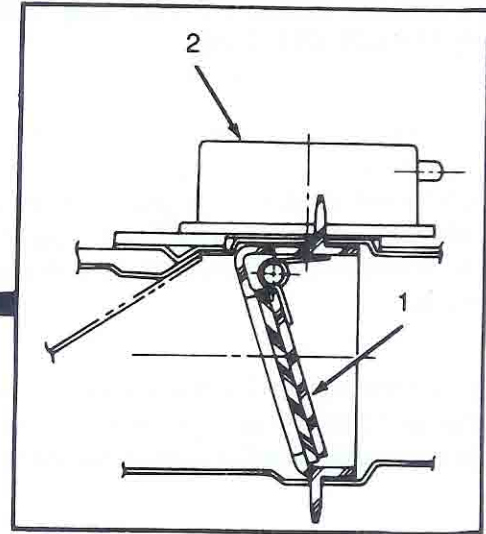


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TAC SYSTEM



1. Trap Door
2. Trap Door Vacuum Motor
3. Reverse Delay Valve
4. Thermal Vacuum Switch (TVS)
5. PCV Filter



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If the vacuum hose is not defective, remove the reverse delay valve (3), join the vacuum hose with an adapter and retest as described above. If the door opens, replace the reverse delay valve.

Reverse Delay Valve Functional Test

The reverse delay valve provides approximately 100 seconds delay before allowing the trap door to completely close. Test the valve according to the following procedure.

Remove the vacuum hose from the yellow end of the valve and apply an external vacuum of approximately 6.8 - 13.5 kPa (2 - 4 in. Hg).

With an elapsed time indicator, note the time required for atmospheric pressure to pass through valve and eliminate the vacuum.

Replace the valve if the time required to eliminate the vacuum is less than 4.5 seconds or more than 13.2 seconds.

NOTE: Install a replacement reverse delay valve with the yellow end toward the trap door vacuum motor.

Trap Door Vacuum Motor Replacement

Disconnect the vacuum hoses, heated and ambient air ducts, and remove the air cleaner housing.

Remove the trap door vacuum motor attaching rivet from the bracket.

Lift the motor away from the bracket. Rotate it to clear the door arm and remove.

Rotate the replacement motor to clear the door arm and lower it into the bracket.

Secure the replacement motor to the bracket with a rivet.

Install the air cleaner, ducts and vacuum hoses.

Test the operation of the trap door.

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