

Chapter 6 Emissions control systems

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Specifications

Related specifications can be found in Chapter 4

Torque specifications

	Kg-m	Ft-lbs
EGR control valve	1.8 to 2.3	13 to 17
EGR tube	3.5 to 4.5	25 to 33

1 General information

As pollution control standards have become more stringent, the emissions control systems developed to meet these requirements have not only become increasingly more diverse and complex, but are now designed as integral parts of the operation of the engine. Where once the anti-pollution devices used were installed as peripheral "add-on" components, the present systems work closely with such other systems as the fuel, ignition and exhaust systems, and in some cases even control vital engine operations. **Note:** Refer to Chapter 4 for fuel/emissions related components.

Because of this close integration of systems, disconnecting or not maintaining the emissions control systems, besides being illegal, can adversely affect engine performance and life, as well as fuel economy. The emissions systems are not particularly difficult for the home mechanic to maintain and service. You can perform general operational checks, and do most (if not all) of the regular maintenance with common tune-up and hand tools.

2 Emissions control systems — general component description

Refer to illustrations 2.1a, 2.1b and 2.6

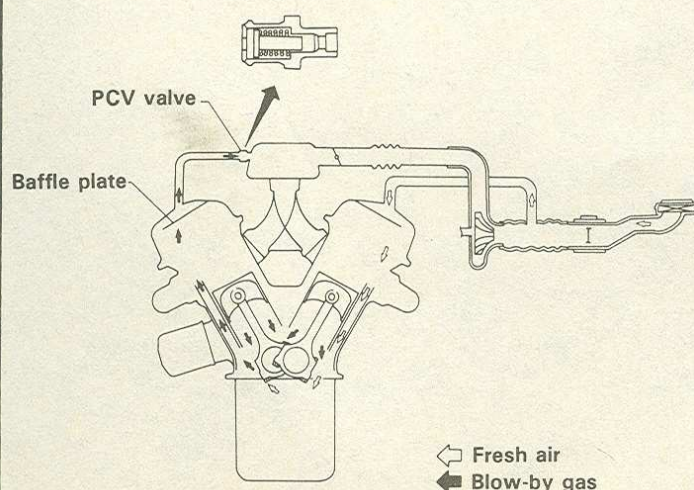
Positive Crankcase Ventilation (PCV) system

The positive crankcase ventilation system (see illustrations) reduces hydrocarbon emissions by circulating fresh air through the crankcase. This air combines with blow-by gases, and the combination is then sucked into the intake manifold to be burned by the engine.

This process is achieved by using one air pipe running from the air duct (suction hose on Turbo models) to the rocker arm cover, a one-way PCV valve located on the left underside of the intake manifold and a second air pipe running from the crankcase to the PCV valve.

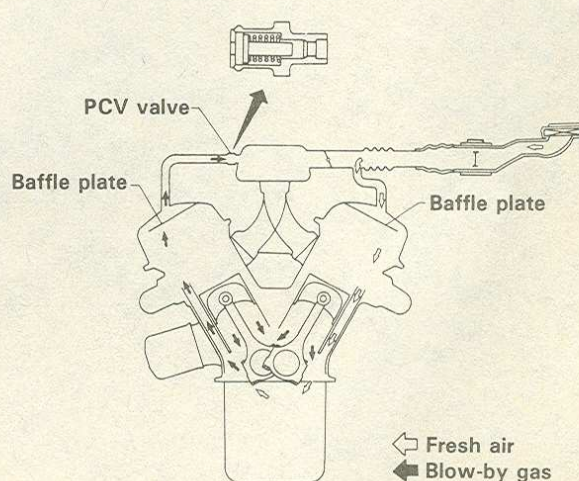
During partial throttle operation the vacuum created in the intake manifold is great enough to suck the gases from the crankcase, through the PCV valve and into the manifold. The PCV valve allows

VG30ET ENGINE (With turbocharger)

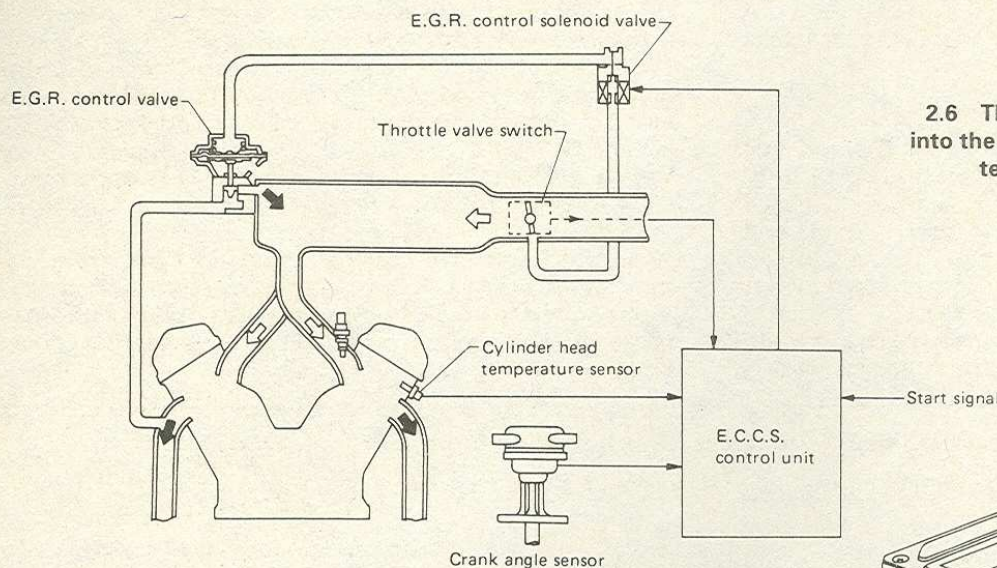


2.1a Positive crankcase emission control system for turbocharged models

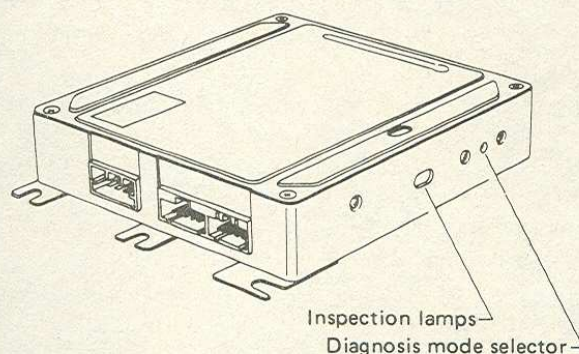
VG30E ENGINE (Without turbocharger)



2.1b Positive crankcase emission control system for non-turbo equipped models



2.6 The EGR system returns exhaust gas into the combustion chamber to lower flame temperature during combustion



3.3 Verify the diagnosis mode selector is turned fully counterclockwise using a small screwdriver

the gases to enter the manifold, but will not allow them to pass in the other direction.

The ventilating air is drawn into the rocker arm cover from the air duct or suction hose, and then into the crankcase.

Under full-throttle operation, the vacuum in the intake manifold is not great enough to draw the gases in. Under this condition the blow-by gases flow backwards into the rocker arm cover, through the air tube and into the air duct or suction hose, where it is carried into the intake manifold in the normal air intake flow.

Exhaust Gas Recirculation (EGR) system

The EGR system (see illustration), returns exhaust gas into the combustion chamber to lower the flame temperature during combustion. This results in a reduction of the nitrogen oxide density in the exhaust gas. To check the EGR valve, refer to Chapter 1.

When the EGR control valve is open some of the exhaust gas is led from the exhaust manifold to the EGR tube. The exhaust gas is then regulated by the EGR valve and introduced into the intake manifold. A signal from the ECCS, sent to the EGR control solenoid valve, cuts the vacuum line for the EGR control valve on demand.

Catalytic converter

Once the exhaust gas, which contains unburned, harmful gases, leaves the combustion chamber it is passed through the catalytic converter. The three-way catalytic converter activates to oxidize and reduce harmful gases (HC, CO and NO_x) into harmless gases (CO₂, H₂O and N₂).

Evaporative emission control system

The fuel vapor from the sealed fuel tank is led into a canister which contains activated carbon and the vapor is stored while the engine is not running. Once the engine is started the gas vapor is drawn through the purge line into the intake manifold. The purge line control valve is closed during idle and opens as engine speed increases.

3 ECCS system – self diagnosis

1984 thru 1986

Refer to illustration 3.3

Self-diagnostic procedure

- 1 Locate the ECCS control module under the passenger side kick panel.
- 2 Remove the module retaining bolts and pull the module out so you can handle it. **Caution:** The self-diagnosis results are retained in the memory by a small current flow from the battery. Disconnecting the battery cable or the ECCS's 15-pin connector erases the memory

stored. Always perform the self-diagnosis regarding intermittent checks before disconnecting.

- 3 Verify the diagnosis mode selector (see illustration) is turned fully counterclockwise using a small screwdriver.
- 4 Turn the ignition switch On.
- 5 Check that the inspection lamps stay on to check the bulbs.
- 6 Turn the mode selector fully clockwise.
- 7 Confirm that the lamps are displaying codes 23, 24 and 31 on turbo models. If not, write down the malfunction code.
- 8 Depress the accelerator pedal one time and release.
- 9 On VG30ET only, shift the transmission through the gears, ending in neutral.
- 10 On 1984-85 models make sure the inspection lamps are displaying codes 24 (VG30ET) and 31. If not, write down the malfunction code.
- 11 Start the engine, and on 1986 VG30ET models with automatic transmission, apply the brake and move the selector to "D".
- 12 Confirm the codes displayed: They should be 14 for VG30ET engines and 31 for others.
- 13 If a VG30ET model, drive the vehicle at more than 6 mph.
- 14 Make sure the lights are flashing code 31. If not, write down the malfunction code.
- 15 Add a load to the system by turning the air conditioning switch On then Off.
- 16 The lights should display code 44.
- 17 Turn the diagnosis mode selector fully counterclockwise.
- 18 Turn the engine off.
- 19 See the decoding chart for trouble code identification.
- 20 Check the malfunctioning area, then erase the memory. **Caution:** The crank angle sensor plays an important part in the electronic computer control system and a malfunctioning sensor is sometimes accompanied by a display which shows malfunctions in other signal systems. If this happens, start with the crank angle sensor.

Memory erasure

- 21 Turn the switch to the On position.
- 22 Turn the diagnosis mode selector fully clockwise and hold it there for more than two seconds.
- 23 Turn the ignition switch to Off.

- 24 After correcting a malfunctioning system be sure to erase the memory.
- 25 Reverse the removal procedures to install the computer control module.

1987 on

- 26 Turn the ignition switch to the On position. Turn the diagnostic mode selector on the ECU fully clockwise and wait until the inspection lamps flash. Count the number of flashes to find which mode you are in, then turn the diagnostic mode selector fully counterclockwise.
- 27 When the ignition switch is turned off during diagnosis, in each mode, and then turned on again after the power to the ECU has dropped off completely, the diagnosis will automatically return to Mode I.
- 28 The check engine light on the instrument panel (California models only) comes on when the ignition switch is turned on or in Mode I when the

emission system malfunctions (with the engine running).

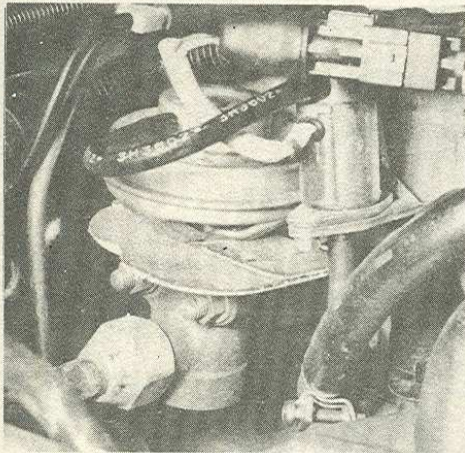
- 29 Malfunctions related to fuel and emission control systems can be diagnosed using the self diagnostic codes of Mode III.

30 To start the diagnostic procedure, remove the dash side finish panel so you can watch the inspection lamps on the ECU. Start the engine and warm it up to normal operating temperature. Turn the diagnostic mode selector on the ECU fully clockwise. After the inspection lamps have flashed 3 times, turn the diagnostic mode selector fully counterclockwise. The ECU is now in Mode III. Check the trouble code chart for the particular malfunction.

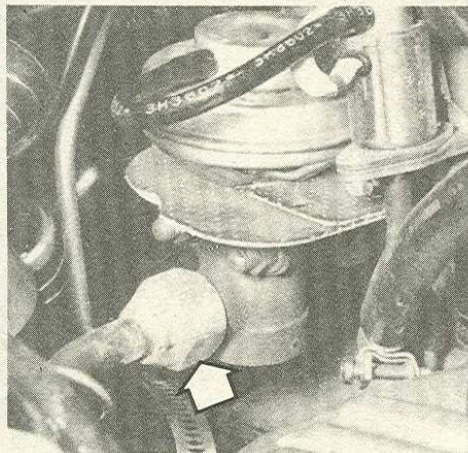
31 After the tests have been performed and the repairs completed, erase the memory by turning the diagnostic mode selector on the ECU fully clockwise. After the inspection lamps have flashed 4 times, turn the mode selector fully counterclockwise. This will erase any signals the ECU has stored concerning a particular component.

Trouble codes*	Circuit or system	Probable cause
Code 11 (1 red flash, 1 green flash)	Crank angle sensor/circuit	Faulty crank angle sensor or circuit.
Code 12 (1 red flash, 2 green flashes)	Air flow meter/circuit	The air flow meter source or ground circuit(s) may be shorted or open. Check the air flow meter.
Code 13 (1 red flash, 3 green flashes)	Cylinder head temperature sensor	The sensor source or ground circuit(s) may be shorted or open. Check the temperature sensor/circuit(s).
Code 14 (1 red flash, 4 green flashes)	Vehicle speed sensor	The vehicle speed sensor signal circuit is open. This repair must be performed by a dealer service department.
Code 21 (2 red flashes, 1 green flash)	Ignition signal	The ignition signal in the primary circuit is not entered during engine cranking or running. This repair must be performed by a dealer service department.
Code 22 (2 red flashes, 2 green flashes)	Fuel pump circuit	The fuel circuit is open or shorted.
Code 23 (2 red flashes, 3 green flashes)	Idle switch circuit	The idle switch signal circuit is open.
Code 24 (2 red flashes, four green flashes)	Park/neutral switch	The park/neutral switch circuit is open or shorted.
Code 31 (3 red flashes, 1 green flash)	Load signal circuit or ECU	One of the load signal (air conditioning, power steering or radiator fan) circuits is open or shorted or the ECU is malfunctioning.
Code 32 (1986 and earlier) ... (3 red flashes, 2 green flashes)	Starter signal circuit	The starter signal circuit is open or shorted.
Code 32 (1987 and later) (3 red flashes, 2 green flashes)	EGR Function	The EGR control valve does not operate.
Code 33 (3 red flashes, 3 green flashes)	Exhaust gas sensor	The exhaust gas signal circuit is open.
Code 34 (3 red flashes, 4 green flashes)	Detonation sensor	The detonation sensor circuit is open or shorted. This repair must be performed by a dealer service department.
Code 35 (3 red flashes, 5 green flashes)	Exhaust gas temperature circuit	The temperature sensor signal circuit is open or shorted.
Code 41 (1984 only) (4 red flashes, 1 green flash)	Air temperature sensor or circuit	Faulty air temperature sensor or circuit.
Code 41 (1985 and later) (4 red flashes, 1 green flash)	Fuel temperature sensor or circuit	Faulty fuel temperature sensor or circuit.
Code 42 (4 red flashes, 2 green flashes)	Fuel temperature sensor	The fuel temperature sensor circuit is open or shorted.
Code 43 (4 red flashes, 3 green flashes)	Throttle sensor	The throttle sensor circuit is open or shorted. This repair must be performed by a dealer service department.
Code 45 (4 red flashes, 5 green flashes)	Injector leak	The injector(s) are leaking.
Code 44 or 55 (5 red flashes, 5 green flashes)	No malfunction	Normal operation

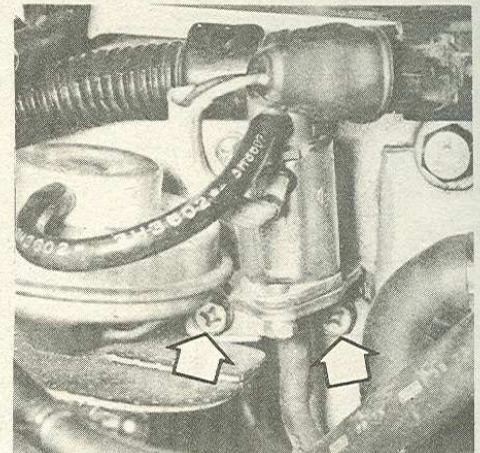
* Not all codes apply to all models



4.1 Allow time for the EGR valve and surrounding components to cool before beginning work



4.3 Disconnect the EGR inlet pipe (arrow)



5.4 Remove the two remaining screws (arrows) to remove the EGR control solenoid valve

4 EGR control valve – removal and installation

Refer to illustrations 4.1 and 4.3

Note: EGR valve testing is found in Chapter 1.

- 1 Allow time for the EGR control valve (see illustration) and adjacent accessories to cool.
- 2 Disconnect the EGR vacuum hose.
- 3 Remove the EGR inlet pipe from the EGR control valve (see illustration).
- 4 Remove the two retaining nuts and lift the control valve off the studs.
- 5 After cleaning the gasket mounting surfaces and installing a new gasket, reverse the removal procedures for installation. **Caution:** When installing the EGR guide tube, be careful of its direction. The outlet faces the rear of the engine. Otherwise the distribution efficiency of the exhaust gas will be reduced.

5 EGR control solenoid valve – removal and installation

Refer to illustration 5.4

- 1 Disconnect the negative cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery, as this would once again allow power into the electrical system of the vehicle.
- 2 Disconnect the electrical connector by pulling it apart.
- 3 Remove the upper and lower vacuum hoses from the valve.
- 4 Remove the two EGR control solenoid valve retaining screws (see illustration).
- 5 Installation is the reverse of the removal procedures.

6 Pressure regulator control solenoid valve – description

Refer to illustration 6.1

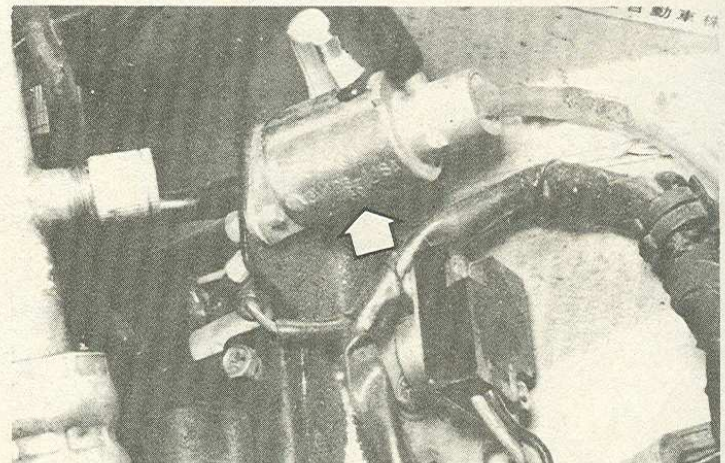
The pressure regulator control solenoid valve (see illustration) cuts the intake manifold vacuum signal for pressure regulator control. The solenoid valve is actuated by an on/off signal from the ECCS control unit.

Once the valve is turned off, a vacuum signal from the intake manifold is fed into the pressure regulator. When the control unit outputs an on signal, the coil pulls the plunger downward and cuts the vacuum signal.

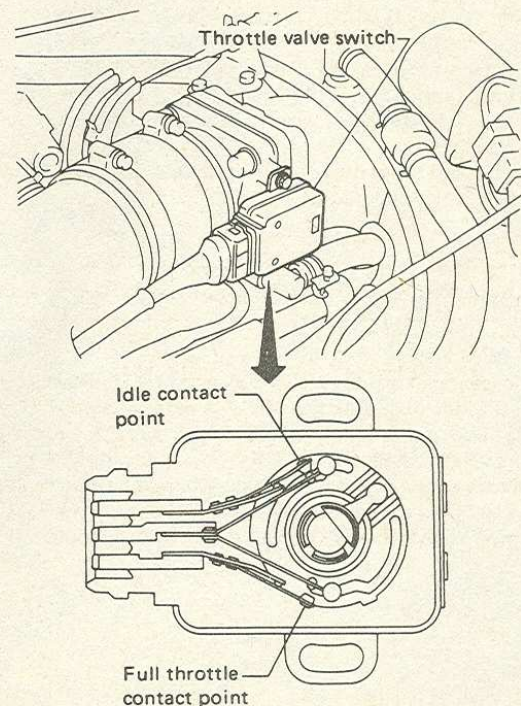
7 Throttle valve switch – description

Refer to illustration 7.1

- 1 Attached to the throttle chamber, the throttle valve switch (see



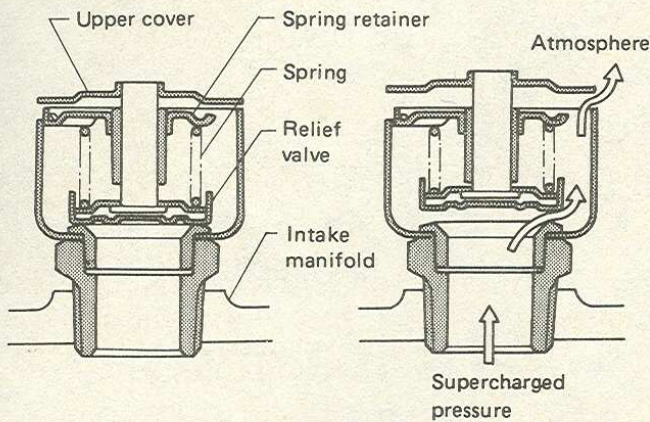
6.1 The pressure regulator control solenoid cuts the intake manifold vacuum signal



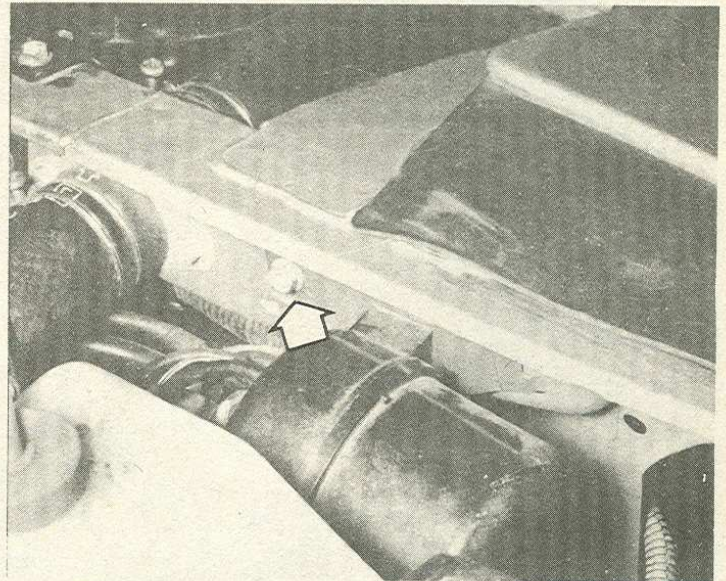
7.1 The throttle valve switch has two throttle contacts. At idle the contact is closed, and it opens when the throttle valve is at any other position

When the pressure in the intake manifold is below 55.3 kPa (415 mmHg, 16.34 inHg)

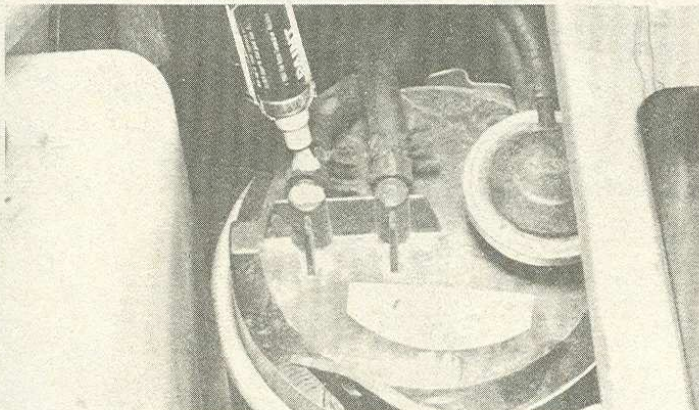
When the pressure in the intake manifold is above 63.3 kPa (475 mmHg, 18.70 inHg)



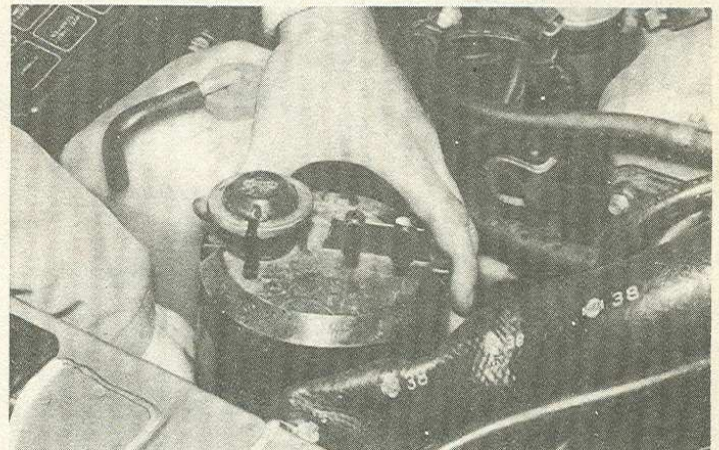
8.1 The emergency relief valve is a pop-off valve to prevent an abnormal rise in supercharging pressure



9.1 Remove the retaining bolt (arrow) and move the climate control vacuum reservoir out of your work area



9.2 Make installation of hoses easier by marking them with paint or colored tape before removing



9.5 It's a tight squeeze but the canister can be pulled straight up to remove it from the vehicle

illustration) actuates in response to accelerator pedal movement. The switch has idle contact and full throttle contact. When the throttle valve is positioned at idle, the idle contact is closed, and it opens when it is at any other position.

2 The full throttle contact is used only for electronically controlled automatic transmission models.

8 Emergency relief valve — description, removal and installation

Refer to illustration 8.1

1 The emergency relief valve (see illustration) is installed on the intake collector of the turbocharged models as a safety device to prevent an abnormal rise in supercharging pressure, and possible engine damage, in case the bypass valve should fail to open properly.

2 The valve is screwed into the intake collector and simply requires the proper size wrench to remove it from the collector.

3 Installation is the reverse of the removal procedure.

9 Evaporative emissions control canister — removal and installation

Refer to illustrations 9.1, 9.2 and 9.5

1 Remove the retaining bolt from the climate control vacuum reservoir and move the reservoir to gain access to the evaporative emissions canister (see illustration).

2 To avoid confusion, mark each vacuum hose with different colored tape or paint before removing the hoses from the canister (see illustration).

3 Squeeze the hose retaining clamps and pull the hoses off the canister.

4 Lift the retaining spring up and over the canister.

5 Pull the canister up and out of the vehicle. It will be necessary to pull the upper radiator hose over, and even then it is a tight squeeze (see illustration).

6 Reverse the removal procedures for installation.