

Chapter 8

Emission Control

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Description

To reduce the output levels of carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NOx), the three primary automotive emissions that cause air pollution, several emission control systems are used in this range of vehicles.

These are the Positive Crankcase Ventilation (PCV) System, Evaporative Control System, and Exhaust Control System.

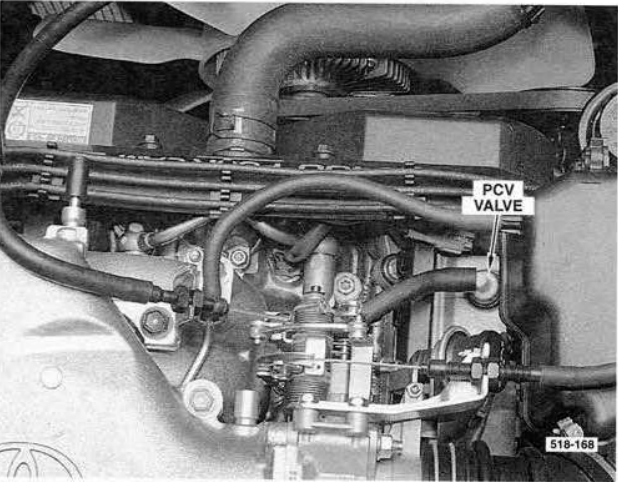
The Evaporative Control System is controlled by the engine control unit (ECU).

The engine ECU also controls the amount of fuel injected and the ignition timing, to suit the conditions under which the engine is operating, giving optimum performance with minimum emissions.

Refer to Fuel and Engine Management (chapter 7) for further information on engine management system.

Positive Crankcase Ventilation (PCV) System

The crankcase ventilation system is of the closed type and is designed to eliminate the emission of crankcase vapours into the atmosphere.



Location of the PCV valve.

Basically the system consists of the PCV valve, breather hose and a sealed dipstick and oil filler cap.

The PCV valve is installed in the right hand side rocker cover.

Fresh air is drawn into the crankcase via a breather hose, which is connected between the air inlet hose and the rear of the left hand side rocker cover. This fresh air combines with crankcase vapours (blow-by) which are drawn into the inlet manifold via the PCV valve and then consumed in the combustion process.

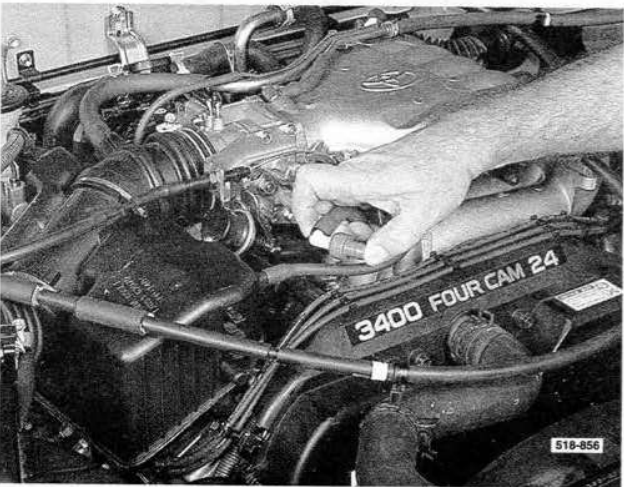
This system is most effective at part throttle operation where a particularly high vacuum is present in the inlet manifold to allow the PCV valve to open and for all crankcase vapours to be scavenged from the crankcase.

If the engine is being operated under hard acceleration or heavy load conditions, and the generated blow-by vapours exceed the capacity of the PCV valve, the excess vapours flow back through the engine breather hose to the air inlet hose and are drawn into the inlet manifold.

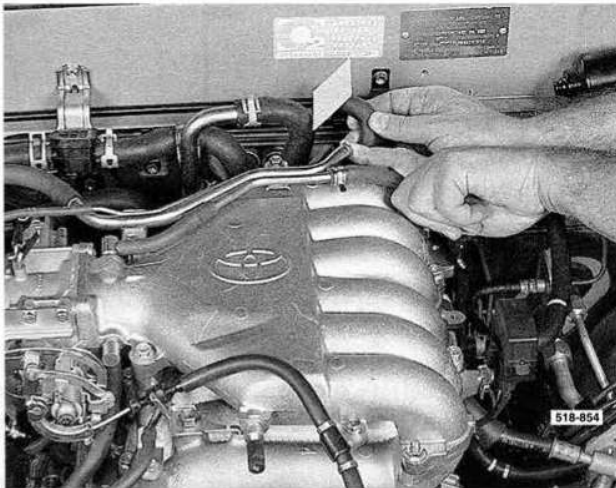
If the engine is excessively worn and blow-by is at a high level, a certain amount of crankcase vapour will recycle through the rocker cover and be drawn into the throttle body, regardless of throttle operation.

ROUTINE MAINTENANCE

- 1 Check the breather hoses are not blocked, collapsed or deteriorated. Inspect the seals on the oil filler cap and dipstick. Renew any components as necessary.
- 2 While the engine is idling, remove the PCV valve from the rocker cover. A hissing sound should be heard.
- 3 Seal the end of the valve with a finger. A strong suction should be felt and the valve should be heard operating as the finger is moved on and off the end of the valve.



Checking the operation of the PCV valve.



Checking the operation of the PCV system.

- 4 Remove and clean the valve in carburettor cleaner or other suitable solvent. Using compressed air, holding the nozzle at approximately 3 cm distance, blow out remaining deposits in the valve. Renew the PCV valve, if necessary.
- 5 Shake the PCV valve and ensure that it rattles. If necessary, renew the valve.
- 6 Install the PCV valve to the grommet in the rocker cover. Renew the grommet if the valve is not a tight fit.
- 7 Disconnect the breather hose from the breather pipe situated on top of the upper plenum chamber, seal the breather pipe and cover the end of the hose with a piece of stiff paper. Start the engine and allow it to idle. After approximately one minute suction should retain the paper against the end of the hose. If no vacuum is present it may indicate one of the following problems:
 - a Engine is not sealed correctly, drawing outside air. Check engine gaskets for leaks and renew as necessary.
 - b The engine may be worn causing excessive blow-by. Check the cylinder compression and repair as necessary.

Evaporative Control System

The evaporative control system reduces the amount of hydrocarbons (unburned fuel), emitted to the atmosphere through fuel evaporation.

The vehicles covered by this manual use a canister containing active charcoal to store the fuel vapours until they are drawn into the engine to be burned in the combustion process.

The basic components of the evaporative control system are fuel tanks with a sealed fuel filler cap, charcoal canister, purge control solenoid and connecting pipes and hoses. The canister is located in the engine compartment on the left hand inner guard.

When the engine is stopped, fuel vapour caused by evaporation, gradually fills the air space in the fuel tank. As the fuel tank is equipped with a sealed fuel filler cap, pressure gradually builds up within the system. Excess fuel vapour from the fuel tank is forced to flow into the charcoal canister.



Although the fuel filler cap is sealed it has a safety valve built in, which relieves vacuum build up.

When the engine is running, with the coolant temperature above 80°C, the ECU activates the purge control solenoid and the stored vapour in the charcoal canister is drawn into the throttle body and burnt with the air/fuel mixture.

Routine Maintenance

- 1 Check all the pipes and hoses for damage, deterioration and blockage. Check that all joints are tight. Renew the components as necessary.
- 2 Check the charcoal canister for damage and contamination by oil, water or raw fuel using the following procedure:
 - a Note the installed position and disconnect the atmospheric, purge and the tank hoses. Disconnect the wiring connector from the purge valve and lift the canister from its bracket. Shake the canister. Renew the canister if it rattles.
 - b Disconnect the purge solenoid hose from the canister.
 - c Blow into the canister tank port with low pressure compressed air (5 kPa). Check that the air flows freely from the other ports. If necessary renew the canister.
 - d If air flow through the atmospheric port, at the bottom of the canister, is restricted, clean the charcoal canister filter by blocking the purge port and blowing compressed air at 300 kPa through the tank port. Check the air flow as previously described.

If air flow through the atmospheric port is still restricted, renew the canister.
 - e Blow into the purge port with low pressure compressed air (5 kPa). Check that the air does not flow from the other ports. If necessary renew the canister.
 - f Apply low pressure compressed air to one of the ports other than the purge port and block the others. If any leak is evident, renew the canister.
- 3 Inspect the fuel tank filler cap seals for damage or deterioration. Check the pressure and vacuum relief valve in the cap. Renew the cap if the seals or the valves are faulty.
- 4 Check the canister purge control solenoid using the following procedure:
 - a Suitably mark and disconnect the hoses from the purge solenoid.
 - b Disconnect the wiring connector from the purge solenoid.
 - c Remove the bolt retaining the canister purge solenoid bracket to the engine.



Location of the charcoal canister.

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Check the fuel tank filler cap seal for damage or deterioration.

- d Attempt to blow through one port of the canister purge solenoid. Renew the canister purge solenoid if air passes from one port to the other.
- e Apply battery power to the canister purge solenoid terminals. Repeat step (d), air should now pass from one port to the other. Renew the canister purge solenoid if necessary.
- 5 For more information on the canister purge solenoid control circuit, refer to Fuel and Engine Management (chapter 7).

Exhaust Control System

The exhaust gas is the greatest source of pollutant emissions from the internal combustion engine. The level of emissions is controlled by the engine management system and, on models with an oxygen sensor, the catalytic converter.

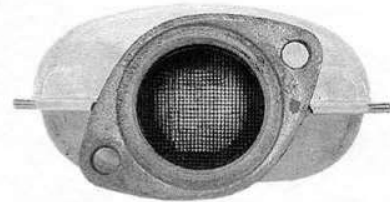
The engine management system constantly monitors the exhaust gases using the sensor installed in the engine pipe. The engine ECU uses the signal produced by the oxygen sensor to adjust the fuel injection and the ignition timing to ensure that the correct air/fuel ratio and complete combustion is maintained, reducing exhaust emissions.

For further information on testing the oxygen sensor, refer to Fuel and Engine Management (chapter 7).

CATALYTIC CONVERTER — WHERE FITTED

A three way catalytic converter is installed at the front of the exhaust system. The converter contains catalyst materials, which convert the hydrocarbons and carbon monoxide present in the exhaust gases to carbon dioxide, water and heat, and the oxides of nitrogen present in the exhaust gases to oxygen and nitrogen.

The catalytic converter does not require periodic maintenance or renewal under normal circumstances. However, it can be



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It should be possible to look through the core of a catalytic converter that is in good condition.

damaged or poisoned by excessively high exhaust gas temperature, incorrect air/fuel ratio or the use of leaded fuel. To prevent the use of leaded fuel, a small diameter filler neck containing a spring loaded trap door is installed to the fuel tank.

The converter can also be damaged by hard impacts which may shatter the core. If the converter overheats or is contaminated with leaded fuel, the core may become blocked or restricted, resulting in loss of performance.

To prevent damage to the catalytic converter, the following precautions should be observed:

- Do not operate the vehicle on leaded fuel.
- Do not push or tow start the vehicle.
- Do not allow the engine to idle for prolonged periods.
- Do not allow oil, coolant or unburnt fuel to enter the converter as this will cause contamination of the catalyst.
- Do not operate the vehicle for long periods if the engine is misfiring.
- Avoid running the vehicle out of fuel.



On vehicles used off road, it is important that long grass is not allowed to build up around the catalytic converter as a serious fire hazard exists.

For the same reason avoid parking the vehicle in long dry grass.

ROUTINE MAINTENANCE

- 1 Inspect the converter for dents and damage. If the converter is damaged it should be renewed.
- 2 Inspect the exhaust system heat shields for damage and correct installation. Renew the heat shields as necessary.

TO REMOVE AND INSTALL

The removal and installation procedure for the catalytic converter is covered under the Exhaust System heading in Engine (chapter 4).

A simple way to check the serviceability of the catalytic converter is to remove it from the exhaust system and, with a light at one end, look through the core. It should be possible to see through the catalytic converter from the front to the rear.