






# Chapter 4 Part D: Emission control systems

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## Degrees of difficulty

<b>Easy</b> , suitable for novice with little experience		<b>Fairly easy</b> , suitable for beginner with some experience		<b>Fairly difficult</b> , suitable for competent DIY mechanic		<b>Difficult</b> , suitable for experienced DIY mechanic		<b>Very difficult</b> , suitable for expert DIY or professional	
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### 1 General information

Apart from their ability to use unleaded petrol, and the various built-in fuel system features which help to minimise emissions, all models have at least the crankcase emission-control system described below. Models with a catalytic converter are also fitted with the exhaust and evaporative emission control systems (refer to Part B or C of this Chapter for further information).

#### Crankcase emission control

To reduce the emission of unburned hydrocarbons from the crankcase into the atmosphere, the engine is sealed, and the blow-by gases and oil vapour are drawn from the crankcase, through a wire-mesh oil separator, into the inlet tract, to be burned by the engine during normal combustion.

Under conditions of high manifold depression (idling, deceleration) the gases will be sucked positively out of the crankcase. Under conditions of low manifold depression (acceleration, full-throttle running) the gases are forced out of the crankcase by the (relatively) higher crankcase pressure; if the engine is worn, the raised crankcase pressure (due to increased blow-by) will cause some of the flow to return under all manifold conditions.

#### Evaporative emission control

To minimise the escape into the atmosphere of unburned hydrocarbons, an evaporative emissions control system is fitted to models equipped with a catalytic converter. The fuel tank filler cap is sealed, and a charcoal canister, mounted underneath the right-hand wing, collects the petrol vapours generated in the tank when the car is parked. The canister stores them until they can be cleared from the canister (under the control of the fuel injection/ignition system ECU) via the purge solenoid valve(s). When the valve is opened, the fuel vapours pass into the inlet tract, to be burned by the engine during normal combustion.

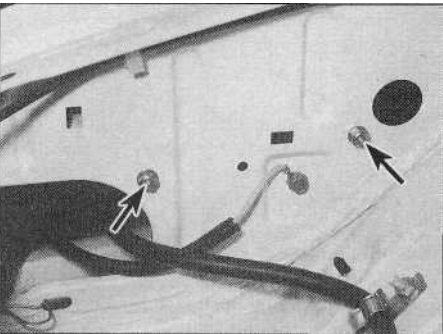
To ensure that the engine runs correctly when it is cold and/or idling, and to protect the catalytic converter from the effects of an over-rich mixture, the ECU does not open the purge control valve(s) until the engine has warmed up and is under load; the valve solenoid is then modulated on and off, to allow the stored vapour to pass into the inlet tract.

#### Exhaust emission control

To minimise the amount of pollutants which escape into the atmosphere, some models are fitted with a catalytic converter in the exhaust system. On all models where a catalytic

converter is fitted, the system is of the "closed-loop" type; a lambda (oxygen) sensor in the exhaust system provides the fuel injection/ignition system ECU with constant feedback, enabling the ECU to adjust the mixture to provide the best possible conditions for the converter to operate.

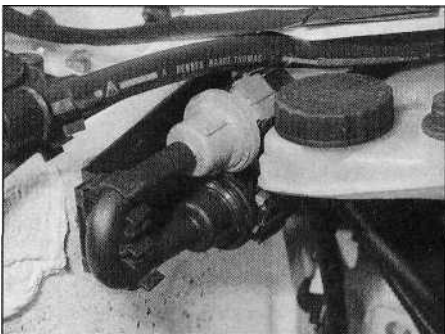
The lambda sensor has a built-in heating element, controlled by the ECU through the lambda sensor relay, to quickly bring the sensor's tip to an efficient operating temperature. The sensor's tip is sensitive to oxygen, and sends the ECU a varying voltage depending on the amount of oxygen in the exhaust gases. If the intake air/fuel mixture is too rich, the exhaust gases are low in oxygen, so the sensor sends a low-voltage signal. The voltage rises as the mixture weakens and the amount of oxygen in the exhaust gases rises. Peak conversion efficiency of all major pollutants occurs if the intake air/fuel mixture is maintained at the chemically-correct ratio for the complete combustion of petrol - 14.7 parts (by weight) of air to 1 part of fuel (the "stoichiometric" ratio). The sensor output voltage alters in a large step at this point, the ECU using the signal change as a reference point, and correcting the intake air/fuel mixture accordingly by altering the fuel injector pulse width (the length of time that the injector is open).



2.3 Charcoal canister is secured to the right-hand wing valance by two nuts (arrowed)



2.5 Peel back the wheel arch liner to gain access to the charcoal canister from underneath the wing



2.7a Twin-purge valve arrangement is located in the right-hand rear corner of the engine compartment -1360 cc model shown

2 Emission control system components - testing and renewal

Crankcase emission control

1 The components of this system require no routine attention, other than to check that the hose(s) are clear and undamaged at regular intervals.

Evaporative emission control Testing

2 If the system is thought to be faulty, disconnect the hoses from the charcoal canister and purge control valve, and check that they are clear by blowing through them. If the purge control valve(s) or charcoal canister are thought to be faulty, they must be renewed.

Charcoal canister - renewal

- 3 From within the engine compartment, slacken and remove the two nuts securing the charcoal canister to the right-hand wing valance (see illustration).
- 4 Slacken and remove the lower bolt securing the right-hand wheel arch liner to the bumper, then prise out the front liner retaining clips.
- 5 Peel the liner away from the wing to gain access to the canister, then disconnect both upper and lower hoses from the canister and

manoeuvre the canister out from underneath the wing (see illustration). Store or dispose of the canister carefully - it may contain fuel vapour.

6 Refitting is a reverse of the removal procedure, ensuring that the hoses are correctly refitted.

Purge valve(s) - renewal

- 7 Either a single- or a twin-purge valve arrangement is fitted, depending on model. The purge valve(s) is/are mounted on the right-hand side of the engine compartment (see illustrations).
- 8 To renew a purge valve, first disconnect the battery negative terminal. Depress the retaining clip, and disconnect the wiring connector from the valve.
- 9 Disconnect the hoses from either end of the valve, then release the valve from its retaining clip and remove it from the engine compartment, noting which way round it is fitted.
- 10 Refitting is a reversal of the removal procedure, ensuring that the valve is fitted the correct way round and that the hoses are securely connected.

Exhaust emission control Testing

11 The performance of the catalytic converter can be checked only by measuring the idle mixture setting (exhaust gas CO

content) using an accurately calibrated exhaust gas analyser, as described in Chapter 1.

12 If the CO level at the tailpipe is too high, the vehicle should be taken to a Citroen dealer so that the complete fuel injection and ignition systems, including the lambda sensor, can be thoroughly checked using the special diagnostic equipment.

13 Once this has been done, any fault must lie in the catalytic converter, which should be renewed as described in Part B or C of this Chapter (as applicable).

Catalytic converter - renewal

14 Refer to Part B or C of this Chapter (as applicable).

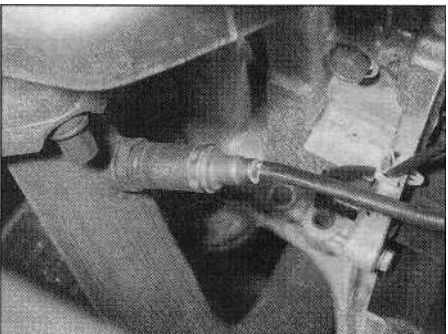
Lambda sensor - renewal

**Note:** The lambda sensor is fragile, and will not work if it is dropped or knocked, if its power supply is disrupted, or if any cleaning materials are used on it.

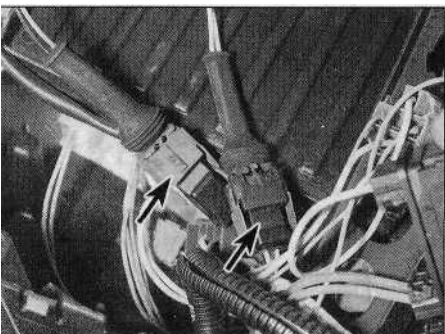
15 On 1124 cc and 1360 cc models, the lambda sensor is screwed into the top of the exhaust front pipe. Trace the wiring back from the sensor to the engine compartment junction box (see illustrations). Open the junction box, then unclip the relay plate and withdraw it from the box, to gain access to the sensor wiring connectors. Disconnect both wiring connectors, and withdraw the wiring from the bottom of the box.



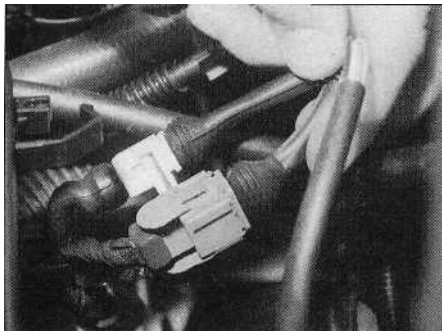
2.7b Single purge valve is located in the front right-hand corner of the engine compartment - 1998 cc 16-valve model shown



2.15a On 1124 cc and 1360 cc models, the lambda sensor is screwed into the top of the exhaust front pipe ...



2.15b ... and the wiring connectors (arrowed) are located inside the junction box



**2.16 On 1580 cc and larger models, the lambda sensor wiring connectors are clipped onto the back of the battery/ECU box**

**16** On 1580 cc and larger-engined models, the lambda sensor is screwed into the base of the exhaust front pipe. Firmly apply the handbrake, then jack up the front of the car and support it on axle stands. Trace the wiring back from the lambda sensor to the engine compartment. Release the wiring connectors from the rear of the battery/ECU box, and disconnect them from the main wiring loom (see illustration).

**17** Unscrew the sensor from the exhaust system front pipe, and remove it along with its sealing washer.

**18** Refitting is a reverse of the removal procedure, using a new sealing washer. Ensure the sensor is securely tightened. Check that the wiring is correctly routed, and in no danger of contacting either the exhaust system or the engine.

### 3 Catalytic converter - general information and precautions

The catalytic converter is a reliable and simple device, which needs no maintenance in itself, but there are some facts of which an owner should be aware, if the converter is to function properly for its full service life.

- (a) *DO NOT use leaded (UK "4-star") petrol in a car equipped with a catalytic converter - the lead will coat the precious metals, reducing their converting efficiency, and will eventually destroy the converter.*
- (b) *Always keep the ignition and fuel systems well-maintained in accordance with the manufacturer's schedule, as given in Chapter 1. In particular, ensure that the air cleaner filter element, the fuel filter (where fitted) and the spark plugs are renewed at the correct interval. If the intake air/fuel mixture is allowed to become too rich due to neglect, unburned fuel will enter the catalytic converter, overheating the element and eventually destroying the converter.*
- (c) *If the engine develops a misfire, do not drive the car at all (or at least as little as possible) until the fault is cured - the misfire will allow unburned fuel to enter the converter, which will result in its overheating, as noted above.*
- (d) *DO NOT push- or tow-start the car - this will soak the catalytic converter in unburned fuel, causing it to overheat when the engine does start - see (b) or (c) above.*
- (e) *DO NOT switch off the ignition at high engine speeds - ie do not "blip" the throttle immediately before switching off the engine. If the ignition is switched off at anything above idle speed, unburned fuel will enter the (very hot) catalytic converter, with the possible risk of its igniting on the element and damaging the converter.*
- (f) *DO NOT use fuel or engine oil additives - these may contain substances harmful to the catalytic converter.*
- (g) *DO NOT continue to use the car if the engine burns oil to the extent of leaving a visible trail of blue smoke - the unburned carbon deposits will clog the converter passages, and reduce its efficiency; in*

*severe cases, the element will overheat.*

- (h) *Remember that the catalytic converter operates at very high temperatures - hence the heat shields on the car's underbody - and the casing will become hot enough to ignite combustible materials which brush against it. DO NOT, therefore, park the car in dry undergrowth, or over long grass or piles of dead leaves.*
- (i) *Remember that the catalytic converter is FRAGILE - do not strike it with tools during servicing work, and take great care when working on the exhaust system. Ensure that the converter is well clear of any jacks or other lifting gear used to raise the car, and do not drive the car over rough ground, road humps, etc, in such a way as to "ground" the exhaust system.*
- (l) *In some cases, particularly when the car is new and/or is used for stop/start driving, a sulphurous smell (like that of rotten eggs) may be noticed from the exhaust. This is common to many catalytic converter-equipped cars, and seems to be due to the small amount of sulphur found in some petroils reacting with hydrogen in the exhaust, to produce hydrogen sulphide ( $H_2S$ ) gas; while this gas is toxic, it is not produced in sufficient amounts to be a problem. Once the car has covered a few thousand miles, the problem should disappear - in the meanwhile, a change of driving style, or of the brand of petrol used, may effect a solution.*
- (k) *The catalytic converter, used on a well-maintained car, should last for between 50 000 and 100 000 miles - from this point on, the CO level should be carefully checked at all specified service intervals, to ensure that the converter is still operating efficiently. If the converter is no longer effective, it must be renewed.*