Frequently Asked Questions

Question
'CAT' (Catylitic Converter)

Answer
European emission control legislation dictates the limits for toxic emissions from a vehicle s exhaust system. Only by post-engine exhaust gas treatment can these limits be met. This function is carried out by a catalytic converter.

What it does:

catalytic converter can be thought of as a post-engine exhaust filter that removes the harmful emissions of an engine. Unlike a traditional filter it works by utilising a combination of heat and precious metals to promote a catalytic reaction which chemically converts those harmful gases into naturally occurring ones, so that no residues remain. Also unlike other filters the catalytic converter is designed to last the life of the vehicle to which it is fitted.

They are located in a position in the exhaust system as close to the engine as possible so that they quickly get to operating temperature. It outwardly resembles a small exhaust silencer. They are a legal requirement on all petrol engined cars made for the UK market since 1993.

How does it work?

A honeycomb structure (either ceramic or metallic) is treated with a wash-coat of precious metals (usually platinum, palladium and rhodium) through which the exhaust gasses flow. The surface of the honeycomb material has a rough finish such that it allows the maximum contact area available to the exhaust gasses. Viewed from either end it resembles a handful of drinking straws with hundreds of tiny flow channels that allow the gasses to pass through.

Once the converter is up to its minimum operating temperature of 350-400 degrees Celsius, a two or three way (depending upon the converter type) process takes place;

Unburnt Hydrocarbons are oxidised into water/steam
Carbon Monoxide is oxidised into Carbon Dioxide and Nitrogen Oxides are converted into Nitrogen and Oxygen

Two way converters only carry out the first two processes and are now rarely used.

Limitations:

converters are an integral part of the vehicle s emission system. They are designed to work within a

very limited band of exhaust gas concentration, too rich or too lean and the life of the converter will be reduced. Only by accurate control of the engine management system (EMS) can this specific exhaust gas concentration be maintained. Failure of any of the EMS components will have an adverse effect on the performance and life expectancy of the converter and this particularly includes the Lambda sensor.

The catalytic converter is designed to last the life of the vehicle to which it was fitted. If it has failed, there will always be a reason behind this failure. Only by investigating and rectifying this reason can you expect the new, replacement converter to perform correctly and reliably for the foreseeable future.

Testing:

The most accurate method of testing a catalytic converter is to measure the gasses entering it and then compare the readings of the gasses exiting it. This directly addresses the main problem with converter diagnosis in that the converter itself can disguise a mild emissions error.

A few vehicles have a pre-cat test point where the exhaust gasses can be sampled before they enter the converter but for most vehicles this is a luxury that we have to do without. Absence of such a port makes exhaust gas comparison tests impractical.

The Lambda sensor, if it is operating correctly, can be used as a pre-cat exhaust gas concentration tester, simply hook a voltmeter up to the output wire and monitor the voltage. A high voltage will indicate a rich mixture; check the vehicle data for actual voltage outputs.

The operation of the converter can also be checked by monitoring the temperature of the converter at the entry and exit points. With a working converter the exit temperature will always be higher than the inlet temperature due to the catalytic reaction. The actual temperatures are unimportant, just check for a difference. Ensure that the vehicle is fully warmed up before carrying out this test and use a non-contact (infra-red) type thermometer. The temperature difference is also, to some extent, unimportant. Later vehicles or lean burn engines will have a much smaller temperature increase than a vehicle running at a higher exhaust gas concentration. This test will not highlight any emission faults; merely confirm if the catalytic converter is working.

Visual inspections can also be quite revealing;

* Check the external surfaces of the converter for any discolourations indicating that overheating has occurred. A straw or blue coloured tincture, would indicate that the converter has been subjected to an over rich mixture. The richer the mixture the hotter the converter will get attempting to correct the error, hence a rich mixture results in an overheated converter.

* Check the converter for signs of external damage or clues that the car has recently been through a flood or ford which has quenched the converter causing it to contract rapidly.

* Visually check the converter internally, look for signs of excessive carbon build up, monolith melt down, extreme black carbon deposits or even total blockage all are clues of emission related errors.

There will always be a reason for the failure, sometimes its straight forward and obvious, like corrosion or physical damage but sometimes it can be very obscure like intermittent emission related faults but the fault will be there.

Details
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