Haynes shows you how

BMW 3-Series and Z4 (99-05) Includes 2006 325ci/330ci Coupe and Convertible models Haynes Online Manual.

1 General information

All models have various built-in fuel system features that help to minimize emissions, including a crankcase emission control system, catalytic converter, and an evaporative emission control system. M52TU and M56 engine models are also equipped with secondary air injection to shorten the catalytic converter warm-up phase.

To prevent pollution of the atmosphere from incompletely burned and evaporating gases, and to maintain good driveability and fuel economy, a number of emission control systems are incorporated. They include the:

- Catalytic converter
- Evaporative Emissions Control (EVAP) system
- Intake Manifold Runner Control
- On-Board Diagnostic-II (OBD-II) system
- Positive Crankcase Ventilation (PCV) system
- Electronic Fuel Injection system (part of the computerized engine control system)
- Secondary air injection
- Variable Valve Timing (VANOS)

This Chapter includes general descriptions of these and other emissions-related devices and component replacement procedures (where possible) for most of the systems listed above. Before assuming that an emissions control system is malfunctioning, check the fuel and ignition systems carefully. The diagnosis of most emission control devices requires specialized tools, equipment and training. If a procedure is beyond your ability, consult a dealer service department or other repair shop. Remember, the most frequent cause of emissions problems is simply a loose or broken wire or vacuum hose, so always check all hose and wiring connections first.

Pay close attention to any special precautions outlined in this Chapter. It should be noted that the illustrations of the various systems might not exactly match the system installed on your vehicle because of annual changes made by the manufacturer during production and because of running changes made during a model year.

A Vehicle Emissions Control Information (VECI) label **(see illustration)** is located in the engine compartment, either on the underside of the hood or attached to the radiator support or one of the strut towers. This label specifies the important emissions systems on the vehicle and it provides the important specifications for tune-ups. Part of the VECI label, the Vacuum Hose Routing Diagram, provides a vacuum hose schematic with emissions components identified. When servicing the engine or emissions systems, the VECI label and the vacuum hose routing diagram should always be checked for up-to-date information.

1.5 The Vehicle Emission Control Information (VECI) label specifies the emission-control systems on your vehicle; including important information and a vacuum hose routing diagram

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 vapor are drawn from the crankcase and the cylinder head cover, through an oil separator, into the intake tract, to be burned by the engine during normal combustion.

Under conditions of high manifold vacuum (idling, deceleration) the gases will be sucked positively out of the crankcase. Under conditions of low manifold vacuum (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.

Exhaust emission control

To minimize the amount of pollutants which escape into the atmosphere, all models are installed with a catalytic converter in the exhaust system. The system is of the “closed-loop” type; one or two oxygen (lambda) sensors in the exhaust system provides the fuel injection/ ignition system ECM with constant feedback, enabling the ECM to adjust the mixture to provide the best possible conditions for the converter to operate.

The oxygen sensor(s) has a built-in heating element, controlled by the ECM, to quickly bring the sensor’s tip to an efficient operating temperature. The sensor’s tip is sensitive to oxygen, and sends the ECM 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-balanced ratio for the complete combustion of gasoline - 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 ECM 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).

Evaporative emission control

To minimize the escape into the atmosphere of unburned hydrocarbons, an evaporative emissions control system is fitted to all models. The fuel tank filler cap is sealed, and a charcoal canister, mounted under the rear of the vehicle, collects the gasoline vapors 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 ECM) via the purge solenoid valve. When the valve is opened, the fuel vapors pass into the intake tract, to be burned by the engine during normal combustion.

To ensure that the engine runs correctly when it is cold and/or idling, the ECM does not open the purge control valve until the engine has warmed-up and is under load; the valve solenoid is then modulated on and off, to allow the stored vapor to pass into the intake tract.

Secondary air injection

M52TU and M56 engine models are equipped with a system that is designed to shorten the amount of time the catalytic converter takes to warm-up. In order to function correctly, the catalytic converter needs to be at a temperature of at least 300°C. This temperature level is achieved by the action of the exhaust gases passing through. In order to reduce the catalyst warm-up phase, a secondary air injection pump injects fresh air just behind the exhaust valves in the exhaust manifold. This oxygen rich mixture causes an “afterburning” effect in the exhaust, greatly increasing the gas temperature, and therefore the catalyst temperature. The system is only active during cold starts (up to 91-degees F [33°C] coolant temperature), and only operates for approximately 2 minutes.