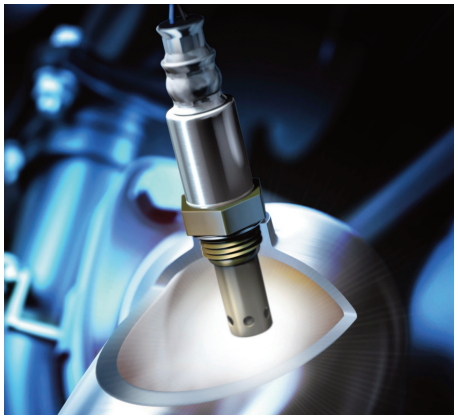
Basics of Lambda Sensors

Without a lambda sensor monitoring oxygen in the exhaust of an engine, controlling the fuel delivery would be impossible, to the exacting standards required by a modern engine. Denso provides details of lambda sensor function and their importance and maintenance.

A lambda sensor, sometimes known as an O2 or oxygen sensor, provides real-time critical information to the ECU, that allows for precise control of fuel delivery. Low emissions, smooth running and maximum power/efficiency all rely on the precise ratio of air to fuel. An air/fuel mass ratio of 14.7/1 is the ideal, and any deviation creates a loss of power and fuel economy, while also creating an increase of noxious emissions.
Carburetors were never able to accurately deliver fuel over a wide range of engine operation, but the introduction of fuel injection, brought precision into fuel delivery. The problem then became how to adjust injectors to always provide proper air/fuel ratios.

Lambda sensors provide information on whether the engine was running lean or rich, and in real time. Lambda sensors are made from ceramic materials that interact with the exhaust gasses and inlet air. The sensor, inserted into the engine's exhaust, does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in the inlet air. By monitoring the voltage signal from the lambda sensor, the ECU knows if the engine is running rich or lean, and can then adust fuel delivery accordingly. High frequency monitoring means that the injectors can be adjusted in micro-seconds, resulting in very precise fuel delivery control and near perfect air/fuel ratios, at nearly all times and all conditions.
Early Lambda sensor designs only knew if the mixture was rich or lean, and by what amount. Newer designs also tell the ECU how fast the mixture is changing, allowing an even more accurate control of fuel during changes in power demands and operation. Some advanced engines have more than one lambda sensor, allowing the ECU to control fuel delivery on a more localised basis, rather than making changes to all injectors at any given moment.



Only use the thread sealant provided with the replacement lambda sensor

Need for Lambda sensor replacement
Due to the hostile environment in which they operate, sensors are subject to a high degree of wear and tear and ageing. It would be difficult to accurately state the expected service life of a lambda sensor, as they will be subject to very different conditions, such as vehicle application, usage and driver behaviour. It would be reasonable to expect, that the service life of a lambda sensor, fitted to a vehicle used mostly for short in-town journeys, would be shorter than one used for steady motorway use. It is recommended that the function of the sensor be checked every 30,000 kilometres or annually. The emissions check (as part of the current NCT) samples the exhaust gases to monitor the efficiency of the engine, exhaust system and engine control systems. A lambda sensor is a vital part of this system, and any fault should be noticeable during an emission check.

A worn, faulty or failed sensor might make itself apparent by causing the engine to run poorly, increasing fuel consumption, increasing unwanted exhaust emissions or illuminating a malfunction indicator lamp on the dashboard or instrument panel. Newer vehicles have the ability to store fault codes in the processor; some of which will relate to the lambda sensor and associated systems. Defective sensors can also cause irreparable damage to the catalyst.

On removal, examine the sensor tip for contamination/disclolouration. If it is light grey in colour, then there is a coolant leak. A fault that caused the sensor to fail needs to be fixed before a new sensor is fitted. Oil/grease contamination on the exterior of the sensor also has to be cleaned and the source eliminated.

Sensors, and their wiring harness and connectors, that have sustained physical damage, will most likely have their life shortened or performance affected and should also be replaced. DENSO lambda sensors are made with a stainless steel housing for durability, but careful handling is still required during installation. Grease, dust or any other material blocking air from entering the sensor, will also interfere with proper operation and service life. Be sure to use only the thread sealant compound provided when replacing a worn or damaged sensor, and be certain to clean the port.

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