



Variable Valve Timing

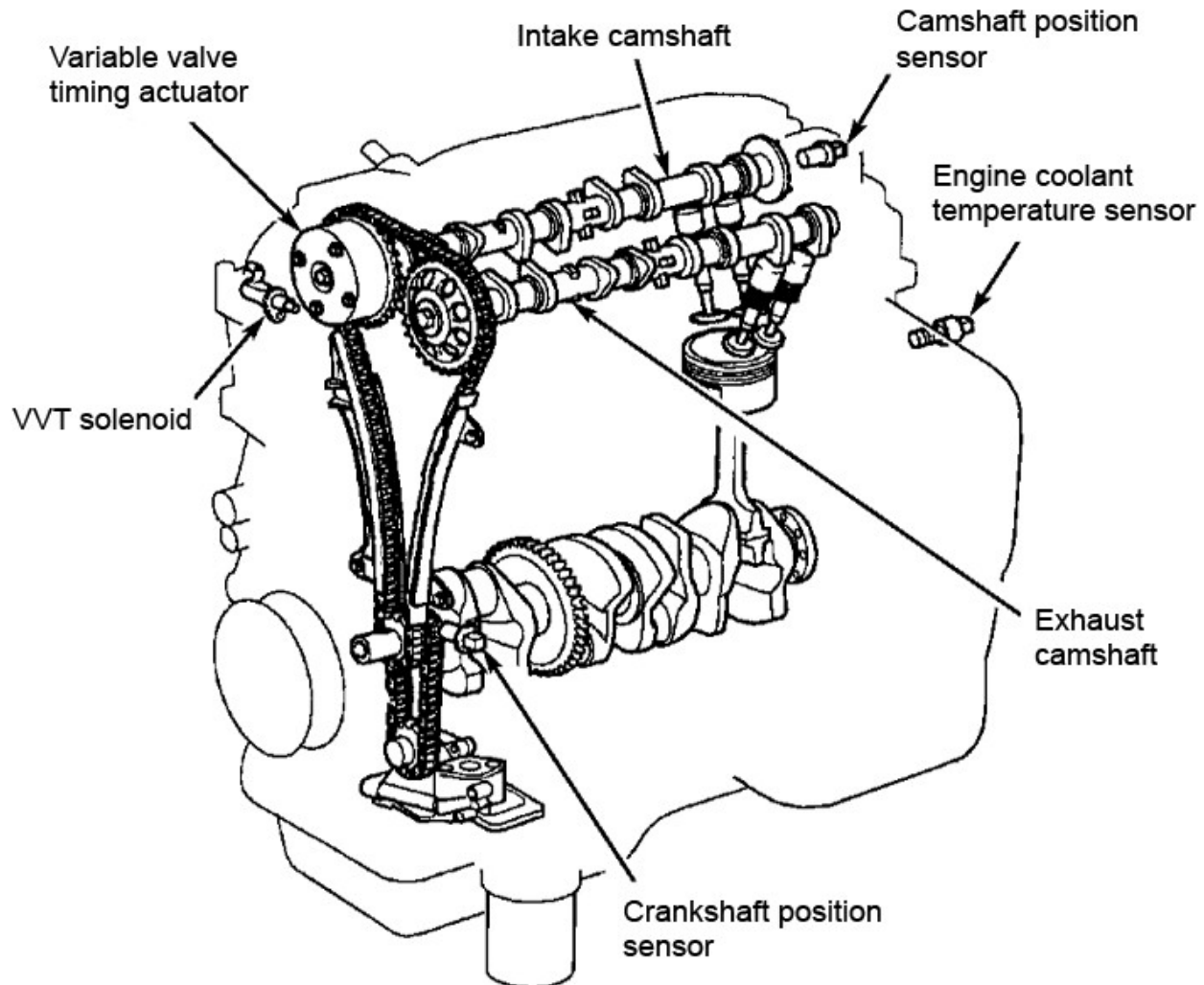
Customer Education Sheet

Engines with variable valve timing (VVT) have better performance and less emissions under a variety of engine speeds.

Why Engines Have Variable Valve Timing

In any given engine, the camshaft and crankshaft must rotate in sync so the valves open and close at the right time. This “timing” is necessary for the engine to run properly. In vehicles without VVT, this timing is the same regardless of engine speed. This isn’t always ideal, since the optimum timing is different at low and high RPMs. To give the best overall performance, engineers would choose a timing that was a compromise between low and high RPM needs. With variable valve timing, the timing can be adjusted as engine speed changes to provide the best performance at both low and high RPMs.

Parts of a Variable Valve Timing System



How Variable Valve Timing Works

Different manufacturers have different ways of accomplishing variable valve timing, but here is one system in a nutshell: the engine control module (ECM) looks at the information it receives from various sensors (the engine temperature sensor, the camshaft position sensor, the crankshaft position sensor, etc.) to determine if and when it needs to adjust the valve timing. Once the ECM decides that an adjustment is needed, it sends an electrical signal to the VVT solenoid. This solenoid controls how much pressurized engine oil goes to the VVT timing actuator (also called a cam phaser). This actuator is hydraulically-controlled, and will adjust the timing depending to how much oil pressure it receives from the VVT solenoid.

Variable Valve Timing Issues

VVT problems often manifest as performance issues, as most VVT systems are only activated at high RPMs (for example, over 4,500). Other signs of VVT problems can include reduced fuel economy, a rough idle, and a check engine light. However, plenty of other things can cause these issues, so a proper diagnosis of any problem is important.

Causes of Variable Valve Timing Issues

One of the biggest causes of VVT issues is lack of regular maintenance. The oil passages in VVT solenoids are very small, and thus extremely prone to sludging. Solenoids and sensors can also fail over time, just like any other electrical part. In some cases, a vehicle's ECM may also go bad and need to be replaced.

The Importance of Engine Oil

Clean engine oil is crucial for the proper operation of variable valve timing systems. Oil that's dirty or is not changed regularly can lead to sludge or debris plugging the tiny passages of the VVT solenoid, which causes the system to function improperly or not at all. Sludge can also accumulate inside the VVT actuators or cause issues in the valve assembly, which can result in poor lubrication and scoring of the camshaft. Using the correct type of oil is also important, as different oil viscosities will change how the actuators function.

