ENGINE MANAGEMENT SYSTEM - VVC - MEMS 2J

The Engine Control Module (ECM) monitors the conditions required for optimum combustion of fuel in the cylinder through sensors located at strategic points around the engine. From these sensor inputs, the engine control module can adjust the fuel quantity and timing of the fuel being delivered to the cylinders. The ECM also controls the valve period, by driving the variable valve control (VVC) mechanism, to produce the optimum engine torque characteristic.

The main features are as follows:

- A single ECM controls the fuel injection system and the ignition system. The ECM incorporates short circuit protection and can store intermittent faults on certain inputs. TestBook can interrogate the ECM for these stored faults.
- The ECM measures the cam period via the cam sensor, and controls the VVC mechanism via two solenoids: one which increases the cam period and one which reduces it.
- The ECM is electronically immobilised preventing the engine from being started unless it receives a coded signal from the anti-theft control unit.
- The ECM uses the speed/density method of air flow measurement to calculate fuel delivery. This method calculates the density of intake air by measuring its pressure and temperature. The density signal, along with engine speed, allows the ECM to make a calculation of the air volume being inducted, and hence determine how much fuel should be injected to give the correct air/ fuel ratio.
- A separate diagnostic connector allows engine tuning or fault diagnosis to be carried out using TestBook without disconnecting the ECM harness multiplug. The multiplug is located on the passenger compartment fusebox.
- The ECM harness multiplug incorporates specially plated pins to minimise oxidation and give improved reliability.
- The ECM controls the operation of the radiator, air conditioning and engine compartment fans based on signals received from engine coolant temperature and engine bay temperature sensors. If a high engine temperature is detected, the ECM will prevent the air conditioning system from operating.
- If certain system inputs fail, the ECM implements a back-up facility to enable the system to continue functioning, although at a reduced level of performance.
- The ECM used on the VVC engine implements tune select. This means that each ECM may contain one or more vehicle's engine calibration. When first supplied, the ECM has no calibration selected and will not run the engine. When fitted to a vehicle, the ECM calibration for that vehicle must be selected using TestBook. This is to prevent ECM's being fitted to vehicles with the wrong calibration selected. It is an additional action to programming the ECM security code.

IGNITION SYSTEM - VVC

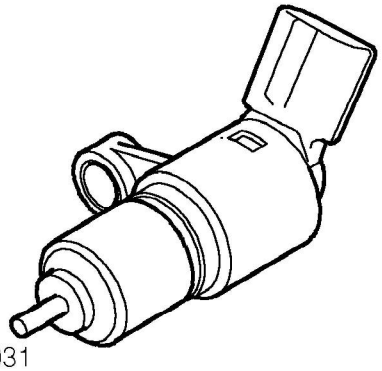
The engine control module determines the optimum ignition timing based on the signals from the following sensors:

1. Crankshaft position sensor - Engine speed and crankshaft position
2. Camshaft position sensor - Camshaft position
3. Manifold absolute pressure sensor - Engine load
4. Engine coolant temperature sensor - Engine temperature
5. Throttle position sensor - Throttle pedal position

The VVC engine employs a direct ignition system which consists of two twin-ignition coils driven directly from the ECM. Each twin-ignition coil supplies two cylinders.

BASIC IGNITION TIMING - VVC

Crankshaft position sensor



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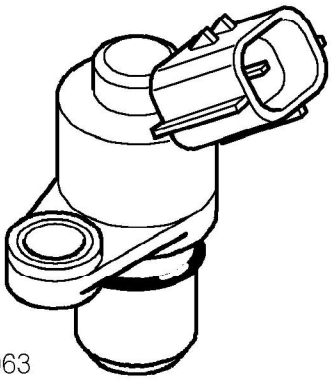
The speed and position of the engine is detected by the crankshaft position sensor which is bolted to, and projects through, the engine adapter plate adjacent to the flywheel.

The crankshaft position sensor is an inductive sensor consisting of a bracket mounted body containing a coil and a permanent magnet which provides a magnetic field. The sensor is situated such that an air gap exists between it and the flywheel. Air gap distance is critical for correct operation.

The flywheel incorporates a reluctor ring which consists of 32 poles spaced at 10° intervals, with 4 missing poles at 30°, 60°, 210°and 250°. When the flywheel rotates, as a pole passes the CKP sensor, it disturbs the magnetic field, inducing a voltage pulse in the coil, which is transmitted to the ECM.

By calculating the number of pulses that occur within a given time, the ECM can determine the engine speed. The output from this sensor when used in conjunction with that from the manifold absolute pressure sensor provides idle stabilisation and reference for both ignition and injection timing.

Camshaft position sensor



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The camshaft position sensor has two functions. The first is to enable the ECM to run a sequential fuelling mode. The second is to measure the actual cam period, this measurement is achieved using teeth on the camshafts to indicate when the valve opens and closes.

If the camshaft position sensor fails when the engine is running, the engine will continue to run normally in sequential fuelling mode. If the sensor fails before the engine is started, the engine will start but run in grouped fuelling mode. The engine running in grouped fuelling mode can be detected by a reduced rev limit: 5500/5800 rpm in comparison to the normal rev limit of 7000/7300 rpm. Camshaft position sensor failure can be identified using TestBook.