



BMW E90 Misfire and Engine Management Light Illuminated

By Damien Coleman

A 2008 BMW E90 with a 2.0L spark ignition engine (engine code: N43B20A) was reported to have been suffering from occasional rough running when starting and the engine management light was illuminating. When the vehicle was being tested initially there was no issue when starting it but a slight misfire was found under harsh acceleration.



A [Snap-on VERUS Edge scan tool](#) was connected to the vehicle through the 16 pin data link connector and the following fault codes were found:

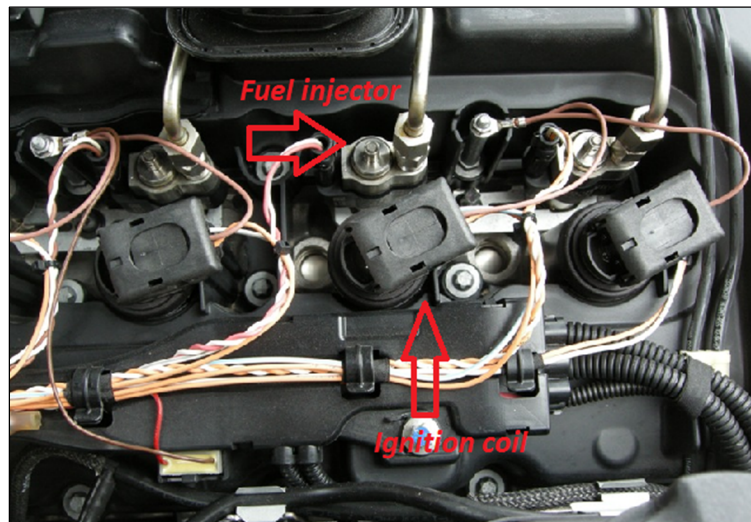
- 29CC - Combustion Misfire on Several Cylinders
- 29CD – Combustion Misfire on Cylinder 1
- 29D0 – Combustion Misfire on Cylinder 4

Due to both cylinder 1 and 4 being highlighted as the cylinders with the combustion concern, a fault such as incorrect identification of the cylinder was ruled out. This is because the firing order of this engine is 1-3-4-2.

On a number of occasions an engine control module has identified the incorrect cylinder as misfiring, for example cylinder 3 misfire being detected when the fault is actually cylinder 1.

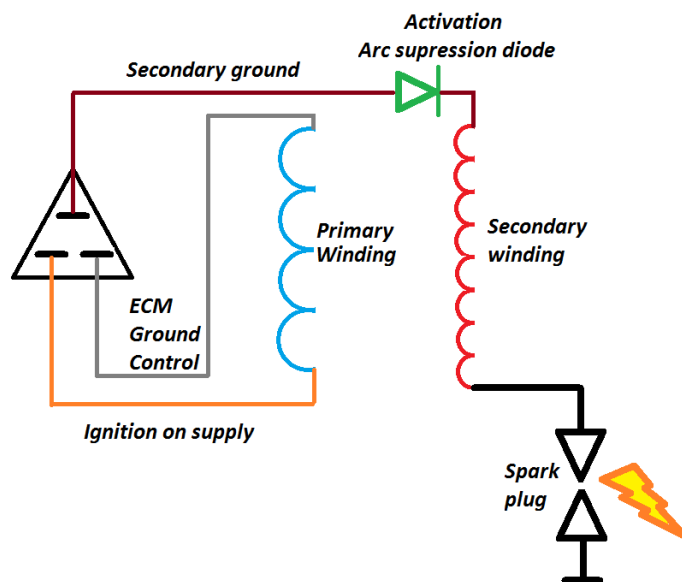
Another factor which will normally be considered with multiple cylinder misfires is an issue with cylinder sealing for adjacent cylinders, although again this was ruled out due to the cylinders affected being on opposite ends of the engine.

At this point the fault codes were cleared and the vehicle was road tested. The misfire associated with cylinder 1 could be reproduced under harsh acceleration during wide open throttle conditions. Such a misfire is normally ignition related so the ignition coil for cylinder 1 was tested using an oscilloscope.



- Direct ignition coils and high pressure direct injection injectors

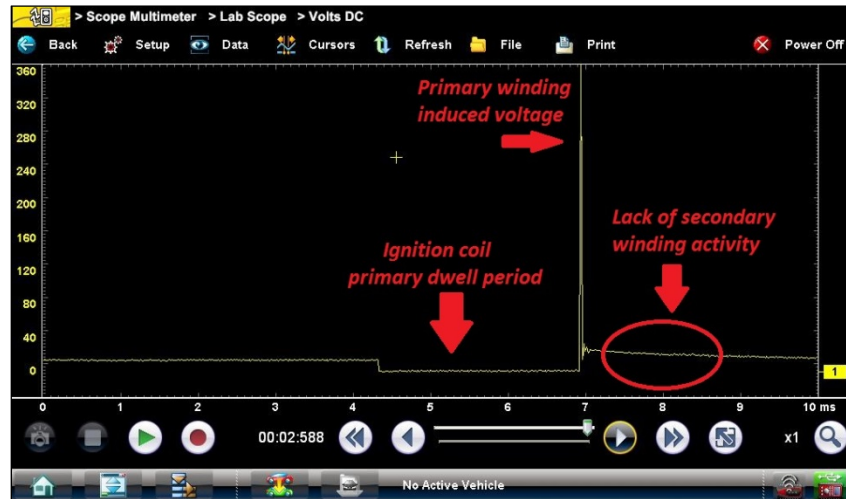
Below is a diagram illustrating the operation of the ignition coil fitted to this particular vehicle:



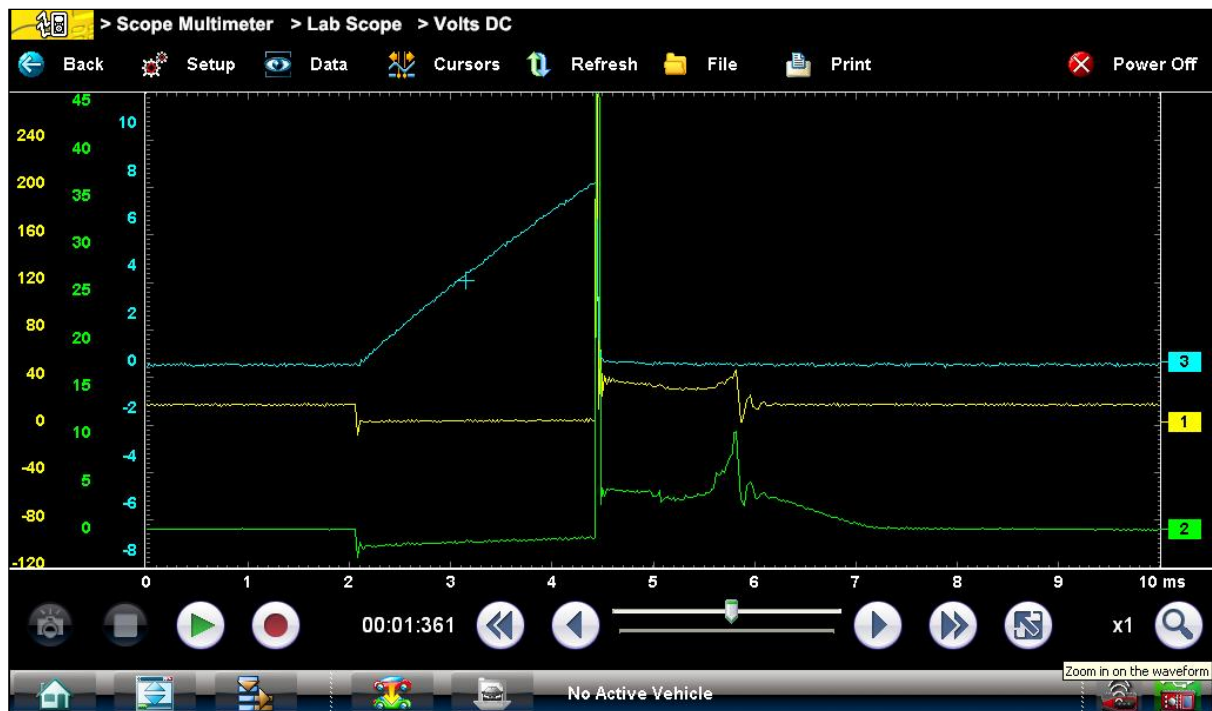
The purpose of the AAS diode is to eliminate "switch on" sparks in the secondary winding when current begins to flow through the primary winding.

These diodes are only fitted to direct ignition coils and are not required for wasted spark coils.

The oscilloscope was connected to the ECM ground control circuit pin on the ignition coil block connector to monitor ignition coil primary voltage. As the waveform displayed from the primary winding has a direct relationship to the activity taking place in the secondary circuit, any abnormalities can be observed (note: only primary voltage display to simplify image).



The above waveform indicated a problem in the secondary circuit which is integrated into the ignition coil assembly. The ignition coil was replaced for cylinder 1 and the following oscilloscope pattern was captured:



- Yellow trace:** Ignition coil primary voltage.
- Green trace:** Ignition coil secondary voltage.
- Blue trace:** Ignition coil primary control current.

The above image validates the repair for cylinder 1 misfire. The vehicle now operated as expected without any starting issues or misfires detected.

However a few mornings later the vehicle was again running with a severe misfire and the code which returned was cylinder 4 misfire detected. This fault appeared to be much different to an ignition misfire because other symptoms were noted:

- A substantial amount of fuel was leaving the exhaust while the engine was idling

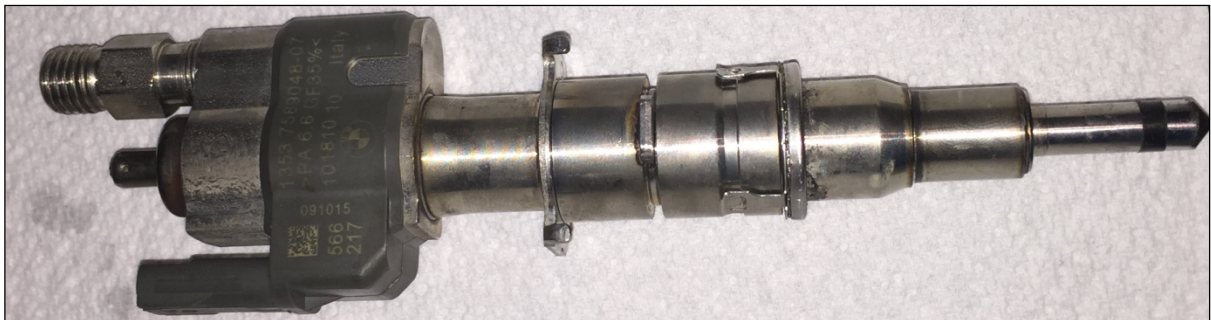
- The fuel pressure was approximately 8 Bar on the high pressure circuit, but it should be 140–150 Bar

Due to EOBD (European On Board Diagnostics) legislation, when a cylinder misfire is detected the injector for this cylinder must be disabled. An oscilloscope was connected to the fuel injector control wire and after 20 seconds of running the engine control module deactivated the cylinder, although fuel was still being delivered to the cylinder in a quantity which would not support combustion.

This engine uses high pressure piezo electric fuel injectors which operate at ≈ 150 Bar. The fuel is injected directly into the combustion chamber. If the injector fails in the open position unmetered fuel will be delivered directly into the cylinder.

The fuel pressure was measured using live data from the scantool and displayed 8 Bar, and a voltage test at the fuel rail pressure sensor showed a voltage of 0.6V. The normal voltage from this component should be 3V for a pressure of 150 Bar. This validated the data received from the scan tool.

The injector was removed from the cylinder head and fuel drips were evident at the tip of the injector. The fuel injector was again connected to the fuel rail via the high pressure pipe and the tip of the injector was inserted into a graduated container. When the low pressure fuel pump was activated unmetered fuel exited the injector which verified the initial diagnosis.



- Injector removed from cylinder head

The injector was replaced and coded using the scan tool. The injector must be coded to allow for individual characteristics for each injector created during the manufacturing process.