



**Tim Stock**

## Intermittent Faults

One of the most challenging issues faced by technicians is the intermittent fault that only occurs rarely, but has a big impact on the performance of a customer's car. It disappears just as fast, leaving behind it only a fault code. On investigation of the fault code, there is no apparent issue detected. The fault can be so intermittent that it may require many hours of investigation to identify the cause.

### Case Study: 2008 Hyundai Santa Fe 2.2 CRDi

Recently we had a garage that was trying to diagnose a fuel pressure code on this Hyundai Santa Fe 2.2. The code scan revealed a fault code P0091 - Fuel Pressure Regulator 1 Control Circuit Low. The customer complaint was that on starting the vehicle on some occasions, the vehicle went straight into limp home mode with very limited power. The power was so low that it would not pull up the slope from the customer's drive.

On recycling the key, the power would normally return, and the vehicle would drive fine. But the code would be logged.

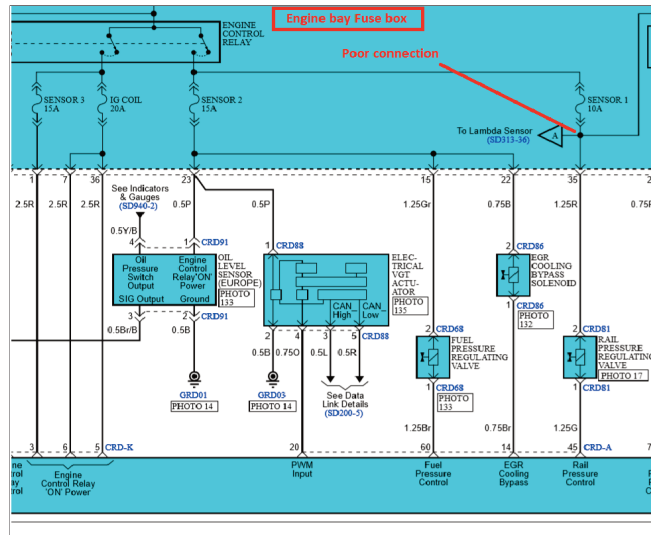
The Technician was experienced, and decided to scope the fuel pressure sensor and fuel rail control valve to monitor the signals during start up. No problem was detected, so the injector return flow on a cold engine was tested. This proved the injectors were all

A fuel rail pressure control valve was fitted just in case it was an intermittent failure causing the fault. Still the customer

experienced the issue several days later.

So, we decided to monitor the rail pressure signal, the rail pressure control solenoid signal, the control solenoid current, and solenoid supply voltage. Over the next few days, the signals were monitored every time the vehicle was started from cold, and on the fourth day the problem occurred. On play back of the scope trace when the fault occurred, the current was lower on the control solenoid and supply voltage dropped to 3.3 volts, indicating an issue. The supply voltage returned to battery voltage after cycling the key.

We investigated the wiring diagram for the circuit and found a splice that was responsible for the intermittent low voltage issue. The connection was



**A poor electrical connection had caused the intermittent fault**

returning low flow and showed no hydraulic issues. A fuel filter was replaced to remove this from the diagnosis. A test drive could not repeat the issue.

not firm and at times would be not fully connected, resulting in a voltage drop at the connection. The loom was corrected to prevent any further volt drop problems and the intermittent problem has not returned.

## AdBlue overview

Selective Catalytic Reduction (SCR) was introduced in 2010, to reduce the amount of oxides of nitrogen (NOX) emitted from diesel vehicles. Oxides of nitrogen are produced when an engine runs a high compression ratio and in a lean condition, typical for a modern diesel engine. Engineers had to develop SCR to treat these emissions.

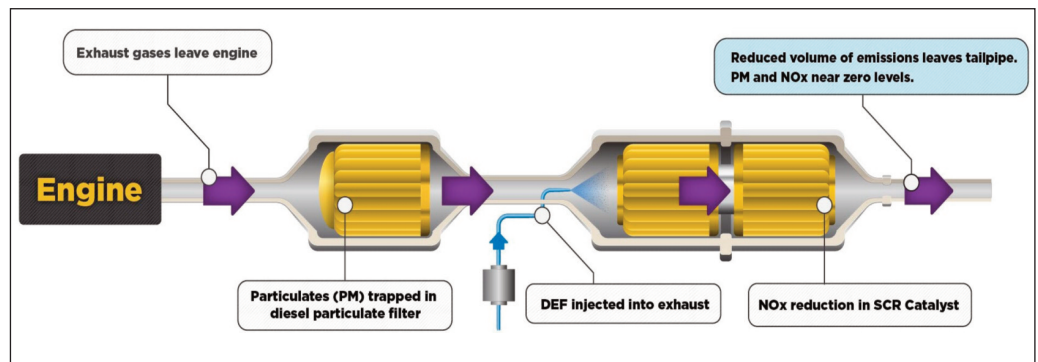
Diesel Particle Filters (DPFs) were already removing particulate matter, a major cause of breathing difficulties. DPFs have been a problem for technicians for some time, but most have come to understand the systems and how to diagnose them.

But with SCR, we face different issues that have been cropping up more often as the systems have been in service for some time.

AdBlue, the trade name for the diesel exhaust fluid, is a ratio of 32.5% Urea and 67.5% distilled water. The fluid can freeze in cold climates, so the SCR system requires various heaters to keep the system operational.

The fluid also is corrosive to some metals, Copper in the wiring looms to the system often fails if exposed to the fluid. So, care is required when disconnecting components.

The dosing unit can suffer from a buildup



of solids such as Ammonium Nitrates and Sulphates that can block the flow of the fluid, and in some cases, it can hold the dosing injector open. This can result in very heavy consumption of fluid. The NOX sensor, located after the SCR Catalyst, can suffer from excessive flow of fluid, not to mention a failure of the SCR Catalyst as well.

The system control unit monitors the AdBlue fluid temperature and level, calculating the range to next required filling. AdBlue consumption is between 2 and 6 % of diesel fuel. Higher figures can indicate an issue. Delaying refilling the AdBlue reservoir is a common problem for the Helpline. The vehicle owner will stretch the distance before re-filling the SCR tank, even when a warning message is displayed on the dash. If the fluid is not topped

up when required, some vehicles will refuse to start after a set mileage, often requiring a diagnostic tool to reset the system.

The NOX sensor has a limited life span. Similar to a Lambda sensor in appearance, it comes with its own module that measures Nitrogen oxide particles in parts per million (PPM). It also transmits information on SCR efficiency, on the CAN network, to the SCR control module. If the NOX sensor is older than 4 years, or subject to high mileage usage, the "No start in XX Miles" message to the driver may be triggered.

We have had calls on how to diagnose the SCR system, only to find the SCR Catalyst is missing from the vehicle. SCR catalysts are sometimes stolen due to their high value in scrap metal or component parts.