Auto Intelligence

Essential Information for the Modern Workshop

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BOSCH
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Welcome

The next two issues of Auto Intelligence are devoted to Euro V, which comes into force next year. This issue looks at diesel and its associated emissions-control technology. In the next issue, we will look at how Euro V is affecting petrol engine technology.

If it seems a little early to be talking about this, remember these technologies are already on the road and this year has seen growing numbers of Euro V-compliant new cars. It will naturally take some time to acquire the technical knowledge, diagnostics skills and equipment needed to cope with the added servicing complexity, so there is no time like the present to examine this topic.

The good news is that many of these additional technologies are covered by the technical training offered by Bosch and, once the fundamental servicing capabilities are in place for modern petrol and diesel cars, it is a relatively short leap to cover them.

Contents

Emissions-control accelerates to meet Euro V

2009 will see a surge in emissions-control technologies as manufacturers look to meet the new emission standard

Bosch's Denoxtronic SCR AdBlue dosing system can reduce NOx emissions by up to 85%.

Euro V requires an 80% reduction in exhaust particulates, and 40% in Nitrogen Oxides (NOx) and so will have a major impact on diesels. To prepare for the new standard, vehicle manufacturers have been working with systems experts like Bosch to develop new emissions-control technologies.

These fall into two categories; improved injection processes, which are already on the road in premium models, and exhaust gas treatment, with one or more of each of these technologies often being utilised on the same application to reduce different pollutants.

The three primary new injection system trends are increased pressure, variable injection and piezo injectors. At over 2,200 bar, many direct-injection diesels will meet the new NOx limits without exhaust treatment. The latest common-rail systems offer up to eight injections per power cycle, with pre-injections to stop smoke and reduce combustion noise and post-injections to lower soot emissions and regenerate the particulate filter. Fast acting piezo injectors shorten the intervals between individual injections and so use less fuel, while improving power and reducing noise.

These are the exhaust treatment technologies you are most likely to encounter:

Diesel Particulate Filters (DPF)
A technology founded in the Truck market, almost every diesel car will need a diesel particulate filter (DPF) to reach the particulate emissions targets for Euro V. A DPF is a porous ceramic or sintered metal filter mounted in the exhaust system to collect soot in its tiny channels. This soot is then burnt off to 'regenerate' the filter; this is either done automatically when the engine runs at high load or with a chemical additive.

Exhaust Gas Recirculation (EGR)
EGR is relatively cheap and effective and so is already used in many diesel and petrol vehicles. EGR feeds a portion of the, often cooled, exhaust gas back to the engine air intake. This has a lower oxygen content which reduces combustion intensity and hence the amount of NOx created. EGR only operates during idle and part-load as recirculating the exhaust gases produces more particulates and CO.

Selective catalytic reduction (SCR)
SCR catalytic converters change NOx into harmless Nitrogen and water by injecting a chemical agent - Adblue - into the exhaust stream between the engine manifold and main catalyst. Bosch uses a system called Denoxtronic which networks with the engine ECU to match the Adblue dose to different engine operating temperatures and speeds. This system can reduce NOx emissions by up to 85%.

NOx Storage Catalyst (NSC)
Positioned downstream of the catalytic converter and particulate filter, the NSC has a coating which traps oxides as nitrates while the engine is running in lean mode. When the NSC becomes saturated the air-fuel mixture is enriched for a few seconds with either EGR or post-injection to dissolve the nitrate into non-toxic Nitrogen. NSC is expensive but it can reduce NOX emissions by up to 85%.

Finally, downsizing with turbo control is a major trend across all engines. Smaller 3-cylinder engines improve efficiency by around 10% and these are combined with turbochargers to boost torque. Exhaust turbos are already common in modern diesels but they are becoming more sophisticated. For example, variable turbine geometry (VTG) turbo-chargers with adjustable guide blades can alter the charge-air pressure in the exhaust-gas, allowing higher exhaust gas recirculation rates. See the back page for a look at VTG.

Are you ready for diesel?

Our one-minute self-test will tell you if you are at the forefront of your profession or missing an opportunity

With expert diesel support, garages with good diagnostic skills can retain modern diesel cars rather than sending them to the dealer

BCS unlocks fleet work opportunities

With private car owners tightening their belts, a steady flow of fleet work would be a blessing or perhaps the difference between success and failure

Good customer service combined with a broad technical competence, including diesel, could enable you to access fleet work and the estimated 3.5 million company-owned vehicles. This has been the experience of garages in the Bosch Car Service network, who are working with Lloyds TSB Autolease to increase their fleet customer base.

Lloyds TSB Autolease is one of the UK's largest fleet funding and management companies and the BCS network has already serviced over 4,000 vehicles from their fleet.

The emphasis on diesel training and competence within the BCS network has helped secure the agreement with Lloyds TSB Autolease, as over 80% of its new company vehicle orders are diesels. Lloyds say this is largely due to a significant increase in company drivers opting for diesel vehicles in response to the CO_2-based BIK regime.

With retail sales also now evenly divided between diesel and petrol, the message is clear. So why not invest in your diesel offering and make some fleet work a target for 2009.

How well prepared are you to take full advantage of the huge increase in diesel diagnostic and service work? Why not take a couple of minutes to fill in our short test. Just answer 9 simple questions to check your chances of building diesel business.

Equipment

Do you have a diagnostic scan tool?	**Yes 1**	**No 0**
Have you been trained to use it?	**Yes 1**	**No 0**
Do you know its capability on diesel systems?	**Yes 1**	**No 0**

Technical data

Do you have access to quality service data?	**Yes 1**	**No 0**
Do you have access to repair procedure info?	**Yes 1**	**No 0**
Do you have access to a technical support line?	**Yes 1**	**No 0**

System training

Have you had any training on diesel systems?	**Yes 1**	**No 0**
Do you understand how the latest systems operate?	**Yes 1**	**No 0**
Are you confident taking on diesel work?	**Yes 1**	**No 0**

Now, count up your answers, scoring 1 for each yes and nil for any 'no's. How well did you score?

1-3 Oh dear, urgent action is needed if you are to take in any diesels!

4-6 Not bad, but still lots more to be done – now is the time to fill in those gaps

7-9 Congratulations – you really are well prepared!

Don't panic

Even if you haven't fared well in this test, the important thing is not to panic and give up on diesel completely. With good general diagnostic competence for injection systems and the right contacts, you may be able to keep that diesel vehicle and a potentially loyal customer.

Bosch has a network of diesel specialist workshops, Bosch Diesel Centres (BDC) around the country staffed by highly skilled and fully trained technicians, who can offer advice to garages and can perform repairs on the complete range of pumps and injectors, including the latest high-pressure technology.

It is common for garages to use an external specialist for help and advice or to sub-contract work. The Bosch Diesel Service (BDS) network offers a similar specialist service so make sure your nearest BDS or BDC is in your address book so you don't have to turn away any more customers.

You can search for your nearest BDS/BDC at **www.boschautoparts.co.uk**

Yet more support for workshop Technicians

The 3rd Bosch ESI[tronic] software update for 2008 is packed with new vehicle systems & helpful features

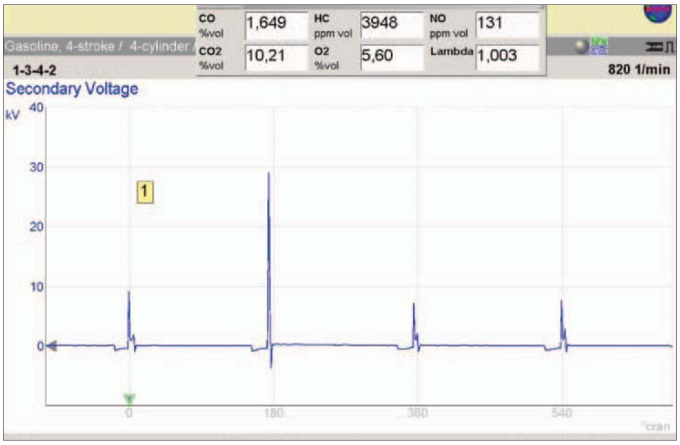
This year's 3rd ESI[tronic] update is now available and includes ECU diagnostic information (SD) for an additional 2,729 vehicles. The key additions can be seen in the accompanying table.

The Service Information System (SIS) includes the latest information on a further 1,546 vehicles and now has an improved look, with digital images replacing line drawings on all new service information.

Technical Service Bulletins
This update also includes a new feature; Technical Service Bulletins (TSBs), which help technicians identify and repair common vehicle problems, providing a valuable addition to both the SIS and diagnosis and repair programmes within ESI.

TSBs provide information direct from the vehicle manufacturers on known vehicle problems, classified by system group, ie: ABS, Airbag, Engine Management etc. Each bulletin carries a clear description of the cause, with validated repair tips and images to guide the technician.

The TSB's cover 5,466 vehicles in this first edition, with regular updates in following ESI[tronic] releases.



The latest CompacSoft[plus] release enables technicians to view both secondary ignition trace and direct exhaust gas values

Vehicle	System
Audi A3,	Tyre monitoring program
BMW 1,3 series	Condition based service reset
BMW 5 series,	Common rail engine management steering column control diagnosis
Citroen C3,C5	Central body electronics
Fiat 500, Panda, Punto	Engine management, ESP
Ford Mondeo MKIV	Central electronics, voice control
Nissan Xtrail	ESP
Toyota, Lexus	Engine management systems via CAN
Vauxhall Astra H	1.3 common rail injector coding
Vauxhall Corsa, Astra	Diagnosis via high speed CAN

CompacSoft[plus] release 2008/3
ESI[tronic] 2008/3 also includes a new CompacSoft[plus] software release - version 3.10 - for the FSA Motor Systems Analyser. This update provides increased vehicle coverage for test steps with vehicle-specific setpoint data.

A helpful new feature with this release is the ability to show exhaust gas values in a moveable window within the FSA programme, allowing them to be viewed at the same time as the oscilloscope screen, giving the user the ability to compare both secondary ignition trace and direct exhaust gas values.

ESI 2008/4

The fourth and final ESI[tronic] update for 2008 will include additional data for over 90 systems from 26 vehicle manufacturers. Systems of interest include adaptive lighting for Citroën, BMW's dynamic drive control and a roof operating unit and tyre pressure monitor for Mercedes Benz. The 2008/4 update will be available in November.

News In Brief... News In Brief... News In Brief...

ACS 600 and ACS 650 A/C units

In early 2009 Bosch will launch 2 new automatic A/C service units with no manual shutoff valves to simplify operation. Automatic functions include refrigerant extraction and recycling; used oil drainage, evacuation and leak testing; fresh oil and UV additive feeding and precise refrigerant feeding. There is also a quick-start function. A simple user interface aids navigation through service settings, using integrated and updateable vehicle and customer databases.

Wraps come KTS 340 off in Frankfurt

With the launch of the new KTS 340 Mobile Compact Diagnostic Tester due next spring, visitors queued at the 2008 Automechanika Show to get their first look at this new addition to the KTS range. With its robust appearance and user friendly touchscreen, the new standalone tester made an excellent first impression, attracting a great deal of positive comment.

KTS 200 software offer

Bosch has introduced a concessionary price on its KTS 200 software for existing users of Bosch ESI[tronic] software. Instead of paying the standard subscription for the tailor-made KTS 200 service software, owners of Bosch KTS 650, 670 and KTS 5 Series modules who purchase a KTS 200 as a second diagnostic tool will recieve the KTS 200 software at a reduced price.

BDM 300 Engine Speed Measurement

The new Bosch BDM 300 significantly improves engine speed measurement for MOT emissions testing. By combining two technologies; mechanical vibration and sound, the BDM 300 offers better connectivity and accuracy than vibration-only devices, effectively replacing the increasingly unreliable battery sensing method. With its self calibrating automatic function, the BDM 300 can be used on all engine and vehicle types.

VW's fleet titan

Launched in 1973, the hugely successful Volkswagen Passat continues to live on in its sixth incarnation. The fifth generation was launched in 1996 on the same platform as the Audi A4 and underwent a facelift in mid-2000. This medium size family car has earned a long list of accolades over the years from the motor industry press, including family car of the year and best fleet car. Here we look at parts on the most popular models of the 2000 face-lifted version.

VW Passat 2000 – 2005 ESI[tronic] System coverage as of 2008/3

Engine Management Petrol
Bosch Motronic ME 7.5 (various)

Engine Management Diesel
Bosch EDC 15P

ABS/ASR/ESP
Bosch ABS 5.3
Bosch ESP 1.24, 1.34

Airbag
Bosch AB5, Siemens ABIII

Service Interval Reset
Service interval reset 3.0, 3.0.1

Heating & Ventilation
Climatronic 2.0, 3.0, 3.0.1
Auxiliary supplement heater 1.0, 3.0

Transmission
AG4, Digimat, GS2, GS8, DS 085
5sp automatic 01V/L, 09A/B
6sp automatic 09E/F, 09 G/K/M
AWD 09L, AWD 09D
Twin clutch 6sp 02E

4 Wheel Drive Electronics
Automatic blocking control

Chassis and Steering
Electro-Hydrauilic power steering 1.0
Electro- Mechanical power steering 3.0
Adaptive suspension 1.0
Adaptive air suspension 3.1

CAN bus
Can Gateway 2.0, 3.0, 3.0.1, 3.1

Lighting
Lighting control LWR, dynamic ALWR 1.0
Litronic 4.0SL

Electrical Energy management
Battery management 3.1

Immobiliser
Immobiliser 3.0
Access systems immobiliser 3.0, 3.0.1

Instrumentation
Combined instrument 1.0, 2.0, 3.0, 3.0.1, 3.1

Parking Distance Control
Parking distance control 1.0, 2.0, 3.0, 3.1

Central Electronics
Central electronics ZE 1.0, 2.0, 3.0, 3.1
Central electronics ZEII 2.0

Steering Wheel Electronics
Multifunction steering wheel 1.0

Other System Coverage
Central mod electrics
Central locking system
Interior monitoring
Driver seat electronics
Seat and mirror electronics
Sunroof electronics
Door control systems
Trailer control systems
Navigation system 1.0, 3.0
Audio 1.0, 2.0, 3.0
Sound system 1.0

Functionality
Control unit identification
Read and clear error memory
Display actual values
Actuator tests
Quantity comparisons
Engine tests: EGR valve and Boost pressure control
Adaption and resetting of service intervals
Service adaption: Brake bleeding
Control unit enable
System tests
Variant coding
Adjustments

Fuel / Air systems
Air mass meter - New and Exchange
Pressure regulator, injection system
Lambda control sensor
Lambda diagnosis sensor
Universal Lambda sensor
Electric fuel pump, intank kit
Throttle-valve assembly
Purge control valve
Air filter element, engine
Fuel pipe filter
Injection valve
Temperature sensor, intake system
Speed sensor, ignition/injection
Phase sensor
Knock sensor
Engine management ECU

Wiping Systems
Wiper arm
Wiper motor
Conventional wiper blades
Aerotwin wiper blades:
OE & retrofit

Filters
Air filter
Cabin filter
Cabin filter, activated carbon
Fuel filter, gasoline injection
Oil filter

Ignition
Spark plug, Super plus
Spark plug, Double Platinum
Spark plug, Super 4
Ignition leads
Ignition coil

Diesel specific
Sheathed-element glow plug, Duraterm Chromium
Sheathed-element glow plug, Duraterm
Unit injector (UIS)-New and Exchange
Air mass meter, diesel-New and Exchange
Diesel boost pressure sensor
Tandem pump, fuel and vacuum
Speed Sensor
VP44 distributor pump-New and Exchange
2-stage injector
2-stage injector with needle motion

Starting system
Starter-New and Exchange
Alternator-New and Exchange
Starter battery, S6
Starter battery, S5
Starter battery, S4
Starter battery, S3

Horn
Electropneumatic horn

Transmission
Master cylinder, clutch
Slave cylinder, clutch

Lighting
Bulb, main headlamp
Bulb, driving lamp
Bulb, fog lamp
Bulb, rear fog light
Bulb, parking/position/side
Bulb, front turn signal lamp
Bulb, rear turn signal lamp
Bulb, reversing lamp
Bulb, tail light
Bulb, registration plate lamp
Bulb, indicator lamp
Bulb, interior light
Lamp, rear; l&r mounting
Headlamp; right-hand traffic, l&r. mounting
Tail lamp, glass, l&r mounting

Braking
Brake Pads Front
Brake Pads Rear
Brake Discs Front
Brake Discs Rear
Pad Accessories Front
Pad Accessories Rear
Calipers Front
Calipers Rear
Brake Hoses Front
Brake Hoses Rear
Brake Cables
Master Cylinders
Wheel Speed Sensors Front
Wheel Speed Sensors Rear
ABS/TCS/ESP Hydraulic Modulators
ABS/TCS/ESP ECU's
ESP Pressure Sensors
ESP Yaw Rate Sensors
ESP Lateral Acceleration Sensors

Component News... Component News...

Wiper Blades: Aerotwin continues to improve

Bosch Aerotwin Wiper Blades now cover 92% of cars on UK roads with a programme now containing 57 part numbers with a further 5 new part numbers in preparation to be released soon. In addition, the Bosch rear blade programme also includes 6 new rear Aerotwin blades.

Sensors: Bosch engine management drives new VW Scirocco

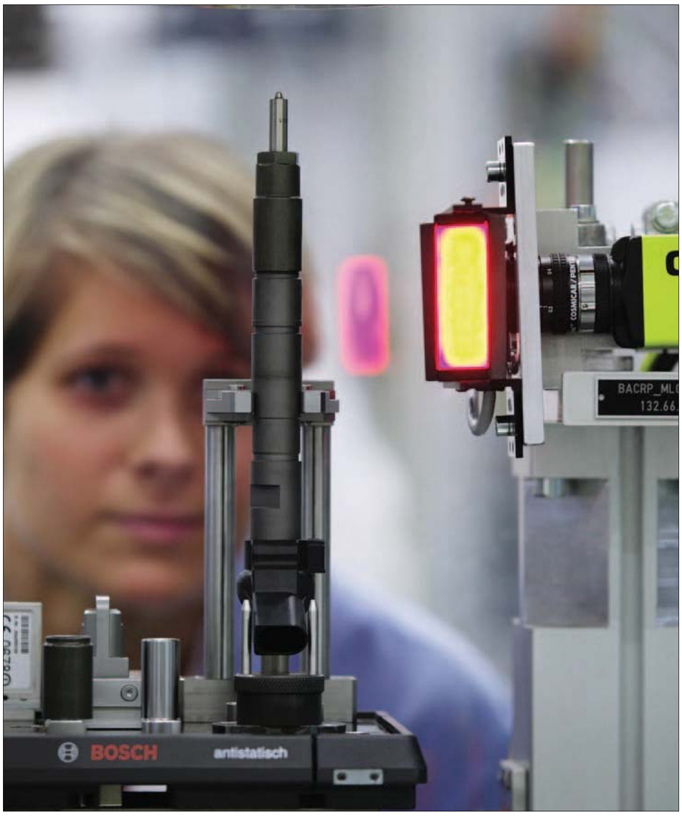
As the number one supplier of lambda sensors to the vehicle manufacturers it's no surprise the new VW Scirocco gets its lambda sensors from Bosch. Both the control (upstream of the catalytic converter) and diagnostic (downstream of the catalytic converter) sensors are of the latest 'wideband' design. The engine management system is also of Bosch design.

Calipers: Bosch gets fashion conscious

Bosch has introduced a new range of stylish powder-coated calipers in its Exchange (BX) range, which will be offered as a direct OE replacement for the growing number of vehicles fitted with sporty red calipers. The new calipers are included in a 140 part-number expansion of the BX caliper range whilst there are also extensions for 5 other product ranges; Kits Super Pro (42 part numbers), 12 new wheel cylinders and 17 new shoes, plus a vast increase in brake hoses and cables. Bosch now has approximately 1100 brake discs in the range, making it the most comprehensive in the market with coverage of approx 98% of vehicles in Europe.

Awesome Injectors

Just a couple of facts about the technology behind the modern diesel injector explain why they are so expensive and should only be handled by the expertly trained



A piezo inline injector for the 3rd generation of common rail injection system undergoes strict testing before leaving the plant

The only way to fulfil all the requirements of modern diesel injection is to use extreme precision in the manufacture of nozzles. As the world's leading injector manufacturer, every Bosch nozzle reflects the entire know-how of diesel technology in development, material science, production and measurement technology.

So, in case you were wondering if there might be some quick 'masking tape and blue tack' type fixes out there, check out these mind boggling facts about high-pressure diesel injectors

Manufacturing Tolerance
The factory allows variations of just 0.002 mm for moveable parts. In comparison, a human hair is 30 times thicker.

Fuel injection pressure
At 2,200 bar, this is equal to concentrating the weight of a luxury saloon on a finger-nail – a little one. Ouch! So, you can see why these have to be tested under strictly controlled conditions by well trained experts.

Injection Quantity
Put that sort of pressure together with a hole that's just half a millimetre across and it's no surprise the fuel reaches speeds of 1,240 mph. And the injector is capable of varying the amount of fuel injected from 1 mm^3 to 350 mm^3. That requires degree of control that would keep NASA busy.

Faster than the Blink of an Eye
Injection takes place in 1 to 2 milliseconds. That's 200 injections for a single blink of a human eye.

Break the common rail injector code

Understanding the relationship between the injector's code and the engine management system can help solve poor running headaches

The main components in a diesel injection system are produced to extremely precise production tolerances. The more lax the tolerance, the lower the engine performance will be, along with higher exhaust emissions. Therefore in the relentless drive for higher engine output, improved fuel economy and lower exhaust emissions, injector tolerances are of increasing importance. This not only applies to engine assembly, but whilst the injector wears in service.

What is Injector Coding?
Even within the extremely fine production tolerances of diesel components, injectors display varying fuel flow characteristics. Therefore engines fitted with injectors of varying characteristics can display uneven idling and poor emissions.

The first generation of common-rail injectors either had no coding or were classified according to their production tolerance. The classifications or 'flow groups' were displayed on the injector solenoid by a letter or number i.e. A/B/C or red, green, blue and on assembly only injectors of the same flow groups were fitted. Once in service, if an injector was found to be faulty it had to be replaced with an injector of the same flow-type or, quite commonly for the aftermarket, an injector of the middle tolerance.

Increasingly tighter emissions legislations like Euro IV and Euro V have resulted in stricter tolerances on diesel injection components and the evolution of new generations of engine management systems employing more sophisticated electronics. A revised form of injector coding was required, where each injector is given a specific alpha-numeric code at the factory which relates to a more stringent range of flow measurements and characteristics. This injector code is then programmed into the vehicle ECU for each injector fitted to each cylinder.

The Bosch coding system is referred to as the IMA code and is displayed on the solenoid housing of each injector.

Once fitted, a replacement injector's code has to be programmed into the engine ECU with a diagnostic tool.

The very latest generation of common rail engine control technology employs self monitoring systems such as 'injector drift' and 'quantity comparison'.

As the injector wears its flow characteristics will vary, therefore after time the original coding will no longer match the injector's performance. To combat this, the ECU will automatically learn and adjust itself, compensating for this wear within each injector, this is known as injector drift.

During idle, the engine management system monitors the engine speed between each power stoke and attempts to smooth out idle by continually varying the performance of each injector. Quantity comparison shows the degree of variation of the control to each injector, displayed through actual values via diagnostic equipment. This data can be very useful in identifying combustion related engine problems.

Above all, the advances described above are adopted by the different vehicle manufacturers at different times. Therefore the independent workshop technicians will see a wide variation of systems fitted across the range of cars visiting their workshops.

This is why it is important for today's vehicle technicians to enrol on the Bosch range of training courses to ensure they are able to identify the systems they are working on and repair them effectively and safely.

The Bosch ESI[tronic] information system provides a wealth of application data, systems identification and knowledge, and includes the software system driving the industry leading KTS range of diagnostic equipment.

What does a workshop need to be aware of?

1. **Systems employing IMA coding**
If an injector with an IMA code is faulty, the code of the replacement must be programmed into the ECU with a diagnostic tool. Failure to do so means the engine management system will carry the wrong flow characteristic for the new injector, resulting in inefficient combustion.

2. **Systems employing Injector Drift**
When an injector is replaced the learnt value will remain within the vehicle ECU. The ECU needs to be reset to its default setting so that it can re-learn the characteristics of any new injectors in conjunction with injector coding.

3. **Systems employing Quantity Comparison**
Analysis of actual values will show the degree of variation of control to each injector. Further investigation will be needed to check why the ECU is adapting the injector performance. This could be any number of faults from a badly worn injector to loss of compression.

4. **Bosch Diesel Centre field repair**
Injectors are being repaired by Bosch Diesel Centres with a Bosch EPS 815 diesel test bench, which can reassign a new IMA code. Technicians should be aware that if this IMA code has been blanked out then the injector has possibly been repaired and the original code is no longer valid.

UIS Overview

The UIS (Unit Injector System) or PD (Pumpe-Düse) was introduced to passenger vehicles in 1998, primarily used by the VAG group. Due to the nature of the UI, it has to be incorporated into the design of the engine that it is being fitted to.

The UI system can include the following components

In-tank Pump
Supplies fuel from the fuel tank to the tandem pump*

Fuel Cooler
Cools the fuel on the return flow*

Tandem Pump
Incorporates a mechanical vacuum and fuel pump driven via the camshaft. This supplies fuel into the gallery in the cylinder head, and can operate up to pressures of 7.5bar or 14bar on the later systems.

Unit Injector
Fitted directly into the cylinder head and operated via a rocker arm by the camshaft, it combines the components of a high pressure diesel pump and injector in one assembly. When injection is required it is then activated via a solenoid which is electronically controlled by the ECU, injection pressures can easily exceed 2000bar.

Sensors
They are common to most engine management systems and consist of coolant, fuel and air temperature, air mass, crankshaft speed sensor, camshaft position sensor, atmospheric and boost pressure, pedal position, clutch and brake switches.

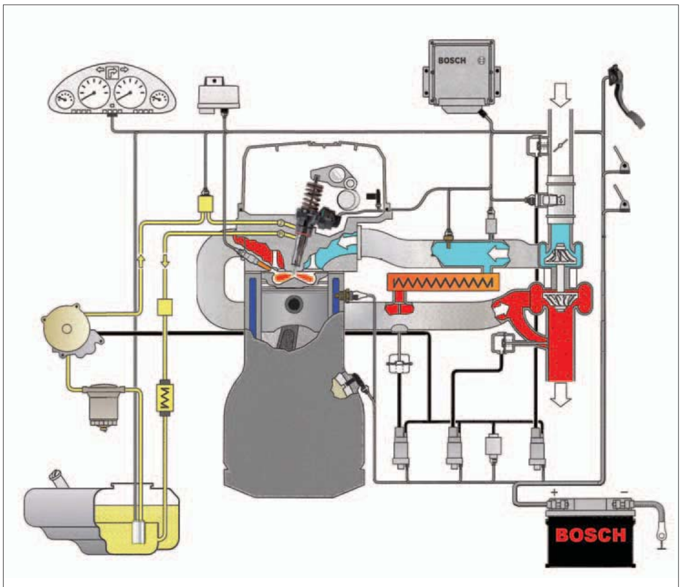
Exhaust Gas Recirculation (EGR)
Consists of the EGR valve, which is ECU controlled via a vacuum control solenoid. Later systems may use an electrically operated valve and in some vehicles an EGR cooler is fitted.

Turbo-Charger
Most commonly used with the UI system is the variable geometry turbo (VGT), which is ECU actuated via a vacuum control solenoid.

Throttle Valve
Typically vacuum controlled, later vehicles use an electronically controlled valve. Fitted to give smooth engine shutdown and can also be used to aid EGR operation.

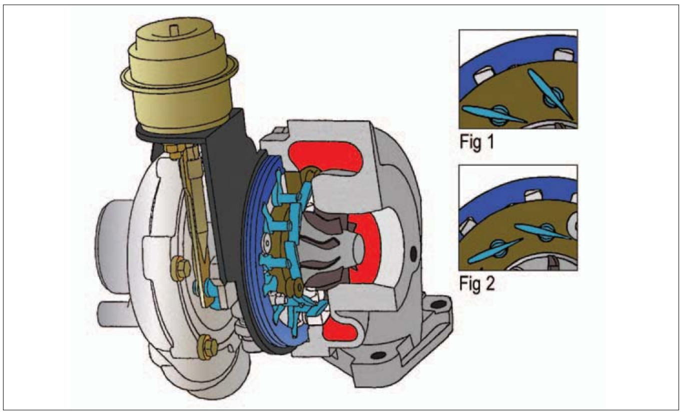
Control Unit (ECU)
The two Bosch operating systems are EDC 15P which has 121 pin ECU and fitted to early vehicles 1998 to 2005, and EDC16U 154 pin ECU fitted to some late 1.9 TDI and all Bosch equipped 2.0 TDI engines 2005 onwards.

(*May not be fitted on all vehicles)



An overview of the Unit Injector System (UIS) showing the main components outlined above

Boost Pressure Control



We have frequent questions about boost pressure control faults with diesel engines, when fitted with a variable geometry turbo (VGT). Commonly the customer complains that the vehicle drives okay around town but when driven hard the fault occurs.

The VGT has a series of vanes situated around the outside of the turbine (see illustration above). The vanes affect the direction and flow of the exhaust gases onto the turbine wheel. The vane mechanism is controlled by the engine management ECU via a vacuum control solenoid operating a diaphragm on the turbo; later designs incorporate an electrical actuator which is built into the turbo.

Fig 1. When the vanes are in this position they direct the exhaust gases toward the centre of the turbine wheel, this reduces turbine speed and in turn reduces boost.

Fig 2. When the vanes are moved into this position they direct the exhaust gases toward the outer edge of the turbine wheel, increasing turbine speed and in turn increasing boost.

The design of the variable vane mechanism makes it susceptible to carbon fouling, which can cause the vanes to stick, usually leading to boost pressure problems.

Below is an example of the typical fault code description, what it means, possible symptoms and the test procedure.

Boost Pressure Above Control Limit:
The ECU has detected via boost pressure sensor that the boost pressure has exceeded control limits and has effected reduced power mode by other means.

Possible Causes:

- Boost pressure sensor reading incorrectly, due to a faulty sensor or a fault in the wiring or connector, typically shorting the signal wire to sensor supply voltage.
- Fault in wiring between control unit and boost control solenoid, short circuit or short to battery negative.
- Incorrect vacuum pipe connections, that causes a permanent vacuum supply at the turbo actuator diaphragm.
- Turbo Faulty

Diagnosis Procedure:

- Talk to customer and obtain information on when the fault occurred, typically for an over-boost situation under load up a hill or under hard acceleration.
- Monitor actual values via diagnostic equipment, if available. If not connect a pressure gauge to a suitable point on the inlet manifold.
- Typically driving the vehicle and replicating the fault whilst a passenger monitors the boost pressure is the best way to check for an over boost problem.

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