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TECH TIPS

Launch Issue
June 2011

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This seminar is designed as the perfect introductory course for future modules.

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Common Rail Diesel including DTS
CAN bus

Hybrids
Air Conditioning
ABS & ESP

Diagnostic (from Day 1 to Advanced)
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- Used Car Salesmen
- Everybody interested in current new technology in cars.

During the **last year**, eXponentia has delivered **28,800 hours** of technical training to **3,600 mechanics** in **9 European countries**

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- Electrically powered steering (EPS)

Safety

- Electronic stability control (ESC)
- Dual stage airbags
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TECH TIPS

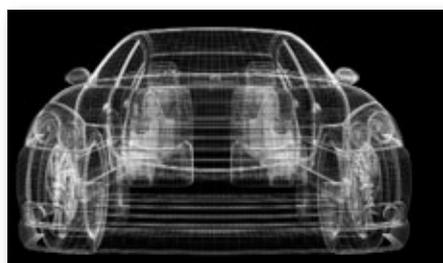
Welcome to the first edition of Tech Tips Monthly

In response to the growing need for technical information for the independent aftermarket, Autobiz is pleased to bring you some of that information, from leading aftermarket suppliers and automotive training professionals.

Irish mechanics are up there with the best trained mechanics in the world. We punch well above our weight in competitions like the WorldSkills competition; where Ireland came second last year and is hoping for even better this year.

By keeping up with technology, independent garages can compete for business and stay successful.

This launch edition of Tech Tips Monthly has some great contributors, who talk about new technology that will soon be turning up in your garage, solutions to problems you might have seen already and the knowledge and tools to adapt and keep your business ticking over in the face of change.



As technical editor, and a qualified mechanic and engineer, I spend lots of time talking to mechanics around the country and getting their feedback on technical issues.

Each month there will be a Tech Tips Monthly section in Autobiz, so if there are any technical issues you would like to see covered, or you have a tech tip you would like to share with fellow Autobiz readers, contact me at john@autobiz.ie and let me know.

John O'Callaghan, Technical Editor

Tech Tips

Battery Technology with Diagnostic Solutions Ltd. AGM battery technology	4
Accessory Belts with Gates Keeping it all in line	5
Lighting Systems with Osram Safely replacing HID bulbs	6
Steering & Suspension with Febi-Bilstein More than the sum of its parts	7
Engine Cooling / Belt Tensioning with Dayco Don't forget the water pump	8
Lighting Systems with Philips Let there be more light	9
Diagnostics with eXponentia A needle in a haystack	10
Exhaust & Emissions with eXponentia Cleaner diesel with FAP	11
Clutches with LuK Some questions on clutches	12
Service Data with DIT Accessing on-line service information	13
Exhaust & Emissions with Bosch Cleaner diesel with DPFs	14
Overrunning Alternator Pulleys with INA Dealing with an OAP	15

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AGM Battery technology

Diagnostic Solutions has been asked lately, by a number of people, about the new battery technology called “AGM”, so they thought that we would explain a little about it.

Firstly, AGM is an abbreviation for Absorbent Glass Mat.

As you are aware, until now, lead acid batteries had an electrolyte liquid within the battery. AGM batteries have a fibreglass mat separator, which stores the electrolyte and leaves no free acid in the battery.

The benefit of this technology is that if we had a normal flooded lead acid battery, and we subjected it to the high charging rates capable of today’s modern charging systems, we would damage the battery plates and severely shorten the life span.

Because the AGM battery does not lose oxygen, formed at the positive plate during high charge rates like the flooded battery would, rather it combines with hydrogen produced at the negative plate to form water, the AGM battery is maintenance free and is capable of handling the high charge rates of today’s and future systems.

The combination of systems such “stop-start”, alternator management and regenerative braking, is leading to a wider use of AGM technology.

Alternator management monitors the state of the battery charge and switches off the alternator when the battery is fully

charged. An alternator can absorb 10% of the engine’s output, so switching it off saves fuel. With some systems, the alternator produces its charge on the over-run, that is when you lift off the accelerator, also saving fuel.

“ Fitting a non AGM unit to save on price will cause all kinds of problems in a very short space of time. ”

Regenerative braking uses the braking of the car to charge the battery, but a conventional lead acid battery can only accept 20% of this charge burst.

Unfortunately the benefits of an AGM battery come at a price, with an AGM unit typically costing three times more than a conventional lead acid flooded unit.

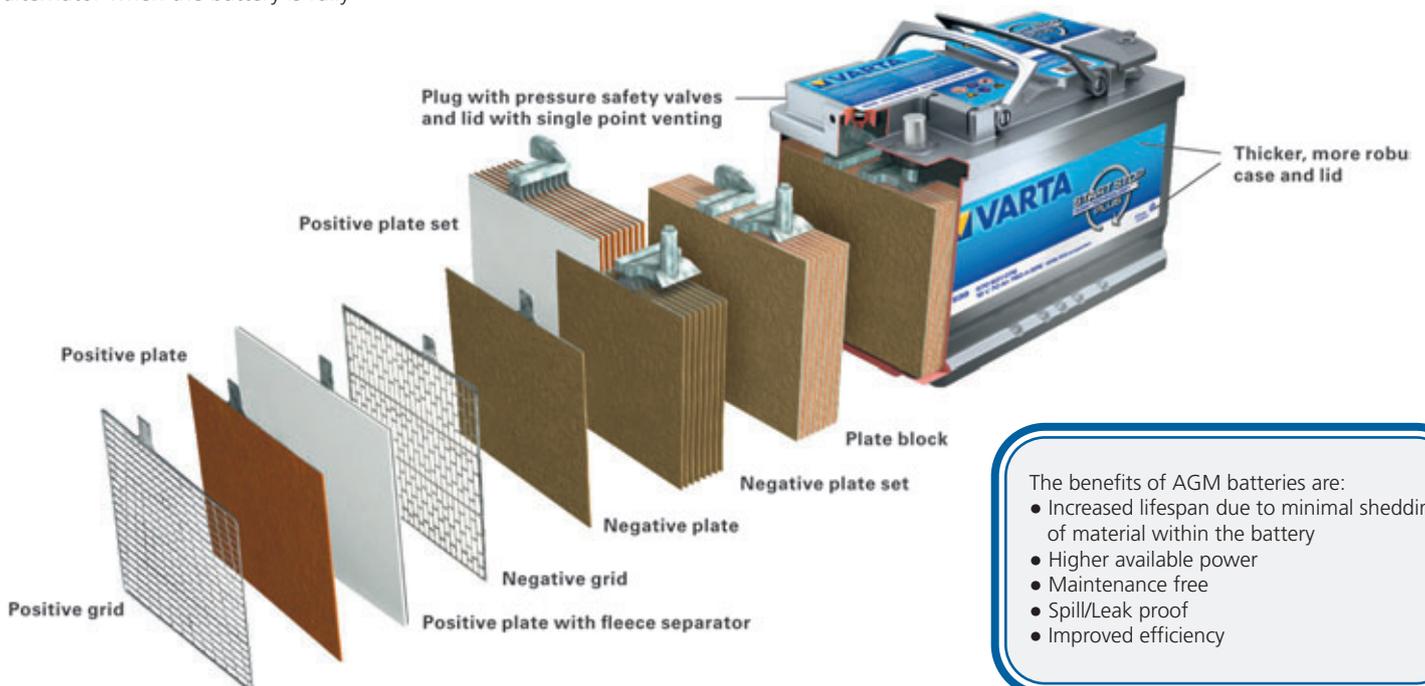
They also require the use of smarter battery chargers for maintenance and recharging.

On replacing a battery, it is commonly required to use a scan tool to inform the charging system of which type of battery has been fitted. It is important to pay attention to which type of battery is fitted when you are replacing them. Fitting a non AGM unit to save on price will cause all kinds of problems in a very short space of time.

We recently heard of someone who fitted a lead acid battery in place of an AGM and the vehicle was back in his workshop within two weeks with a host of other problems. These included battery management faults, because of the incorrect battery, CAN Bus drop outs on start up, which were due to the system voltage dropping low when the starter engaged.

So take care with these new batteries, as it is possible to have two seemingly identical vehicles but one has the new AGM because it has stop/go, while its companion will have a lead acid battery because it uses conventional technology.

DIAGNOSTIC SOLUTIONS LTD.



- The benefits of AGM batteries are:
- Increased lifespan due to minimal shedding of material within the battery
 - Higher available power
 - Maintenance free
 - Spill/Leak proof
 - Improved efficiency

Keeping it all **in line**

Identifying problems before they turn into costly belt drive failures, can mean the difference between a satisfied customer now and an expensive rectification job in the near future. Gates does some straight talking about key issues.

Rapid improvements in Accessory Belt Drive System (ABDS) technology, mean that new and experienced mechanics have had to update their installation techniques, acquire new tools and master the installation of some new components.

Customers who have just paid to have a new belt installed, rely on good mechanics to deliver "peace of mind" that the ABDS as a whole is as good as new.

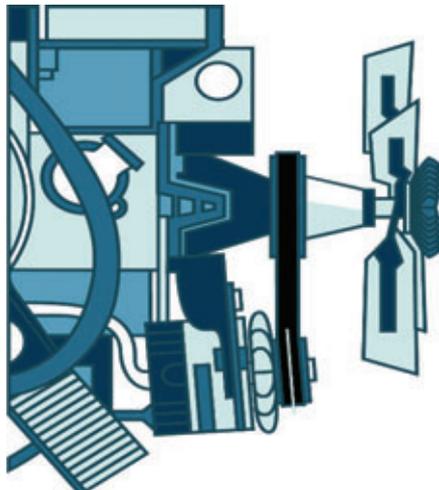
Inspection Criteria

In order for the belt to continue to operate as efficiently as it should within the ABDS, an inspection must always confirm:

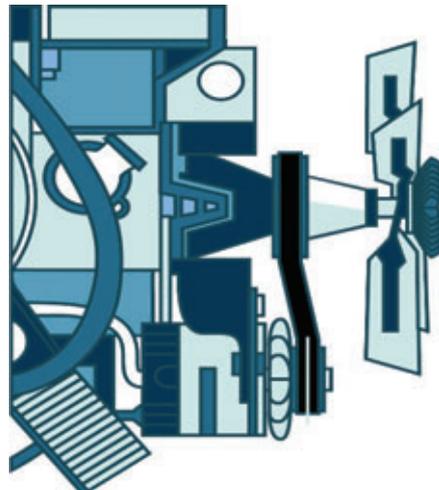
- Pulleys in good condition (free from wear, clear of dirt, grease and grime)
- Alignment checked (with any misalignment repaired before installation of a new belt)
- Tension checked (insufficient tension causes slip, generates heat as well as noise and results in premature belt failure)

Examining Pulleys

V-belt pulleys and multi-ribbed pulleys should be inspected and cleaned before any new belt installation. Any build-up of road dirt or oil/ rubber residue in the grooves of the pulleys, should be removed with alcohol-based brake cleaner and a soft bristled brush. Any oil remaining on any of the pulleys will be transferred to the new belt as soon as the engine starts and the problems will begin all over again.



An angular misalignment



A parallel misalignment



Two types of misalignment may exist within the ABDS, parallel and angular. A combination of both possibilities may also occur.

Checking Alignment

When an accessory belt is replaced, it is essential to check the alignment of the pulleys. This is a very critical factor for multi-ribbed belts. Misalignment can cause severe belt wear and damage. Just a few degrees of misalignment can increase the temperature of the belt, reducing belt life by as much as 50%. Premature belt failure is inevitable and the consequences will be disastrous for the engine.

Misalignment can cause:

- Belt routing problems
- Excessive belt and pulley wear
- Noise
- Belt instability
- Damage to any components that rely on the ABDS as a power source

Angular misalignment refers to pulleys within the same drive system plane, that are tilted because their shafts are not parallel.

Parallel misalignment describes the condition whereby pulleys are outside the plane of other pulleys in the drive system, while the shafts remain parallel. Correct positioning of a pulley on the shaft will resolve the problem, by helping to ensure that all pulleys are in a common plane.

The improved technology of specialist tools has made the diagnosis of misalignment much easier. For instance, the Gates DriveAlign laser alignment tool allows identification of the two most common types of misalignment in serpentine belt systems - even in the tight confines of the engine compartment. By positioning the tool within the grooves of a pulley and then aiming its bright laser beam at an opposite pulley, ensures that detection of any misalignment is instantly achieved.

As drive systems become more complex, new components such as Torsional Vibration Dampers and Overrunning Alternator Pulleys have been added to improve both the performance of the ABDS and ride quality.

Gates will say more about these in a future issue.



Safely replacing HID Bulbs

The replacement of HID Xenon bulbs is growing. Gas discharge bulbs have been in use since 1991. Initially reserved only for the luxury car market, they now appear as standard and options, in an increasing number of mid-sized cars.

A High Intensity Discharge (HID) lamp does not have a filament like halogen and older type lamps. Instead of supplying current to a filament to make it glow, an electrical arc is created between two electrodes within a xenon gas filled bulb. The lamp can only ignite when high voltage is applied. Igniting, heating and stabilizing the arc of an HID lamp requires electronic controls, consisting of an electronic igniter and ballast. As a result of the high voltages needed to operate HID bulbs, great care

should be taken when replacing them. HID lamps offer a number of advantages: they are brighter than halogen lamps, they produce less heat and provide a much longer lamp life. An Osram XENARC lamp generates twice as much light as a modern halogen lamp and still requires less energy. The light efficiency is 300% higher than conventional halogen lights, and provides improvements in driving safety. The colour of the light is much closer to that of natural daylight; it is

whiter and is therefore perceived as being brighter. Osram's XENARC® lamps have an average lifetime of 3000 operating hours, which normally covers the usual lifetime of a car. XENARC lamps are approved for use in special xenon headlights only. Headlights must be fitted with automatic levelling and cleaning systems.



Tips for the safe replacement of HID (High Intensity Discharge) Xenon bulbs

Safety should come first. HID bulbs produce a very bright light and require a high voltage for ignition. They also reach extremely high temperatures. Both of these facts requires some additional safety measures.

Please observe the following tips and information for your own safety.

-  • Replacement should be made by trained technicians.
-  • Do not touch the glass of the bulb.
-   • Wear safety gloves and goggles at all times.
-  • Never use a bulb with cracked glass.
-  • Caution: HOT! Let bulbs cool for about 5 minutes. Do not replace bulbs before they've cooled.
-  • HID Bulbs should only be used in headlights with protective covers.



A simple guide to changing HID bulbs successfully

Voltage Supply

Turn off the ignition and light switch. Remove the negative battery terminal after knowing and understanding the battery resetting procedure. Disconnecting the battery may result in incorrect operation of numerous systems on a vehicle. Without the correct resetting procedure, you can't restore the correct functions. After the battery is disconnected identify the HID ballast, normally a small metal box close to the headlight, and remove the plug from the ballast.



Determine the battery resetting procedures before disconnecting the battery

Cable Connections / Plugs

Remove the cover over the rear of the HID bulb, at the rear of headlight, and then unplug the connector from the HID bulb.

Replacing the Lamp

Remove the bulb from the reflector. The bulb will usually be held in place by a retaining ring that needs to be twisted to release the bulb. Identify the bulb type (D2S, D2R, D1S, D1R, D3S, D3R, D4S, or D4R) and replace with the same type. Replace bulbs in pairs to ensure colour match.



Do not handle the glass of the bulb

Checking the Plug Connections

After replacing the bulbs, plug the connector back on the bulb, ensuring that it is pushed fully home and locked in place. Replace the cover over the rear of the HID bulb.

Functional Test

Re-connect the plug into the ballast, ensuring that it is pushed completely into the socket. Replace the negative battery terminal and follow all of the battery resetting procedures. Switch on the lights and check for correct operation. Only light HID bulbs when they are installed in the headlight.



Success!

More than the sum of its parts

For Independent repairers, choosing the correct replacement parts for the plethora of choices now available, is a time consuming business. Febi Bilstein provides a few tips on how to tackle these daily decisions, and allow the repairer to give their customers the best service possible.

The technical design of modern cars is getting more and more advanced. Empirical and design development data, collected over many years, is going into the technical design of cars, and each and every single component is engineered to a very specific purpose, fine-tuned to perfectly work as a whole, which, in this case, truly is more than the sum of its parts. Each component relies on the specific design and precise operation of adjacent or related components.

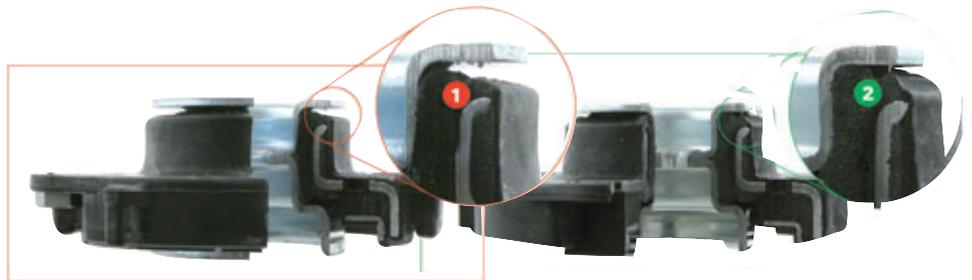
For service and repair professionals in the independent aftermarket, it is becoming more and more important to not only have the necessary skills and knowledge, but also purchase the correct parts to fit to the vehicle. The independent aftermarket offers a vast choice of replacement parts: For independent repairers, it is just one of the daily challenges to make the right choice of parts. And it is not an easy choice, as the market is flooded with parts claiming to be as OE, cheaper than OE, or even better than OE. To make the right choice easier, here are a few tips for professional technicians on how to tackle these daily decisions, so they can offer their customers the best possible service.

Firstly, what you fit to a vehicle should match the part that was fitted at first production; This means that it is absolutely crucial to use parts that meet exactly the same specifications as the part originally fitted to the vehicle by the manufacturer.

Aluminium control arms are a prime example: Aluminium components were developed by the vehicle manufacturers for

the reason of reducing the weight of the vehicle and therefore allowing improved fuel economy, better performance and enhanced safety. Replacing an aluminium wishbone with a cast iron part, can result in an increased weight of up to 40% to the originally fitted part. This can have adverse effects not only on the vehicle's

vibrations being transferred to other areas, for example to the interior of the car or the steering wheel. To reliably fulfil these requirements, rubber metal parts must consist of the correct rubber compound (hardness) to be able to absorb the vibration, and this rubber compound must be securely attached to the metal. For strut



A proper, secure rubber to metal adhesion at right compared to a sub-standard one on the left

performance, but also on associated parts in the suspension.

Another steering component which is crucial to the complete system is the tie rod end. Many are designed to absorb vibrations from the wheels by a rubber core, the tie rod end ensures a comfortable and smooth driving experience. Some track rod ends in the independent aftermarket lack this rubber core, and are instead made of solid metal. This might increase the service life of the tie rod itself, however does not fulfill the purpose of the part; dampening vibrations. In fact, vibrations are being transferred to associated parts in the steering system, causing premature wear and failure, which could result in costly repairs.

top mountings, for example, it is crucial to meet these quality standards, as inferior rubber creates higher loads on the shock absorbers and other components in the suspension system, which can lead to increased wear and premature failure.

As these examples show, each component in the vehicle has its own purpose and at the same time affects other parts in the system. Design changes, which might lead to a cheaper price or a longer service life of one component, do often not make sense when you look at the bigger picture. Therefore professional technicians base their choice of parts on the vehicle manufacturers' original design and technical specifications – and can be assured that the customer's driving experience and safety are guaranteed.

Rubber metal components are fitted to various areas of a car to avoid



The solid metal tie rod end, at left, can transmit potentially damaging vibrations to the rest of the steering system.



The one on the right is as designed and originally fitted on the car.



Don't forget the **water pump**

Dayco discusses the importance of replacing the water pump along with timing belts and details the proper belt tensioning procedures for some Daewoo models.

In its lifetime, the average OE water pump will circulate literally millions of litres of coolant, so it is vital that when a unit requires replacement, a pump of matching OE quality is fitted. This is an area where there is no room for the factor, workshop or motorist to compromise.

In the same way, the need for the drive belt to be changed when the water pump is replaced cannot be

over stated. It is the responsibility of the workshop to ensure that this rule is followed because for a comparatively small cost the reassurance given by the fitting of a replacement makes the failure to do so a false economy.

One of the developments is that the water pump is often designed as an integral part of the timing system. This means that instead of being driven by

the auxiliary belt, which had been common, the water pump is driven by the timing belt. In some circumstances the water pump even doubles as a belt tensioner and it is the water pump itself that the technician adjusts to obtain the correct timing belt tension. Whatever the actual configuration, if the water pump is driven by the timing belt, then it is vital that a new water pump is fitted along with new tensioners, pulleys and idlers.

Daewoo 1.4 and 1.6 16v Belt Tensioning

Although perhaps not the most common of vehicles, there are still many Daewoo's travelling the length and breadth of the country, so they are not infrequent visitors to the service bays of the independent workshop.

Therefore, technicians need to be aware of one of the peculiarities that can affect a number of engines, including the 1.4 and 1.6 16v in the Aranos/Espero/Kalos/Lacetti/Lanos/Nexia/Nubira/Rezzo/Tacuma model range, when replacing the timing belt during a scheduled service.

On these engines, the timing belt tensioner is mounted alongside the water pump. In order to achieve the correct tension of the belt, the adjustment has to be made via the new water pump itself. Unfortunately, it is not uncommon for the replacement belt to be installed at the incorrect tension, because although the technician may have gone through the right procedure, they have undertaken the process on a hot engine. When the

engine is cold, the tension of the belt is too low, which means that during the warm up of the engine the belt will 'flap' in the drive. This can cause the pointer on the tensioner to make contact with the end stop and break. This will result in the failure of the belt, which could also lead to major engine damage.

It is therefore vital that timing belt replacement on this engine is undertaken when the engine is cold. Dayco's technical bulletin T10143EN, gives technicians some useful installation tips to prevent premature belt failure.

Tensioner Assembly and Tensioning Procedure

Dayco recommend fitting a full timing belt kit and water pump when undertaking a timing belt replacement and the KTBWP5591 is the kit for this application. The kit will ensure that the technician installs a new tensioner, idler and water pump along with a Dayco High Tenacity (HT) timing belt, which will guarantee the service life of its HT belts for two years.

Remember to operate on a cold engine

Make sure the timing notches on the camshaft pulleys and the crankshaft are correctly aligned (A, B and C on the accompanying illustration) and thread the timing belt anticlockwise, starting from the crankshaft pinion, making sure that the belt is properly tensioned.

Using the appropriate tool (J-42492 or KM-421-A), rotate the water pump clockwise to tension the belt. The belt tensioner indicator, in its release position, should rest against the stop on the right (shown in Fig. A).

Slightly tighten the water pump bolts and then rotate the crankshaft clockwise by two turns and make sure the timing notches (A, B and C) are still aligned.

Loosen the water pump bolts and rotate the water pump anticlockwise until the tension indicator is aligned with the matching indicator on the plate (see Fig. B).

Tighten the water pump bolts to a torque of 8-10 Nm and reassemble the other components in the reverse order of their disassembly.

Finally, tighten the crankshaft pulley bolt to a torque of 95Nm + 15°/30°.

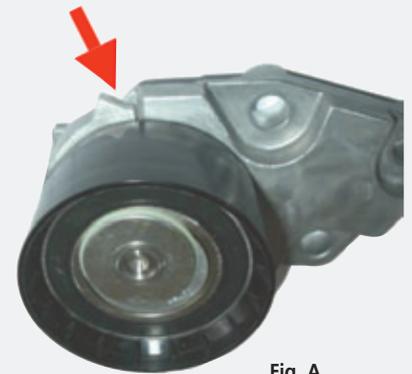
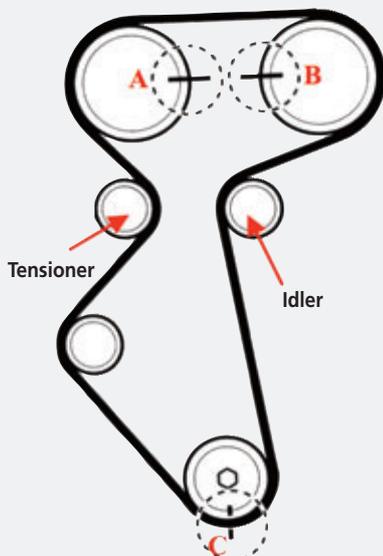


Fig. A

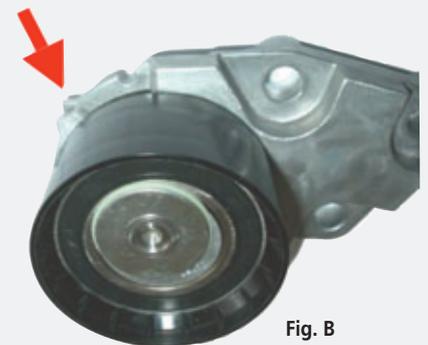


Fig. B



Let there be **more light**

Philips outlines the benefits of Daytime Running Lights (DRLs), their correct installation and the potential profit opportunity they present.

DRL installation in 9 steps

Each of the Philips DayLight DRL kits is installed in the same way and contains two light modules with leads, mounting brackets, a ready-wired control box plus screws, cable ties, connector and instructions.

1) Use the supplied guide to plan where to install the lights within ECE regulations, including the direction they face. You can log on to www.led-drl.co.uk to upload a picture of a particular car to see how it will look.



2) With positions carefully marked, fix clip-on brackets with the screws provided. Brackets can be surface mounted or inset, depending on the car.

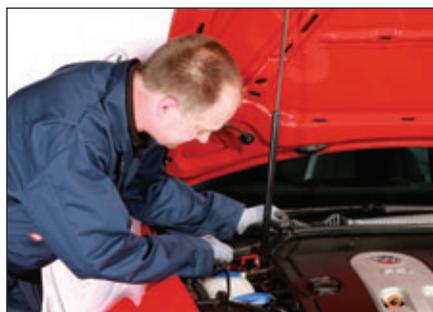


3) Find a solid place under the bonnet to mount the control box, (preferably near the battery and away from heat). Don't fix box yet, but ensure the mounting surface is clean.

4) It is recommended for safety that the negative lead from the battery is removed before connecting control box power cables. Be sure to know and understand any battery resetting procedures. Disconnecting the battery may result in incorrect operation of numerous systems on a vehicle. Without the correct resetting procedure, you can't restore the correct functions.

5) Route the light module wires through mounts and engine bay to the control box. Do not clip home the lights yet.

6) Turn on the sidelights, remove the headlight connector plug and use the control box lead to identify the supply.



An LED on the control unit indicates when you've found it.

7) Turn off sidelights. Use the supplied one-touch connector to securely join the control box sidelight lead to the power supply you have just found. Firmly fix the control box under the bonnet using the adhesive



pad and plug the two sidelight modules into the control box.

8) Check that everything is working by starting the engine. Depending on the model, the LEDs will automatically dim or switch off when the car's own lights are used.

9) Clip lights into brackets, replace any panels removed, including the battery cover. Finally, tidy the wiring using the kit's cable ties.



Tests have shown that DRLs could prevent 1,200 to 2,000 fatalities per year in Europe. Therefore, all new cars will henceforward be equipped with daylight lighting, making them more visible to oncoming traffic and pedestrians. They also provide a good potential profit opportunity for bodyshops

and garages in the retrofitting of DRLs.

More information on DRLs in general, as well as further fitting support, can be found on Philips' dedicated DRL website, www.led-drl.co.uk Philips DayLight DRLs are available

throughout the Ireland at branches of AD Ireland and at Autoparts Express Ireland.

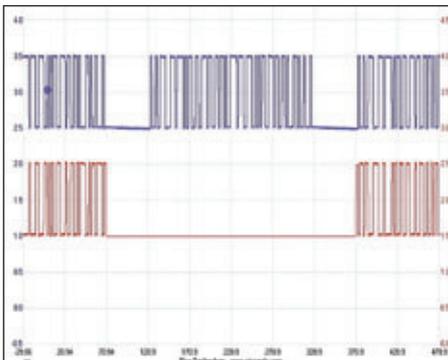
PHILIPS

A needle in a haystack

eXponentia gets to grips with the Controller Area Network (CAN) Bus system and figures out an intermittent fault on a 2007 Citroen C8 climate control system.

I am sure we have all become aware of the complex nature of wiring used on vehicles over the last five years, and in particular, the Controller Area Network (CAN) Bus system. This month's troubleshooting guide looks at an interesting fault on a 2007 Citroen C8, when it was four years old, and was probably only worth a fraction of the original purchase price, and there lies a problem which we will discuss later on.

The fault with this vehicle was within the climate control system. For no apparent reason, the climate control system would shut down, resulting in no air being blown into the vehicle's cabin either hot or cold. At the same time the climate control instrument panel, although still illuminated, would not function. Occasionally the rear fans would work, but more often than not they wouldn't. This fault could last for just minutes or stretch out over a couple of hours, after which the system would function normally. The tri-zone climate control ECM was read by an approved repairer, who diagnosed a fault with the ECM module and the internal temperature sensor, which incorporated a small fan to pull air over the temperature sensor. These parts were replaced at a cost of £300, but within a few days the fault had returned and the car was returned to the repairer. Given the complex wiring of this particular vehicle, the garage replaced the new parts, with the original



The scope trace of the climate control circuit showed an intermittent fault, but only when the damaged wire was manipulated

old parts, refunded the customer's money, but explained that trying to track the exact cause of the problem would be prohibitively expensive, compared to what the customer had actually paid for this vehicle.



The cause of the intermittent fault: a partially cut wire that would only act up when the driver put their foot on a plate that covered the wiring loom

This is how we became involved with this vehicle. On reading the serial data from the climate control ECM, there were indeed several interesting faults, most of which seemed to indicate a CAN communication malfunction. As

“ Although the wire was not completely cut through, there was sufficient damage to the wire that caused an intermittent fault whenever the driver placed their foot on top of the cover. ”

the fault was intermittent, our thoughts were that the CAN wires were either shorting together or to ground. We thought this was being caused either by movement within the vehicle chassis, or by movement of passengers within the vehicle, but where the break was and what caused it was going to take some tracking down.

After acquiring some specific wiring diagrams, we were able to trace the location and path of the particular pair of twisted wires which operated the climate control system. There were seven pairs of twisted wires on this car that were part of the climate control circuit. Once

we connected our scope, we could see our traditional CAN trace. We then started to gently move the wiring looms which contained our seven pairs of twisted wires.

Initially the scope trace remained the same, then from nowhere, we briefly saw a scope trace which indicated an open circuit on the CAN circuit. No sooner had we seen this, the scope trace returned to normal. For a further 10 minutes we could not replicate this fault, until I moved my foot and the fault returned momentarily.

On closer examination, under the rubber car mat there was a hard plastic removable plate covering the vehicle's car battery. Once the plate was removed, it could be seen that one of the wires had become trapped and was partially cut. Although the wire was not completely cut through, there was sufficient damage to the wire that caused an intermittent fault whenever the driver placed their foot on top of the cover.

I do expect we were somewhat fortunate in finding this fault relatively quickly. However, this type of fault it's going to become ever more common as these types of complex systems are now more commonly used on vehicles and will start to become even more commonplace within our workshops.

Cleaner diesel with FAP

eXponentia looks at the Filter Air Particulate (FAP) system, the aims of the system and the opportunities it presents for the independent garage.

I suspect few technicians would argue that diesel engines have changed beyond all recognition within the last 10 years, and that the technology responsible for this is really at the cutting edge of automotive design. Delphi ceased production 5 years ago, of their traditional rotary pump in favour of their common rail pump, and Bosch produce 20% more diesel components than petrol components.

One of the principal forces behind this relentless development, has been for the cleanest diesel emissions possible. In the late 90s, we saw the first use of oxidation catalysts for diesel engines. Around this time, we also saw the introduction, by the PSA group, of the HDi series of diesel engines. This French manufacturer has been synonymous with diesel engine design; even their XUD engines of the early 90s were regarded as one of the best diesel engines of their day.

As stated earlier, one of the principal driving forces behind this development has been the relentless demand for ever lower emissions. Whilst common rail direct-injection engines have made great improvements, not only in efficiency and output but also on emissions, the emissions goal is a moving target, with successive governments demanding even lower and lower output. Of principal concern to health specialists, are the tiny soot particulates which are emitted by all diesels engines.

The PSA group was the first volume manufacturer to introduce particulate trap systems on their diesel-powered vehicles. This system, known as Filter Air Particulates (FAP), was first introduced in 2000 on their 2.2 litre HDi powered vehicle. FAP is now available on the 1.6 and 2.0 litre models. Unfortunately, whilst a main dealer may be fully conversant with this new system, my own personal experience tells me that most independent garages are totally oblivious to this system. As with all new technology, whilst it presents a challenge, it can also offer an opportunity to the independent garage to successfully understand and manage new technology.

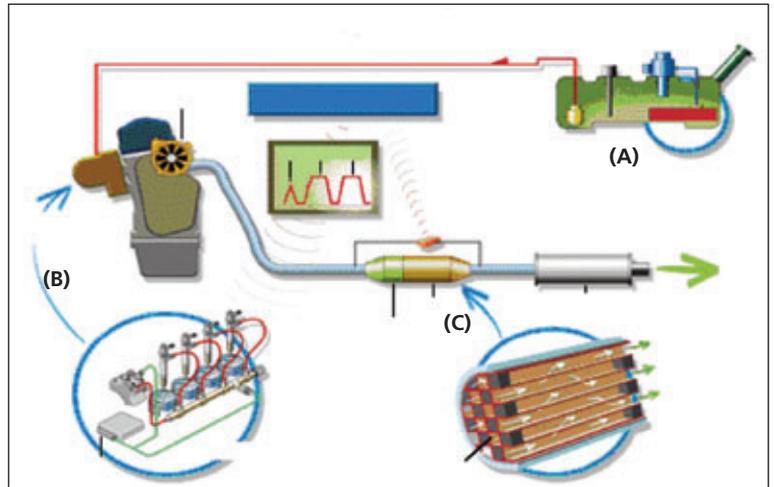
What is FAP?

Let's first look at what the PSA group wanted to achieve. They wanted a system that dramatically reduced particulate emissions, required minimal maintenance and that remained reliable. So how have they achieved this? Firstly, there is an additional storage tank for the diesel additive. This liquid additive contains a rare earth metal called cerium. The diesel additive is injected into the main diesel fuel tank and mixes with the fuel every time

the tank is refilled. A sensor within the fuel cap lets the system know that the fuel cap has been removed and then replaced. Within the additive storage tank, there is a pump, injector and a level sensor. As you can see, we have barely passed the additive storage tank and have encountered several new pieces of technology! We will come back to the purpose of the diesel additive later.

So, what other new technology do we have on the vehicle? Well, there is an oxidation catalyst. Okay, this is not new technology in its own right, but this is now placed in front of the diesel particulate filter (DPF), a complete one-piece assembly within the exhaust system. The DPF utilizes a porous silicon carbide substrate that traps the soot particulate. As you might guess, the particulate trap would become saturated with particulate matter and would stop functioning properly within a few hundred miles, unless there was a way to regenerate the filter.

This is where the diesel additive comes in. The cerium in the additive attaches itself to the soot particulate, which are trapped within the DPF. The function of the additive is to lower the combustion temperature of the soot particulate, so the system knows when to regenerate the filter. There are two pressure take-off points within the one piece assembly; the first just before the oxidation catalyst portion of the assembly and the second at the very back end of the DPF section. When a pressure differential greater than 10% exists, the system will regenerate the filter (about every 300 to 500 miles). This is achieved by multiple post injections of fuel, which increases the combustion temperature. The catalysts oxidises unburnt hydrocarbons generated by the post injectors releasing additional quantities of heat. These two actions will increase exhaust temperatures to 450° centigrade, which is the combustible temperature of the soot particulates. Simply put, the soot is burned away by periodically raising the exhaust temperature.



Some of the FAP system components: Additive tank (A) which injects the additive into the fuel supply (B) at regular intervals and the Diesel Particulate Filter Assembly with an integral oxidation Catalyst (C)

So there you have it! The reason why we have FAP and how it works. So, what opportunity does this bring to our modern independent garage? Although the system is fairly straightforward, there are equally many things that can cause the system to malfunction, including something as innocuous as an emergency filler cap. The emergency filler cap will never trigger the injection of the diesel additive into the main fuel tank, and the soot in the DPF will accumulate because the ordinary exhaust is not hot enough to combust the soot.

At some point, about 100,000 miles, the DPF will need to be either cleaned or replaced as it will become clogged with ash from the combustion of soot particulate. However, the most immediate point of concern is the replenishment of the diesel additive. Whilst in the trial stages, it was envisaged that the additive tank would need refilling at around the 70,000 mile scheduled service. However, it has become very apparent that many vehicles are running out of the additive at around 30 to 40,000 miles. This may be due to many things, such as the quality of diesel, driving style and vehicle usage. Unfortunately, something as straightforward as topping up the additive tank does require a particular procedure in order to cancel the low-level indicator. In some cases, diagnostics may be the only option.

Without a doubt, if you service a large fleet of PSA vehicles, you need to seriously consider the ability to interrogate this system as a priority, given its widespread use today.

Some questions on **clutches**

The modern-day vehicle uses a multitude of new technologies, not only in engine management systems, but also in transmission controls. LuK answers some questions about clutch replacement and some newer developments.

LuK has been to the forefront in the development of new technology in clutches, and have developed innovations such as the Dual Mass Flywheels (DMF), Self Adjusting Clutch (SAC) and Concentric Slave Cylinders (CSC).

Why use a Dual Mass Flywheel (DMF)?

In earlier times, noise levels generated by the vehicle were accepted as part of the nature of things. However, today we demand a quieter environment in which to travel, so noise pollution is unacceptable. To compound things further, the increases in power and torque have led to unacceptable levels of torsional vibration. To combat this increase in vibration and noise, LuK developed a DMF in 1985 which was more efficient than the conventional damper assembly. A DMF should be checked for any signs of wear or overheating and replaced if necessary. Worn DMFs can cause premature failure of a new clutch. LuK has a DMF testing tool available that will accurately assess the condition of the DMF, giving confidence to the technician on whether to replace a DMF or not.

Can you use a conversion kit to replace a DMF with a solid flywheel?

Vehicle manufacturers spend millions of euros developing and testing their powertrains with DMFs to minimise noise, vibration and improve durability. Solid flywheel replacements cannot absorb as much damaging vibration as a DMF, and therefore you run the risk of not only degrading the quality of drive, but also shortening the life of the driveline components. This can result in premature failure of such items as the gearbox, driveshafts and in some cases even a crankshaft.

What is a Self Adjusting Clutch (SAC)?

The SAC was introduced to help maintain a constant pedal feel throughout the life of the clutch. This is achieved by means of an adjuster



A self adjusting clutch has opposing ramps that take up slack as the clutch wears

ring, which has twelve ramps that locate on opposing ramps within the cover pressing. Acting on pressure from three small coil springs, the adjuster ring moves on the ramps and reduces the gap between the pivot point and the cover, once a change in load has been detected. This has eliminated the need for any adjustment by the garage.

What is a Concentric Slave Cylinder (CSC)?

The CSC is a combined, all-in-one hydraulic slave cylinder, input shaft snout and release bearing. A CSC has less moving parts and less friction is generated, allowing for a better pedal feel and operation. As there are fewer moving parts, reliability is also greatly improved. It is always advisable to change the CSC with every clutch replacement, because the release bearing is part of the assembly.



A CSC combines the slave cylinder, input shaft snout and release bearing in one unit

Should I lubricate the release bearing inner bore and gearbox input shaft?

The inner bore of the release bearing only needs lubricating if the bearing inner race is metal. Bearings with a plastic inner sleeve do not need lubrication. Only use a high melting point grease when lubricating and never use a copper based grease, as it is not a lubricant. Apply the grease to the gearbox snout, gently slide the bearing up and down a couple of times, remove the bearing and wipe off any excess grease.

Clutch plates will need the input shaft to be lubricated with the exception of nickel coated hubs, which are self-lubricating. To grease the input shaft, smear a little grease on the splines and then slide the new clutch plate up and down a couple of times, remove the

plate and wipe away any excess grease.

The DMF I am fitting has a lot of play in it compared to the old one:

Some vehicle manufacturers use DMFs from LuK in addition to other suppliers. Different designs use different bearing technology between the two masses, so there will be a difference in movement. If you are not sure, call the LuK Technical Hotline on 0044 1432 264264.

The new clutch I have fitted does not work correctly:

This can be caused by several things. To help prevent this from happening, careful diagnosis of the original fault is required. Was the old clutch badly worn? Is there any oil contamination etc? Also, it is good practice to compare the old clutch against the replacement before fitting. When fitting the replacement, bolt the clutch and the gearbox up evenly and sequentially, making sure not to hang the gearbox and create strain through the clutch plate centre hub. If a clutch cable is fitted, it is recommended to change the cable with every clutch replacement, even if it looks OK. Was the DMF, if fitted, checked for wear (a poster from LuK advising on the checking process is available on request).

Is the clutch of original manufacturer specification?

All LuK clutches, DMFs and CSCs are manufactured to original equipment specification and therefore meet current Block Exemption Regulations. During the manufacture process, they are tested several times so that you can fit with confidence.

Is there a web site where I can find further information?

Yes there is. Visit www.repxpert.com and subscribe, free of charge, where you can access valuable and useful information on LuK products. The web site also gives a step by step diagnostic guide to help with getting the job completed right first time. You can also contact LuK's dedicated Technical Hotline team on 0044 8457 001100.



Accessing on-line service information

As more and more service information is made available on-line, Damien Curran from the Dublin Institute of Technology (DIT) navigates his way through some of the data and lets you know where you can find it.

Technical documentation has always been a fundamental part of a technicians tool kit. In the past, main dealers would have a technical documentation bay or area filled with shelves full of repair manuals and current flow diagrams or, as most people would still call them, wiring diagrams.

These hard copy manuals required a lot of effort from staff to ensure that when one is finished with the manual, it goes back in the appropriate folder, ready for its next use. When a new engine or transmission is fitted to a model range, the technical documentation must be updated in order to ensure that when a technician takes the manual for that vehicle, it is up to date.

To counter this vast expanding hardcopy library, manufacturers have put their new manuals, as well as their back catalogue of past models, onto an electronic format which can be accessed via a computer, therefore reducing the physical space required to store current and future manuals. This does not necessarily make a technician's life easier at first, as navigating your way around the interface requires some practice in order to get the hang of where each section and subsection are located. As a result, most manufacturers will offer documentation training to their dealer network. But like most things in life, familiarity will only come with use. The more the technician uses the system, the quicker they will be able to find the information required.

This is all very well for main dealers, but how can an independent garage and their mechanics keep up to date with changing systems, models and technology and also get access to the relevant manuals in order to carry out repairs? When it comes to carrying out fault finding on various systems on a vehicle, a technician may need access to a diagnostic repair manual in order to get information related to a given fault code. If their diagnostic tool

does not read an existing or stored fault code, then the technician may require information about live data to see if any parameters are out of specification. Based on this information, the next step may require the use of a current flow diagram in order to carry out relevant wiring checks. Then the mechanic might require a repair manual detailing correct removal and refitting procedures.

So how do I get myself access to these manufacturers' manuals? The answer is by using the manufacturer's online documentation website. These websites give repairers access to repair and diagnostic manuals, service procedures and current flow diagrams. Current flow diagrams must be accessed, from time to time, in order to carry out an efficient diagnosis, while abiding to all the relevant procedures in order not to damage or cause problems with other systems on the vehicle.

Here are the currently available manufacturer's technical websites, with the possibility of even more in the future:

Electronic Repair &

Workshop Information (ERWIN)

VW	erwin.volkswagen.de
Audi	erwin.audi.com
Seat	erwin.seat.com
Skoda	erwin.skoda-auto.cz

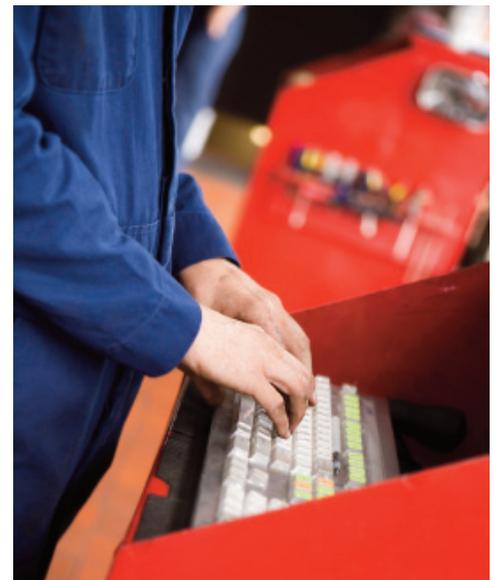
Toyota Service

Toyota	www.toyota-tech.eu
Lexus	www.lexus-tech.eu

Info Tech

Renault	infotech.renault.com
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Unfortunately, each manufacturers website differs, so it can take some time to learn how to navigate your way around each site. As always, there is no such thing as a free lunch, and access is tariff based. However, you can opt for 1 hour sessions from between €4 to €8 (depending on the site)



or one day, one week and so on. You can decide how to best meet your need for access to the proper information while keeping control of your expenses.

There is, however, an alternative to the manufacturers websites. Companies like Autodata offer online access to current flow diagrams, repair methods, diagnostic testing, fault codes and also technical bulletins for a huge range of vehicles. The advantage here is one interface for all manufacturers, so you don't need to get used to a different interface for each manufacturer. Although these companies do offer an alternative, there can be lag time between the first use of new technology on a model and the appearance of the relevant data in non-manufacturers manuals. Given the troubles encountered in keeping up with a manufacturers expanding model ranges, a technician may need to access the manufacturers' site from time to time.



Cleaner diesel **with DPFs**

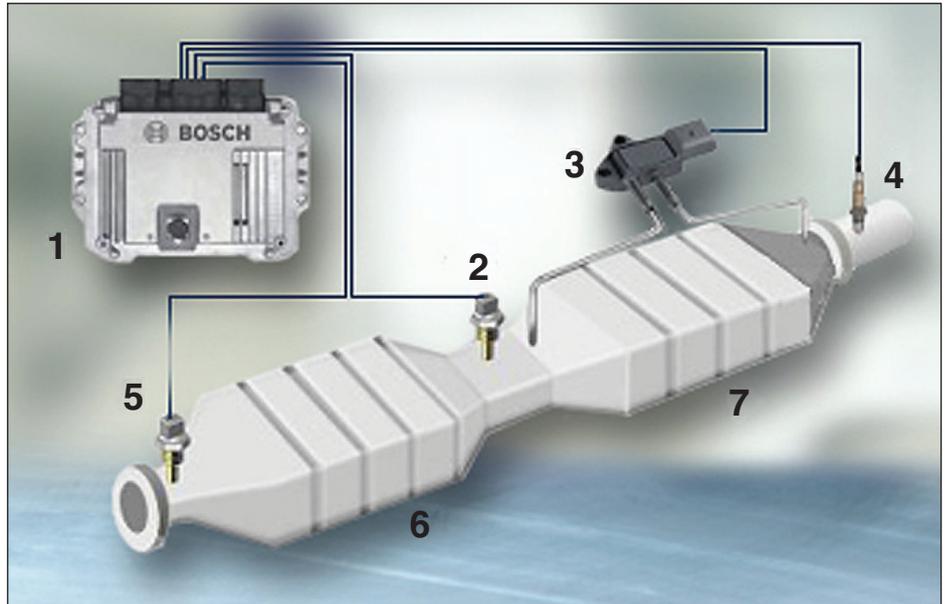
Diesel Particulate Filters (DPFs) require motorway speeds to convert trapped soot into ash. As many cars never reach those speeds, blockages can occur, resulting in breakdowns. Bosch takes you through steps for diagnosing and fixing the problem.

DPFs are fitted to nearly all modern diesel vehicles and are an increasing problem for breakdowns. With some cars only being used around town and for the school runs, they never see motorway speeds. This can result in blockages which require a diagnostic tool to repair, and can be an ideal opportunity for the independent workshop.

A DPF is a ceramic honeycomb fitted within an enclosure in the exhaust system, similar to a catalytic converter, and is designed to catch and prevent soot escaping from the exhaust pipe. It does this by passing the exhaust gases through holes as small as 1 nanometer and, if running efficiently, the filter will catch up the 95% of the soot in the exhaust. At motorway speeds, high exhaust temperatures convert the trapped soot into ash, which is much less harmful than the micro particles contained in diesel emissions.

The soot content of the DPF is calculated using sensors to monitor the pressure differential either side of the DPF. As the amount of soot increases, air flow becomes more restricted and the pressure differential in the DPF increases. Listed below are the five stages of soot content in the life of a DPF.

1. Passive regeneration - up to 18g of soot content in the DPF will usually be cleared in normal day to day driving.
2. Active regeneration – with 18-24g of soot content, the ECU will try to help clear the DPF. This is done by altering the timing of the engine to increase the temperature in the exhaust system, to turn the soot to ash.
3. Customer regeneration – with 24-40g of soot content, the DPF fault lamp will come on and the customer should refer to their handbook. This will usually advise to take the car for at least a 10 minute journey at motorway speeds. If the fault lamp is ignored, or the customer is unable to make a high speed journey, the vehicle will eventually require a trip to the local workshop.
4. Workshop forced regeneration – 40-45g



Design schematic of a diesel exhaust system fitted with with a particulate filter:
1 ECU, 2 Temperature sensor, 3 Differential-pressure sensor, 4 Soot sensor, 5 Temperature sensor, 6 Oxidation catalytic converter, 7 Particulate filter

of soot will require a diagnostic tool to be connected to the vehicle. Forced regeneration will run a sequence of steps adjusting engine speed and fuelling to increase the exhaust temperature to around 600°C.

5. DPF replacement – typically over 45g of soot content will result in the total blockage that not even a forced regeneration can fix, time for a new DPF to be fitted. This can be an expensive repair, with diesel particulate filters costing over a thousand euros from some manufacturers.

A forced regeneration must be carried out with extreme caution as many things can go wrong. You need to be sure the engine and all belts are in good condition and all fluids are correct, as the engine can be held at 4000 rpm for 10 minutes. This causes strain on the engine and very high levels of heat.

The car must be standing on a concrete floor, not painted or tarmac, and the rear of the car must be free from any flammable items. The vehicle should be outside as exhaust extractors can't be used and large clouds of smoke can be produced.

Inferior quality DPFs can melt or catch fire so ensure only quality parts are used and fitted.

Some manufacturers only allow the forced regeneration to be carried out whilst driving the vehicle. The Bosch KTS diagnostic tool can program a regeneration to happen at the next convenient point. The workshop can then take the vehicle on the motorway and regenerate the DPF safely. All Bosch KTS diagnostic tools have DPF functionality. This gives independent workshops the chance to offer a main dealer level service and carry out functions such as resetting the adaption values after fitting a new filter, reading actual values and, of course, forced regeneration. Without a diagnostic tool nothing can be done on the vehicle.

Be aware though that some manufacturers have taken the decision to remove the forced regeneration function from their OE testers, which shows the concern around this subject.

BOSCH

Dealing with an OAP

Steve Carolan of INA & FAG explains the purpose, testing and replacement of Overrunning Alternator Pulleys (OAPs) and their cousins, the Overrunning Alternator Decoupler(OADs)

The function of the Overrunning Alternator Pulley (OAP) and the Overrunning Alternator Decoupler (OAD) is to decouple the alternator from the rotational irregularities of the crankshaft in an internal combustion engine, since the alternator has the highest amount of inertia in the accessory belt drive. In this way, the alternator is driven using only the acceleration portion of the crankshaft and reduces the rotational vibrations and irregularities

Advantages

The positive influences on the accessory belt drive result in:

- damping of belt vibrations
- reduced load in the belt drive
- reduced tensioner movement
- increased belt life
- improved noise behaviour of the belt drive
- increased alternator speed in the idling speed range
- reduced belt slip and noise on the alternator pulley during gear changes

Decoupling function

The OAP and OAD decouples the alternator from the rotational irregularities of the crankshaft up to an engine speed of approx. 2000 revolutions per minute. The decoupling function of the overrunning pulley unit is dependent on the load condition of the engine (amplitude of torsional oscillation), the inertia and the load condition of the alternator. Furthermore the overrunning pulley decouples the alternator inertia during significant decreases in engine speed, such as gear changes.

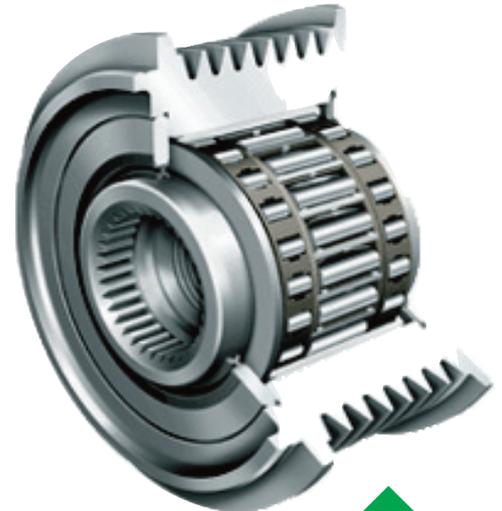
Applications in which the OAP provide benefit include:

- Diesel or petrol engines with severe periodic crankshaft vibrations
- Very low engine running speeds
- V-engines with valve cut-out (cylinder or block cut-out)
- Sudden contacts in automatic transmissions
- Sudden contacts caused by Aircon compressors
- Extremely high performance alternators (high inertia)

Design

Outwardly, the Overrunning Alternator Pulley resembles the fixed drive wheel. In fact, it consists of the following components all fitted into an integral, compact unit:

- Drive wheel with profile for poly V-belt
- Overrunning clutch / mounting unit with outer and inner rings plus clamping ramps
- Roller bearing for overrunning function and freewheeling support
- Inner ring, threaded, for fitting alternator shaft
- Serrations for assembly tool
- Seals
- Protective cap.



For protection against heavy water impacts and other dirt contamination, a cover snap is fitted on the front side. To ensure that the OAP has a long service life, the protective cap must re-fitted when the OAP is replaced or tested, and must remain in place at all times.

Characteristics to look out for when testing an OAP

It is recommended you use a suitable tool to make testing the OAP/OAD easier. As these pulleys become more common, the tool manufacturers have kept pace with the need for the specialty tools.

Grasp the outer ring of the OAP with one hand. With your other hand, twist the tool in the directions shown.



The tool jams immediately and cannot be turned when moved in an anti-clockwise direction.



The tool can be continuously turned in a clockwise direction with slight resistance

Characteristics to look out for when testing an OAD

Use a suitable tool, as explained above.



You will notice an increasing spring force when moved in an anti-clockwise direction.



The tool can be continuously turned in a clockwise direction with slight resistance.

Note: A small number of overrunning pulleys have a left-handed thread instead of a right-handed thread. The functions of the left-handed thread are exactly the same as those for the right-handed thread, but reversed.

AUTO**BIZ**

TECH TIPS

