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Tech Tips

4th Issue
Feb 2014


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TECH TIPS

Let's get technical...

This 4th issue of Tech Tips has a round up of all the Tech Tips that were published in Autobiz during 2013.

In my travels around the country visiting garages, I've received good feedback on this technical information and mechanics tell me they would like more of it.

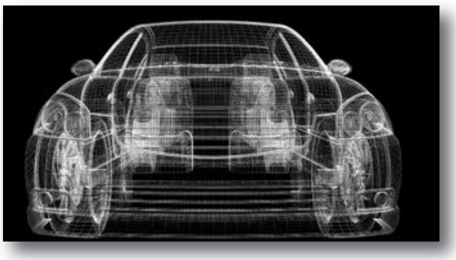
To improve further the access for garages to this all important technical info, we are launching our new online, technical search engine called *Tech Tips plus. Tech Tips plus* will have all of our existing Tech Tips and we are also giving a platform for parts manufacturers to supply us with additional technical data in the form of technical bulletins, videos, installation instructions and more, all available in one convenient location.

As we launch our online *Tech Tips plus*, we have close to 200 documents already online, with many more on the way. With the help of the aftermarket, we expect this to grow substantially, providing a comprehensive bank of technical information that garages can access anytime, quickly and easily.

Logon to autobiz.ie and click on techtips+.

We welcome your input; email me at john@autobiz.ie.

John O'Callaghan, Technical Editor



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Tech Tips

Troubleshooting guide spark plugs

Alan Povey, Technical Services Manager for DENSO

Spark plugs may be a familiar engine component, but their improved performance and longer life, means you are probably fitting fewer replacements than ever before. Alan Povey, Technical Service Manager for DENSO, offers some help in identifying common spark plug faults.

Spark plugs perform a pivotal role in petrol engine response and represent an increasingly complex electrical set-up, so make time to remind yourself of some of the visual signals of spark plug problems, as well as their wider symptoms and likely causes.

A plug's life can be affected by many factors. Dirt and fouled plugs (caused by carbon build-up), breakage and wear can all play a part and the portions of the spark plug that wear over time are the centre and side electrodes. The two main types of wear are:

- Oxidised wear - oxidised scale build-up that drops off in places, only to be replaced by further irregular build-up
- Spark wear - melting / rounded edges / increased plug gaps caused by discharge energy and wear between the two electrodes

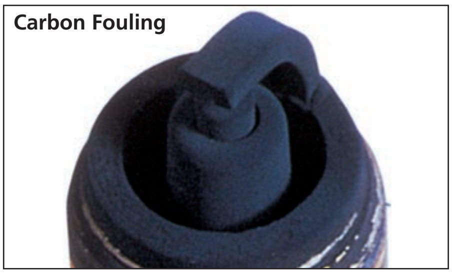
Other main causes of spark plug failure are shown on this page.

Also remember that failure to correctly install, inspect, clean and re-gap Spark Plugs can also result in problems, especially as 70% of a plugs wear is on the firing electrode. A bigger gap will stress the coil pack causing premature failure, causing potentially long term and costly faults. Modified engines also need to be considered to ensure that the correct application is used. If in doubt please consult DENSO.

Normal

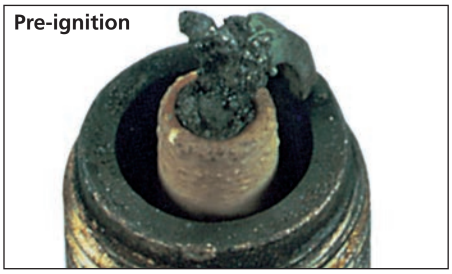
Appearance: Light grey or tan deposits and slight electrode erosion

Carbon Fouling



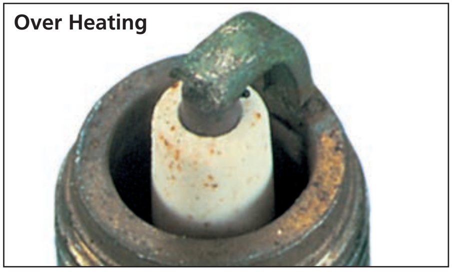
Appearance: Dry, soft black carbon on the insulator and electrodes
Symptoms: Poor starting, misfiring, faulty acceleration
Possible causes: Faulty choke, over-rich air-fuel mixture, delayed ignition timing, bad ignition leads, plug heat range too cold

Pre-ignition



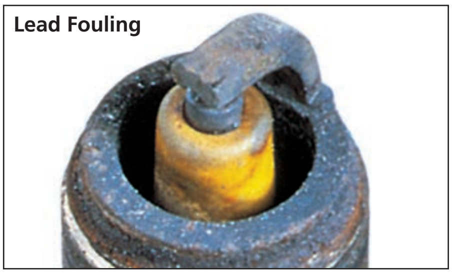
Appearance: A melted or burned centre and/or ground electrode, blistered insulator and aluminium or metallic deposits on the insulator
Symptoms: Loss of power, will cause engine damage
Possible causes: Much the same as over-heating. Pre-ignition takes place when combustion begins before the timed spark occurs

Over Heating



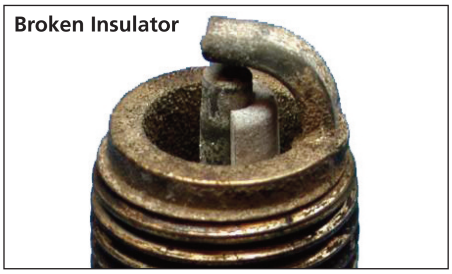
Appearance: Extremely white insulator with small black deposits & premature electrode erosion
Symptoms: Loss of power at high speed or with a heavy load
Possible causes: Plug insufficiently tightened, engine insufficiently cooled, ignition timing too advanced, plug heat range too hot, severe detonation

Lead Fouling



Appearance: Yellow or tan cinder-like deposits or a shiny glaze coating on the insulator
Symptoms: Misfiring under sudden acceleration or heavy load conditions but no adverse effect under normal operating conditions
Possible causes: Use of petrol with high-lead content

Broken Insulator



Appearance: The insulator leg section is cracked or broken
Symptoms: Misfiring
Possible causes: Severely abnormal combustion, lack of attention to gap adjustment

The key to success is knowledge

Any repair requires an understanding of what is wrong, and the effects of what you are doing. Both require an understanding of how things really work. eXponentia's Steve Carter explains the importance of knowledge as it applies to the ever increasingly complex world of the motor trade.

Steve Carter, eXponentia

As a lecturer for eXponentia, I visit numerous colleges, universities and training centres to deliver courses, and quite often a lecturer from this venue will sit in on a course for their continuous personal development (CPD). Often they are stunned by the rapid development in automotive technology, but go on then to tell me that many of their colleagues still perceive this subject to be undertaken by students with poor academic qualifications, but that are good with their hands. This never ceases to amaze me, as we try to understand the complexities of vehicle networking systems such as VAN, CAN bus and Flex Ray. Being good with your hands is not going to help you too much here.

Let's take this example: **2008 Volkswagen Golf 1.6 SFi**, like all VW models of this age, was fitted with a Teves MK 60 ABS/ESP system and it suffered from a common fault - a brake pressure sensor failure. It was also suffering from a steering angle sensor failure, a garage duly replaced both defective sensors. The brake pressure sensor problem had cleared, but the steering angle fault remained. Given the high cost of the steering assembly, and no ability to test it off the vehicle, the garage decided to give me a call.

Arriving at the workshop, the owner duly showed me the two fault codes in the engine management and ABS/ESP units. The component itself is located at the top of the steering column switchgear assembly, and was accessible only by removing the airbag, clock spring and steering wheel.

Now, if you understand CAN bus, you know that the engine management and ABS/ESP control units don't see this sensor directly, they are being informed of the sensor's functionality by the switchgear. This is a small control unit located under the bottom of the steering column by the steering wheel, which the airbag, steering angle sensor, cruise control and other components plug directly into. Therefore, to diagnosis this fault correctly, you should interrogate this control unit first, not the engine management and ABS/ESP control units. When the switchgear control unit was interrogated, it informed me that the sensor was missing. It wasn't, of course, which told me straightaway that the fault was in this control unit and not the sensor. The switchgear module was more like a printed circuit board, and when flexed, it could miraculously see the sensor. The defective module was replaced and the steering angle sensor was recalibrated, a rather lengthy, but necessary, procedure. The car then drove with no warning lights.

So back to my opening statement, the need for the modern motor technician to understand ever more complex systems will continue to increase, and only by staying up-to-date will the technician be able maintain these types of vehicles.

Another example of the importance of understanding how a component or system works when you are diagnosing a problem, was a seat belt on a **2008 Honda Accord** that had a locked spool. The driver's seat belt had retracted into the pillar and would not come out again. The anchor was removed in hopes that with a little more slack, the seat belt would release again. No matter how much slack was given, the spool took the belt in and would not release it.

The next step was to remove the take-up reel, to see if some foreign object has become lodged in the mechanism to prevent it from operating properly. Nothing was found. There were no foreign objects, all parts were in place and were not worn, and yet the reel would not release.

Now I love a good puzzle, but all puzzles require an answer. By removing each separate part of the take-up reel, the fault was narrowed down to the inertial latch mechanism. This is the part that latches the reel into position under heavy braking, or on some models when you pull the belt out rapidly. The latch that extends out to engage teeth to lock the reel in position would not retract, permanently locking the reel. After removing the cover on this part, the fault was easy to see, but difficult to believe. The spring that kept the latch free from the teeth had popped off the latch, allowing gravity to drop the latch onto the teeth. Just how the spring could have become unseated is not clear, but it was a clear understanding of how the seat belt worked that lead to a quick diagnosis of the true fault.

Knowing the function of the components and the system you are working on is critical. Given that the manufacturers keep developing new ideas that end up in your garage, continual training is a mechanic's only hope of staying ahead of the game.

A spring, at top, was unseated, preventing the seat belt reel from releasing the belt

The spring in its proper position

eXponentia™ The Automotive Training Experts

Thinking through DMFs

Malcolm Short, Schaeffler

When a car comes into your garage and you think the Dual Mass Flywheel (DMF) is the cause of the rattle, do you jump right in and change it? Or would you take a few moments and analyse the situation? Schaeffler's Malcolm Short, has some thoughts about what you should be doing.

Firstly, is it the DMF that's rattling? Does the noise go away when you depress the clutch or get worse when driving round corners? Both of these might suggest it is the gearbox rattling rather than the DMF.

Starting and stopping the engine creates the most movement in a DMF, so if you hear noises under these conditions it might suggest a worn DMF, but not exclusively. Does the engine stop cleanly or does it jump up and down on the final gasp? A worn DMF will not cause the engine to perform badly, but a poorly running engine will make a DMF rattle and shorten its life, because it is absorbing more vibration than it should. Likewise, an engine that is cranking slowly due to a poor battery or dodgy starter motor, will not produce a nice clean start and the DMF will be working overtime trying to compensate. Faulty fuel shut-off valves or dribbling injectors, will both create an unsmooth cut-off or worse, an engine deciding to go backwards for the last turn.

So it's starting and stopping cleanly and it looks like it is running OK, but when you increase the revs slightly you get a small noise in the transition period. Is the engine still smooth when doing this, or is it coughing or maybe its the EGR valve that's doing the rattling?

Is the engine running like it was when it left the factory? Cylinder to cylinder imbalance due to compressions or injectors will all contribute to increased vibration going into the DMF.

So it is running OK, it's starting OK, but we still have a rattling DMF (and we are convinced it's the DMF) but it still has relatively low mileage. Do we know this customer, how do they drive it, how do they load the vehicle, are they a 2 tonne plumber with a 1 tonne van, or a builder that uses a Mondeo to move an excavator around, is he a lovely family man that only takes his wife and kids out on a Sunday, all 7 of them all over 14? Vehicle manufacturers carry out extensive testing of their vehicles, including running around at maximum GVW, to make sure they can release the vehicles to the general masses, then we think we can deliver wet concrete in the back of the Transit!

LuK DMF's as OE equipment are tested in the vehicles they are used in at the GVW the vehicle is designed for, using the tune the vehicle manufacturer has chosen. If the vehicle is operated outside of those limits, beyond its design life or with a chip tune to "improve performance", then the DMF will, like most components under those conditions, wear out sooner rather than later.

Equally there are some vehicle specific issues that keep cropping up. The Opel Vectra apparently, has a control unit in front of the battery, that if not clipped in properly with some force, it may fool even the most

experienced of mechanics into believing the DMF is rattling. The swirl valves or their control unit is equally a popular cause of DMF rattling, due to misfire on the same vehicle and glow plugs not working properly, may result in excessive cranking to start. A common cause of rattling DMF at idle on the Vectra is the throttle valve sticking open, due to carbon build up. Closing it with your finger after removing the air intake pipe will confirm it.

In reality, the thought process behind all the above is a few minutes to a professional; he has made his assessment, established that it is the DMF that is faulty, and he has advised the customer of the cost of bringing his car back to how it was when it left the factory.

A professional mechanic should inform the budget concious consumer on the pitfalls of converting the vehicle away from its original specifications and changing its fundamental characteristics. Remember that fitting a solid conversion will not remove the original problem that caused the DMF to wear, it will just pass on even more of the vibration into the gearbox.

Items to check before replacing the DMF:

- Is it the DMF making the noise?
- Does the noise change when the clutch is depressed or when you go round corners?
- Does it rattle on start up and shutdown?
- Is the starter cranking at the correct speed?
- Is the engine misfiring or shaking?
- How is the vehicle used or abused?
- Has any work been carried out recently?
- Is the vehicle chipped?

When you have identified the reason behind the wear:

- Don't use conversion kits purporting to do the same job as a DMF, they don't!
- Lock the flywheel before undoing the DMF bolts (to prevent engine damage due to worn timing chains)
- Make sure you rectify any oil leaks before refitting the DMF
- Check the reluctor ring for damage and the correct number of teeth.
- If a vehicle manufacturer specifies a Torque and Angle for the DMF bolt, it should be replaced.
- If there is no complaint of noise, always measure the DMF wear on a vehicle that has come in for a clutch change, as it may still require changing.

Don't always believe the code

A diagnostic tool can give a fault code that sounds very precise about where the fault lies, but the important thing to remember, is that the tool can only give out the information it receives from the vehicle's ECU. A.D.S reminds us that the information you're getting depends on how intelligent the ECU is.

When we get a trouble code, most of the time this code is only pointing us in the general area of the fault, it is not a final and thorough answer.

A 2003 Toyota Avensis 2.0 D4D came in to our garage with the engine management light on. It was running poorly and lacked power. A diagnostic scan and code reading showed the following fault code: P0340 camshaft position sensor. The code could be cleared, but would come back after the engine was restarted. The next step was to do a quick visual check around the cam sensor area, to see if there was anything obvious, but everything looked fine and the cam sensor looked to be new. The next step was to check the signal from the cam sensor itself. For this test we used the GMTO/ATIS oscilloscope, which has built-in brand specific data with technical information, connection help, automatic set up and sample wave forms. The cam sensor on this car is 2 pin inductive coil type, that transmits an AC signal to the ECU. At idle, there was a good signal and it matched the waveform displayed in the ATIS software.

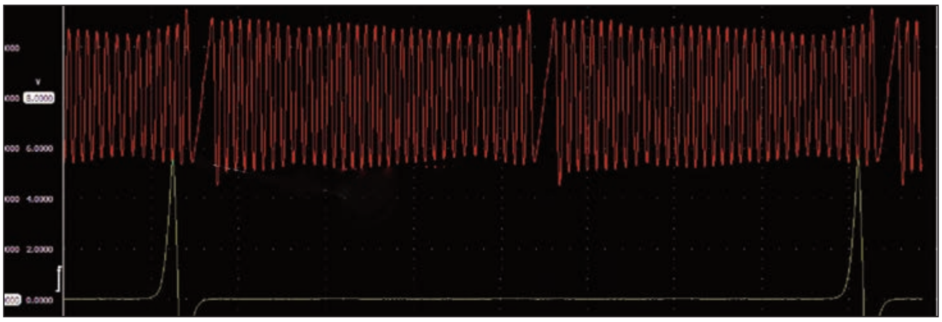


Fig 1. The crankshaft (red wave) and the camshaft (yellow wave) were not sychronised because the timing belt had jumped a tooth. The yellow peak is shifted to the left.

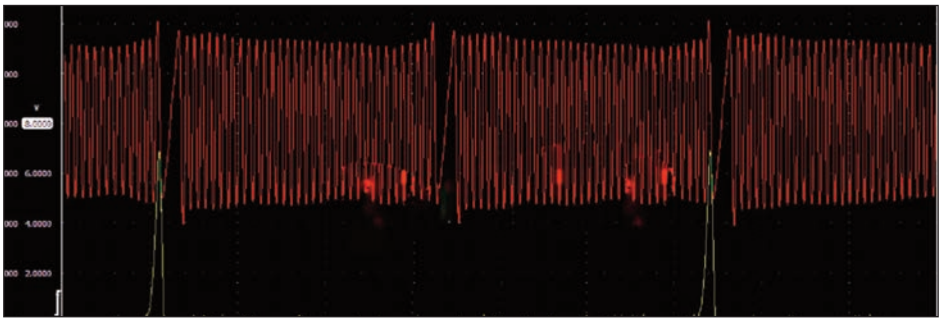


Fig 2. The crank and camshafts were synchronised after the timing belt was replaced. Note the location of the camshaft sensor peak is in the proper location now

This proved that the cam sensor was working properly and the trigger points on the cam sprocket were intact and were not damaged or missing. This also proved that the wiring from the sensor back to the ECU was not shorted to ground or any other wiring, but it did not prove if there was an open circuit. The best way to check for an open circuit, is to scope the sensor signal at the input point on the ECU. Because the ECU on this car is mounted inside, behind the glove box, we decided to leave this test till later, if needed.

The cam and crank signal were checked together. This was very easy to do with the GMTO scope, as there is a option to do a combo test. When you select combo test, it opens up the scope with everything set up and ready to go, and also shows real life connection pictures of which wires to connect to on the sensor. It also has a known good reference displayed on the screen, so you can superimpose or use the cursors, to compare the reference wave form with the one you are checking. With this test you can examine the cam timing.

As you can clearly see in the waveform in figure 1 on this page, the valve timing or the pick up positions on the crank and camshafts are out of sync. With this information, we know that the problem is a mechanical fault and we can proceed with removing the timing covers to check for a problem, knowing that the fault is definitely in this area. After removing the covers and lining up the TDC mark, we could clearly see that the cam timing had jumped a tooth. After fitting a new timing belt kit, the fault code was cleared and stayed out and the engine ran perfectly.

This proves that the ECU on this car cannot determine the difference between a cam sensor fault or a cam/crank synchronisation fault. Some modern systems can pick up a fault code telling you that it is a crank/cam synchronisation fault, and in some cases, in the data stream, you can view crank/cam synchronisation while cranking. But with this and many other cars, it is back to the case of how intelligent the car ECU is.

Having the GMTO/ATIS scope to check this car greatly helped avoid guess work and replacing parts that may not have been needed. When we did decide to remove the timing covers to check further, we were confident that we were going in the right direction.

A.D.S
Automotive Diagnostic Services

Fixing the un-fixable car

A 2009 Audi A3 recently went around to many garages in Ireland, in search for a cure for a severe running problem. After many unsuccessful repair attempts, eXponentia's Steve Carter was asked to diagnose the problem.

Steve Carter, eXponentia

This troublesome car, a 2009 Audi A3 with a 1.6L petrol engine, was recently sold second hand, but after a few months the car was returned to the seller with a severe running problem. Every time the car was started, the engine would only rev up to around 1500 rpms and had no acceleration at all. The sluggish condition would last around 30 seconds and then the car would drive normally. The problem would only be present after start up and would never repeat until the engine was restarted.

Many parts were replaced in numerous attempts by numerous garages to solve the problem, but the problem never went away, never improved, and never got worse. At one point the dash was even removed and sent out for testing, in what was hoped would be a repair, but no fault was found in the dash.

The owner of the car even looked up the problem he was experiencing with his car on Google. He was excited to find that indeed at least one other person was experiencing the same driving problem with a car just like his. However, it turned out to be his own car that one of the mechanics that had tried to repair the car had also asked for help on-line! The owner was lost for an answer yet again. With the future of this car firmly in doubt, as it was considered by everybody to be unfixable, beyond the grasp of any mechanic.

As I was going to be in Ireland teaching some technical training courses, I was approached with a request to look at the car to diagnose the problem. With advance warning, I was able to do some preliminary checks to see if that particular model had any known problems that could be the cause.

I started out checking for trouble codes and noting all of the new parts that had been recently installed, and there were many. There were a few codes in the car, but with all of the work that had been done, it was no surprise. The codes were all cleared and the car was started up and immediately bogged down on acceleration for about 30 seconds and then went back to normal, but no trouble codes were set by this event. When the live data was examined, the reason for the engine bogging down became clear: the ignition timing rapidly went from normal to 15 degrees retarded during the fault, and then returned to normal. After the engine came back to normal, the ignition timing was functioning as expected.

The next thing that was examined was the knock sensor, to see if it was detecting what it thought was a knock and was retarding the timing. It was in good working order. My suspicions were next turned to the Electronic Stability Program (ESP), as it is designed to drop engine power during specific events, such as loss of control of the car by the driver in events such as oversteer. While there is an EPS button on the dash of this car, turning it to the off position merely dilutes it's operation. In case the driver actually does lose control of the car, the ESP system will still respond, in an attempt to avoid or lessen the severity of the event. Switching off the ESP with the button had no effect on the problem.

The next step was to look at the live data from the wheel speed sensors, to confirm that they were all reading about the same speed. All of the speed sensors were in good order without any signs of a problem. If there was a significant difference in wheel speed data, the ECU would think that the driver had lost control of the car and would take action by decreasing engine power. In order to disable the ABS, you must remove the fuses for the ABS under the bonnet. Removing ABS fuses in the passenger compartment, does not completely disable ABS. With the ABS turned off, the car was driven and it ran perfectly.

There were only two sensors left that could have triggered the ESP to decrease engine power, the steering angle sensor, that detects the angle of steering requested by the driver, and the yaw sensor, which detects when a car is spinning out of control.

With the car sitting still and on level ground, the yaw sensor was reading 0.49g's, or a very serious spinning motion. The normal at rest reading from the yaw sensor should have been almost zero, with a reading of 0.2 to -0.2g's when you push down on each front corner abruptly. When the front corners of this car were pushed down, the yaw sensor was reaching 1.2g's, way beyond any reasonable value in anything but a Formula 1 car. The yaw sensor was located in a box firmly fixed under the front passenger seat. The wiring to the box was disconnected, the ABS fuses replaced and the car was taken for another test drive.

This time the car ran perfectly, the problem had been located. The root problem was that the yaw sensor was sending a signal to the ECU, that would normally only occur when the car was being driven too fast around a corner that resulted in oversteer. As the ECU thought that a crash was imminent, it retarded the ignition timing, in an attempt to cut back on engine power. Apparently, the power reduction will occur for only a finite set of time and will not call for reduced engine power during that key cycle.

While this problem is highly unusual, it was solved by following a clear plan of action: Determine the facts and confirm/eliminate possible sources until the problem is fixed. The cornerstone of the process is being current with technology that is in the cars that come into your garage everyday.

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Getting timing belt tension right

Problems persist with the premature failure of the belt and tensioner on the 1.7-litre turbo diesel engine used in many Vauxhall/Opel and Isuzu vehicles. Following the prescribed belt and tensioner change instructions is key to making sure it doesn't happen to you, Dayco explains.

The issue is further complicated, as there are at least ten versions of this unit, each with its own variation. However, the most common cause of failure occurs when belt is over tensioned. Being forearmed with the knowledge, it is easy to avoid if the correct fitting procedure is followed.

In the overwhelming majority of cases, the cause of the failure is as a direct result of the incorrect installation of the new belt and tensioner, so workshops must ensure that the technicians tasked with the repair follow all of the technical guidelines. If these procedures are followed, a failure of this nature is extremely unlikely.

The reason that the belt can become over tight, is because although it is straightforward to install the new spring loaded tensioner, it is also very easy for it to move while it is being secured. Just a small movement can make a big difference on the tension on the belt.

To demonstrate the extent of this phenomenon, if during its tightening the tensioner moves by only four or five degrees, the tension on the belt will increase threefold, from the 20kg it is designed for to a catastrophic 60kg plus, causing the tensioner to wear excessively and ultimately, distort and fail.

To prevent this costly problem, Dayco recommend technicians follow its published fitting procedure, designated for the specific engine code and make sure that they tighten the bolt to the manufacturers specified tension, which is also stated by engine code in the Dayco technical sheet.

This is particularly important as it seems more than a coincidence that the most common failures tend to occur on the Z17DTH and Z17DTL units, which both feature tensioners that have a lower torque setting than the majority of the other engine codes.

Fitting Procedure

The precise detail of the fitting procedures differ according to the engine code, but to set an accurate tension of the belt, the engine must be cold and so it should have been at rest for at least four hours. Common to all engines are the following:

1) The TDC locking bolts must be installed in the camshaft sprocket and the high-pressure pump sprocket. The lug on the crankshaft pulley must be in line with the lug on the oil pump cover.

2) Observe the direction of engine rotation, the timing belt must be installed and tensioned in the direction of the arrows in a clockwise direction starting from the crankshaft, oil pump, fuel pump, camshaft and tensioner pulley.

3) Not all engine codes need this step, but Z17DTH and Z17DTL units require the TDC bolts to be removed and the crankshaft rotated 60° in the direction of engine rotation.

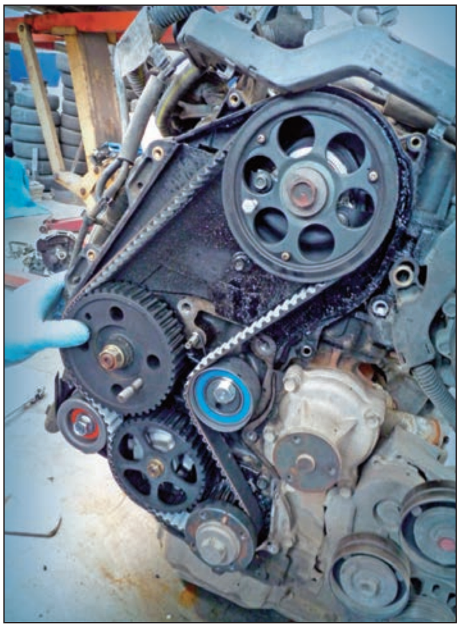
4) Tighten the tensioner bolt to the vehicle manufacturers specified torque for the engine code in question, making sure the tensioner does not move during this operation. It is advised to make a reference point to make sure the tensioner has not moved.

5) Dependent upon the engine code, the crankshaft must be rotated between two and six revolutions in the direction of engine rotation to the adjustment position

6) The lug on the crankshaft must then be in line with the lug on the oil pump cover.

7) Reinstall the TDC bolts to the camshaft and fuel pump sprockets, if it is not possible to install these freely then the tension procedure must be repeated.

To simplify the process further, technicians can use a Dayco Tensiometer, which will ensure the correct tension is achieved. The tool is easy to use and just needs the relevant test code for the belt application to be entered and the belt vibrated. If the test reading is 'OK' the belt is fine, but if the result reads + or – three, the belt will need to be



reset.

Product Quality

Depending on the variant, Dayco provides either timing belt kit KTB414 or KTB468 for the GM 1.7 turbo diesel engine, but both options contain a High Tenacity (HT) or 'white' belt.

The Dayco HT belt has become the original equipment (OE) solution for an increasing number of vehicle manufacturers. As a result, more vehicles fitted with these white belts are coming into the workshop.The kit also improves upon the standard two-year warranty. Dayco's unique Long Life + 1 year warranty is free of charge to the factor, workshop and motorist, and extends the warranty on the Dayco HT belt from the existing two years, to three years.

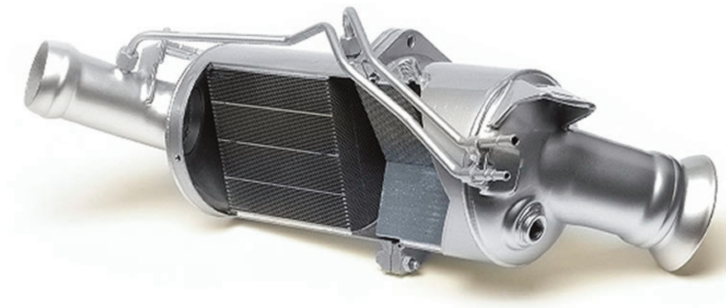
For more information regarding the OEM quality power transmission products in the Dayco range, phone Team PR Reilly on 01-832-0006 or visit www.dayco.com.

DAYCO®

DPF fact and fiction

Ian Humphreys, JLM

Diesel Particulate Filters (DPFs) have been around long enough now to have popped up in your garage. They have changed the knowledge a mechanic needs, but they have also provided new opportunities to garages that adapt. JLM's Ian Humphreys explains some common DPF misconceptions.



All DPF systems are the pretty much the same. Fiction.

There are two general types of systems in use, plus another that is sometimes confused as a DPF system. The design used by Citroen/Peugeot, as well as some Fords, and Volvo use an active regeneration with an onboard additive dosing system. The additive assists the regeneration process by lowering the temperature that the particulates can be burned off. The disadvantage of this design is that the fluid needs to be replaced at regular intervals. The business opportunity to garages is another essential service that you can provide your customers.

Another type is known as passive regeneration, used by Jaguar, Land Rover, Audi, BMW Mercedes-Benz and others. It also uses a catalyst type filter system, but there is no additive. The disadvantage of this system is that it requires optimal operating temperatures to ensure regular, complete regenerations of the filter and can be prone to blocking.

AdBlue is designed to specifically reduce Oxides of Nitrogen (NOx) emissions, so therefore it is not the same as a diesel particulate filter system. AdBlue is a Urea based fluid that is injected into the exhaust to reduce harmful NOx emissions.

DPFs are not necessary. Fiction.

Diesel exhaust contain a wide array of soot particles that are harmful to human health. With more diesels on the road it has become more of a health concern. Some cities, London and Paris to name but two, wash down their streets to remove as much of the harmful soot particles as possible in order to improve public health.

A DPF stores the particulates and then attempts to burn them off, when conditions are right. Exhaust gases pass through the DPF, leaving larger particles behind in the pores of the filter. As the DPF fills with particulates, the ECU will detect that the DPF is filling, by measuring the pressure drop across the DPF, and carry out a regeneration. The greater the pressure drop, the more filled the DPF is.

Regeneration will happen on its own. Fiction.

When a DPF is working properly, passive regeneration will occur. Passive regeneration burns up the particles trapped in the DPF. However, this requires a fully operation temperature engine and vehicle speed of at least 40 mph for a long enough period of time. During passive regeneration, only a portion of particulates in the DPF may be burned up and cleared. This is because the temperature range of passive regeneration is between 250 to 550 C.

Active regeneration generally occurs about every 400 to 500 miles, depending upon the system & how the vehicle was driven. City and low speed driving will call for more frequent regenerations. High speed or motorway driving could cause regenerations to occur less frequently, due to lower engine revs.

Regeneration can occur in all types of driving. Fiction.

Passive regeneration requires temperature in the DPF to be high enough to burn off the particles trapped in the DPF. This will only occur while driving at higher speeds (and engine revs) for extended periods. The filter temperature increases even further during regeneration when (with some systems) excess fuel is injected into the engine during the exhaust stroke. This sends unburned fuel into the DPF where it combusts, increasing the DPF temperature, burning off the particulates trapped in the DPF. A regeneration usually takes around 15 or 20 minutes to complete and will cause the DPF temperature to rise to between 500° to 700° C. If at any time during a regeneration the vehicle speed drops sufficiently, regeneration will not be completed and will have to be attempted again, from the beginning. If an active regeneration has completed 90% of it's cycle and the car comes to a stop or slows significantly, the entire regeneration cycle must be repeated. After a series of failed attempts at regeneration, the ECU may go into Limp Home Mode until the DPF is cleared by a mechanic using the proper diagnostic tools..

Excessive regeneration attempts can cause problems. Fact.

If several regenerations are attempted but not completed, the excess diesel could accumulate in the sump and could result in a runaway engine. A diesel engine can run away if it can get enough fuel from the sump, even with the key switched off. A runaway engine poses a significant danger to all but a few quick-thinking drivers who would know what to do. Most drivers would not know what to do and a collision would most likely be the end result. The biggest indicator of this potential problem is rising oil levels in the sump, meaning that checking the oil level is even more important than ever. If you perform a manual regeneration in your workshop, you must change the engine oil after completing the regeneration for this reason.

Serious Problems can result from removing a DPF. Fact.

Many garages might be tempted to remove a DPF. This can lead to many different problems with the car. The most likely problem to happen on a turbocharged engine with the DPF removed is a turbocharger failure due to over-spooling. The DPF creates a back pressure in the exhaust that is accounted for in the ECU map. Removing the DPF changes the operating characteristics and creates the possibility that the turbocharger will attempt to provide too much boost, and catastrophically fail. So a DPF removal can turn into a turbocharger replacement, that will also fail. The proper repair to the DPF may look cheap then.

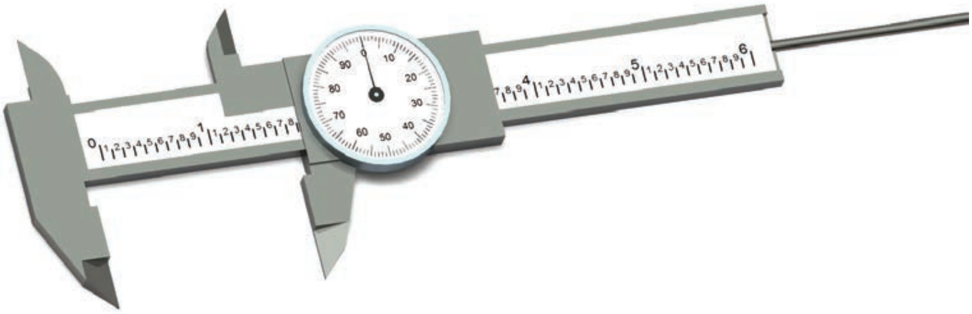
It is also possible that a ECU remap will not be permanent. In a particular instance, a BMW 5 series had it's DPF removed and it was remapped. Later, the battery was so dead that a jump start was needed. After the jump start, the car had reset itself and the original map was back in use, indicating a fault with the DPF.

Have you tried recalibration?

Modern cars are more complex, as well as less fault tolerant. Sometimes fault codes are created by unknown circumstances, not because of a true fault. eXponentia's Steve Carter relates a few instances where the fault might be considered to be phantom.

Steve Carter, eXponentia

The wide variety of sensors and controls on a modern car, must work nearly flawlessly in a wide variety of situations, to operate without triggering a fault code. Most of the situations can be anticipated, but some can't because with increasing complexity comes more possibilities for a phantom trouble code to be triggered. By phantom trouble code, I mean a trouble code that has been triggered without any visible or detectable cause, after a careful and thorough diagnosing of the problem



Our first example is a **2004 Honda HR-V** with a 2.0L diesel engine. The customer had brought the car to thier local garage because the MIL was showing a fault. The garage did their diagnosis and the trouble code indicated a fault with the Throttle Position Sensor (TPS). They cleared the code, and it immediately came back. When the garage found out that a replacement TPS was going to cost £475, they hesitated to replace it, as they were aware that choosing to replace the TPS might not actually solve the problem, it was just too expensive to gamble on. With no solution to the problem, they asked me to see what I could do.

I repeated all of their steps in diagnosing the fault, and then looked at the TPS signal with an oscilloscope. The scope showed the TPS to have a signal that was as expected, so the wiring was examined for any possible faults. When the wiring was found to be in good order and all of the connections were good, it was time to go a bit deeper. The sensor was working as designed, the wiring and communications were good, but the fault was still present and triggering the code.

As I was using a scanner that belonged to the garage, I was not entirely familiar with the menus and noticed that with a few presses of some buttons I could recalibrate the TPS. Thinking there was nothing to lose in trying this, I recalibrated the TPS and the fault went away. A test drive and other checks showed that the TPS was working as it should and the car was deemed to be fixed.

The next example was on a **2009 BMW 1 Series** equipped with Start/Stop and a manual gearbox. The car had a gearshift neutral sensor fault code and the Start/Stop function was not shutting down the engine when the car was stationary, as it should have. The first thought was that the fault code was due to the fact that a service was due soon. A check for the usual problems did not show anything amiss. Thinking back to the HR-V, I decided to see if the gearshift neutral sensor could be calibrated. After a bit of searching for the recalibration feature on the scanner, the scanner went to work recalibrating the sensor and the fault was cleared. A test drive showed that the car was running properly and the engine was stopping and starting as expected. **Take note of this problem:** given the relatively recent introduction of start/stop to cars, it is possible that this particular problem could be likely to occur in this and other makes or models. It is possible that 50,000 miles of driving causes enough bumps and vibrations to confuse the ECU into deciding that the sensor is faulty.

The last example also illustrates another problem that can occur, along with a sensor that was fixed by recalibration. A garage was trying to diagnose a running problem with a **Toyota Prius**. Before you can start to work on a running problem on a Prius, or any other hybrid powered car, you will have to trick it into running continously, known as Mode 1. Without getting the car into Mode 1, you would never be able to find a vacuum leak, coolant leak, or most running problems. Getting the Prius into this mode requires a precise and specific sequence of braking, gear selection, engine speeds and the use of the Start button. With many steps that have to be completed in the proper order and within a given time frame, it is not likely that you will be able to accomplish this in the first attempt. After a few tries you will eventually get the Prius into this mode.

A garage was trying to locate a problem that required the engine to run on, and after a few attempts they were successful. Everything was fine as the mechanic went about finding and fixing the problem that the Prius was brought in for, but then discovered that their was a fault in the brake pedal sensor. Now it's hard to give a customer their car back with a fault still present, but it is extremely difficult when the fault wasn't there before. So the garage was left to sort out this problem as well. All of the diagnostics showed the fault was in the brake sensor, but that the sensor had a good signal and all of the wiring was in good condition. As you might suspect by now, recalibrating the brake pedal sensor sorted the problem. What had probably happened, was that during their attempts to get the sequence right, the brakes were applied with too much enthusiasm, flexing the sensor and creating an abnormal signal.

While I am not saying that recalibrating every sensor that has triggered a fault is a viable way to repair cars, once you have eliminated the other possibilities, it is something that should be considered. Immediately after the sensor is recalibrated, the car should be operated and driven to see if the fault does not return. One of the reasons behind this may be that given the environment in which all of these sensors are subjected to, such as temperature extremes and vibration, a sensor signal or reading outside the expected range can be seen by the ECU and trigger a fault code. This is just another thing that you, as a skilled mechanic will have to add to your skills.

eXponentia™ The Automotive Training Experts

Fitting tips for shocks & coil springs

Replacing Shocks and coil springs is relatively straight forward, but best practices should be followed. KYB provides some basic tips and techniques for replacing worn shock absorbers and coil springs.

Shock Absorbers

• Don't hold the piston rod with any tools (mole grips etc), as this will damage the surface of the piston rod and may cause the oil seals to leak.

• Don't put any water, oil or other liquid inside the strut housing as this may damage the cartridge. KYB cartridges are designed to be used without liquid at both high and low temperatures.

• Don't use an impact wrench to tighten a nut onto a piston rod. This can make the torque higher than the recommended limit.

• Use any fitting parts (nuts, spacers, washers etc) supplied with the shock absorber, rather than the OE parts, as sometimes they may be a different size.

• If the shock absorber being replaced is not the original one, but an aftermarket part from another brand, any ancillary parts (dust cover, bump stop, bushing etc) can not be re-used for KYB shock absorbers. You may need to order OE parts.

• Shock absorbers should always be fitted in pairs.

• Always prime shock absorbers before fitting – fully extend and compress the unit 3 times to remove air pockets inside the shock.

• Always ensure the vehicle is back on all 4 wheels before tightening upper mountings.

Coil Springs

• Use an appropriate spring compressor tool when replacing coil springs. Using an improper compressor can be hazardous, or even fatal.

• Coil springs should always be fitted in pairs, to ensure an even ride height and to ensure the vehicle doesn't pull to one side when braking.

• Take care when compressing springs, they could cause serious injury if they come loose during installation.

• Check spring seats, and top mountings for damage before replacing broken or worn springs.

• After installation, check that the springs are seated correctly.

• Always check wheel alignment after installation.

• Worn or broken spring can damage shock absorbers and other suspension components, it is best recommended practice to replace shock absorbers at the same time as springs.

• A number of coil springs are side load springs, which are curved in shape, but when installed and compressed the spring is straight. Side load (or "banana") springs are curved and exert a side force on the shock absorber which reduces the friction between the shock absorber piston rod and the seal.

This not only improves shock absorber response, but also extends the shock absorber life. Side load springs are fitted to many modern cars.

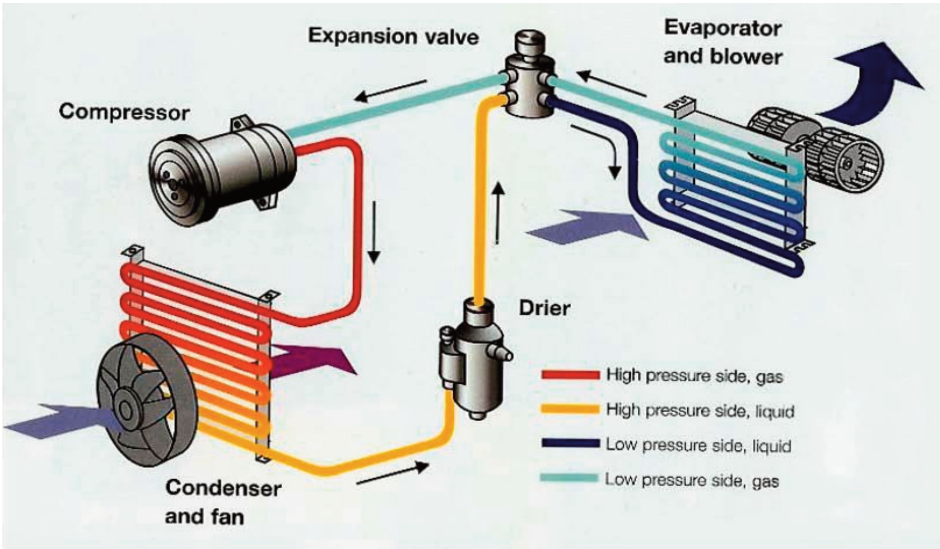
This type of spring is often highly stressed and more difficult to compress than a standard spring. It is recommended to use a powerful spring compressor, otherwise the spring will not be compressed sufficiently to fit onto the strut.

KYB

Understanding A/C servicing

An A/C system not only gives you cool air on a hot day, it will also help clear condensation from your windscreen and increase driver comfort. Texa's Mark Tierney explains the many functions of A/C systems in vehicles, their servicing and the legal permits you need to service them.

Air conditioning is not only for cooling air coming into the vehicle cabin, the air is also cleaned and dried. This proves beneficial in all seasons, as vehicle screens heavy with condensation clear swiftly when a good working air conditioning system is operating. Therefore, in order to ensure a good working air conditioning system, it must be correctly serviced and maintained. Texa UK Ltd offers a range of service stations and pressure test solutions, in order to meet any workshop's requirements.



Vehicle air conditioning systems all work in the same manner. By using specific key components (compressor, condenser, TXV or orifice tube and evaporator) that allows a change of state of the refrigerant from liquid to vapour, and then back again as it circulates around the system. This change of state goes hand in hand with a pressure/temperature change, giving us a high pressure liquid portion of the circuit that is hot, and a low pressure vapour portion of the circuit that is cold. The hot high pressure portion dumps heat outside of the car, so that when the gas returns to the evaporator, inside the cabin, it is colder than when it left. When the cabin air is moist, condensation forms on the surface of the evaporator, making the cabin air drier and reducing condensation on the windscreen. By redirecting this air via the heater matrix, the air can be heated when needed, making the A/C system useful on any day of the year.

Most vehicles use R134a as the refrigerant in the A/C system, but newer ones will use R1234yf. The two systems are not compatible, so if you want to offer servicing A/C at your garage, make sure you purchase a machine that can handle both gasses. There are also different types of lubricating oils, so care must be taken as the wrong type of oil can cause problems. Oil in a conventional A/C system is electrically conductive, while oil in a hybrid A/C system is not. If the wrong oil is used in the hybrid, stray voltage can leave the electric A/C compressor and shock you, or it may confuse sensors to the point that they will shut off the A/C. This will also be true of any vehicle with an electric A/C compressor, such as a start/stop engine.

In order to legally handle either R134a or R1234YF, you must have a permit. The permit can be obtained by attending and passing a course.

When carrying out a service on a vehicle A/C system, you should ascertain whether there is any refrigerant in the A/C system to begin with. If there is no refrigerant present in the system, you must identify all leaks using OFN (Oxygen Free Nitrogen). This is the only method of pressure testing that should be used. Only when all leaks have been repaired is it possible to refill the A/C system. Refilling a leaking A/C system is not only pointless, it is a waste of your customer's money and your good reputation as a dependable garage.

If the A/C System contains refrigerant, then it is always wise to carry out a system operating test in order to ensure that there are no problems with the system prior to the service. This is achieved by running the A/C system on the vehicle and monitoring the running pressures on the gauges of the machine. By checking the system prior to service will help the technician take the correct course of action.

To proceed with the A/C system service, the following steps must be carried out:

· Recovery/Recycling - remove existing refrigerant from the A/C system and recycle in the service station.
· Vacuum – this allows any moisture inside the A/C system to boil off, thus ensuring no damage or operating issues with the A/C system. This step can never be rushed or cut short, or there may still be moisture in the system that will cause either poor performance or system damage. Always allow the service station to run this critical step for the full time period.
· Injection - to replace any lubrication oil from the A/C system extracted during recovery and to inject an Ultra Violet (UV) Dye to help identify any possible future leaks on the system.
· Refrigerant Injection - to apply the correct weight of refrigerant specified for the A/C system, ensuring efficient operation.

An automated A/C service stations carries out each of these phases during an A/C service automatically, and also carries out checks in between and during each phase in order to ensure a proper and efficient service for the A/C system. By spending a short time and a small button pressing exercise, it becomes very easy for the technician to carry out a service while also completing other tasks. If the Texa A/C Service Station detects a problem during the vehicle A/C service, the unit will wait at that specific point, warn the technician allowing them to take the necessary course of action, and will wait for a response from the technician before
proceeding.

TEXA

Problems starting a 2.4D Transit?

Valeo technical have received a number of calls regarding an issue with Ford Transit 2.4 diesels, that are not starting once a conversion clutch and flywheel kit has been fitted. Here are some of the common problems that they have found, with a remedy for each situation.

Valeo Engineer Greg Dodd

Some common problems have been identified that are occurring after fitting a replacement clutch or a solid flywheel conversion. These are faults that have been reported to Valeo's technical experts, along with the possible source of the problems. After further investigation of these calls, all issues were resolved and some common factors were found. This technical guide has been produced to offer help trouble shooting these problems.

Is it the correct part?

Some problems are the result of the most basic of mistakes, the wrong part has been supplied and fitted. The best time to check this is, of course, before the part in installed. Check that the conversion kit supplied is the correct application for the Transit you are working on. Ensure the conversion kit is designed for the correct model, including all possible variants that will affect the identification of the correct replacement part. Valeo produce different conversion kits for model years 2000 to 2006 and also for 2006 onwards Ford Transits.

Possible wiring mix up

On the Ford Transit, there are two electrical plugs on the gearbox, one for the road speed sensor and one for the timing sensor. The two wiring plugs visually look different but can fit either way round. If the wiring connectors have been connected to the wrong sensors, the ECU will receive a sensor signal that is wrong and it will not operate. This will need to be checked to ensure the wiring is connected correctly.

Is the timing sensor clean?

If the Transit will still not start after confirming the wiring to the sensors is correct, check that there is not any damage or contamination on the timing sensor. As the original dual mass flywheel wears, metal particles and dust is produced, and it would have been attracted to the magnet on the sensor. If there is a high accumulation of flywheel metal particles on or around the sensor, the sensor will not register the flywheel timing marks and cause a non-start issue.

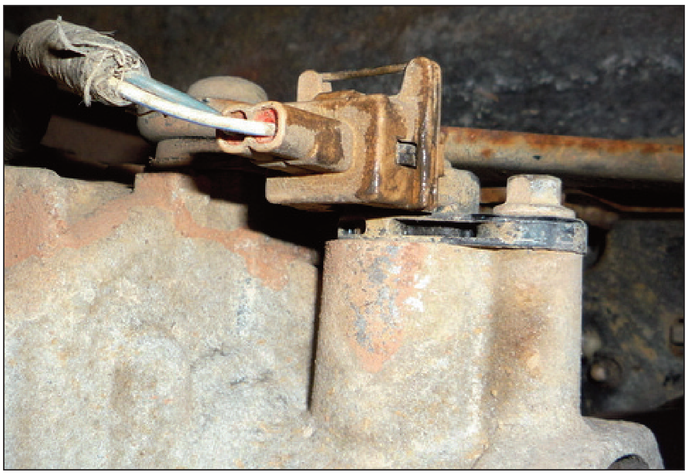
Is the timing sensor circuit complete?

If the timing sensor is working correctly or a new sensor has been fitted and the wiring plugs are connected correctly and the Ford Transit is still not starting, check the continuity of the timing sensor circuit back to the engine control unit (ECU). If the wiring has been broken, chaffed, kinked, crimped, nicked or earthed, the ECU will not be able to see

the signal from the sensor, and the ECU will not allow the engine to start.

What is the battery voltage?

It is possible that the battery can produce enough current to engage the starter and crank the engine, but the battery voltage will be too low for the ECU to operate. This fault will not trigger any diagnostic Trouble Codes, but it will prevent the engine from starting. If the battery voltage has dropped, give it a charge or install a fresh battery.



A timing sensor and a road speed sensor are located on the Transit gearbox. The connectors on both sensors can be accidently switched.

Metal particles can contaminate the timing sensor, so make sure it is clean so that it can work properly.

Electrical problems require proper tools

As electronics electrical circuits get more advanced, the tools required to diagnose and fix them have also evolved. Brendan Ryan, from A.D.S, explains how to use a few of these tools, that are considered by many, to be as essential as a spanner when working on diagnosing electrical faults.

2003 Navara - Intermittent No Start

A 2003 Nissan Navara 2.5 D22 pick-up came in with an intermittent starting problem. The customer also said that the engine management light was flashing when trying to start the vehicle, but once the vehicle was running, it ran fine. The Autoland Vedis II diagnostics scanner showed a single fault, from the crankshaft position sensor.

While looking at the live data stream, it could be seen that when the problem occurred on cranking, the engine speed was jumping up to an unrealistic 2000-3000 rpm. We all know that a cranking engine will be turning at about 250 rpm.

The next step was an inspection of the crankshaft sensor and its wiring. The crankshaft sensor on this model is a 2 wire inductive type sensor. The crank sensor looked to be new, so a quick call to the customer confirmed that a new sensor had been fitted to no avail. We then connected a GMTO oscilloscope to the crankshaft sensor wires and cranked over the engine . The waveform from the crankshaft sensor is shown on the left of figure 1. The waveform was not smooth, and has a lot of noise/interference. As there was a new crank sensor fitted, the next step was to look at the toothed ring on the flywheel and sensor wiring.

The wiring diagram showed the crank sensors were routed to the engine ECU and then onto the instrument cluster. A continuity test, short to earth and short to positive test was done on the wiring and all tests came up OK. The instrument cluster was disconnected and the crank sensor signal was examined on the scope. The signal was still bad, eliminating the instrument cluster as the cause of the interference.

Ideas were becoming scarce at this stage, so after some deliberation, it was decided that it was possible that the starter was causing the interference, as the starter motor is positioned close to the crankshaft sensor on this engine. Checking the crank signal in conjunction with the amps drawn by the starter while cranking with a current clamp was the best way to prove this, and it showed that when the amps drawn increased, it matched the interference pattern in the crank signal.

This proved that a fault to the windings in the starter was causing magnetic field fluctuations, which were creating the interference in the crank sensor signal. The starter motor was replaced and the crank sensor signal pattern was back to normal, as shown on the right side of figure 1.

2000 Alhambra - Communications Problem

In what was initially thought to be a straightforward airbag fault, on plugging in the diagnostic scanner there was no communications with the airbag. There was also no communication possible with the engine ECU or ABS. A very useful diagnostic tool in this situation is a Data Link Connector (DLC) Breakout Box. With the box plugged into the diagnostic socket the diagnostic tool is plugged into the other side of the breakout box, allowing the scanner to function and allowing a direct connection to each of the signal pins if needed.

When the unit is connected, it displays the vehicle battery voltage and then automatically tests all of the pins in the diagnostic socket. If any pin has a fault , the box will light up the faulty pin number and buzz to warn you of the fault. In this case, as you can see in figure 2, there was a fault on pin 7.

On this vehicle, this is the K-Line, used for diagnostics on all control units. A quick look at the radio told us that a aftermarket radio had been fitted to the vehicle. We decided that this was the first thing to check, as the K-Line is routed to the OE radio. On removing the radio, the K-Line was found to be joined into the live wire, the obvious cause of the problem. Once disconnected, communication with the airbags and all other control units was restored, allowing the work to be completed on the airbag fault.

Another feature of a breakout box is that it provides a way to connect a scope to see any of the signals at each pin. This can be indispensable when diagnosing a communication problem without damaging the pins at the back of the connector.

A.D.S
Automotive Diagnostic Services

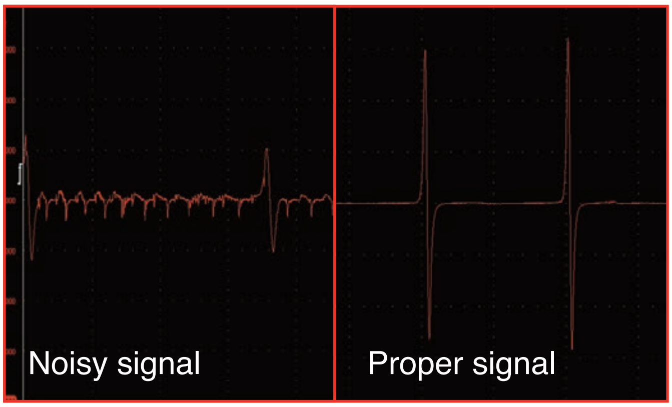


Fig. 1 The noisy crank sensor signal on the left, and a proper, clean crank sensor signal on the right.

Fig. 2 The light at pin 7 on the DLC Breakout Box indicated a fault in the K-Line. A scope could also be used to see the signal at any pin.

Troubleshooting guide glow plugs

Glow plugs are one of the most familiar diesel parts, but their improved performance and longer life mean you are probably fitting fewer replacements than ever before. Here DENSO technical expert, Alan Povey talks us through some of the most common visual signs of glow plug problems, as well as their likely causes and solutions.

Alan Povey, Technical Services Manager for DENSO

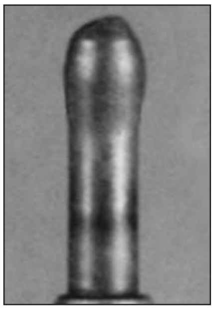
Spark plugs are used in petrol engines to ignite the fuel. Diesel engines don't use spark plugs, as they ignite the fuel by compression. However, they do have glow plugs, which are essential to starting a diesel engine in cold weather.

A glow plug works by converting electric power to thermal power, by directing current through high-resistance coils and generating heat in the combustion chamber. This makes it possible for the fuel injected into the combustion chamber to be self-combustible during engine start-up at colder temperatures, such as during winter.

How to install glow plugs

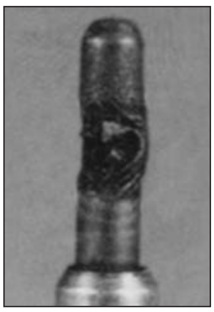
Always use the correct wrench for the glow plug and terminal. When changing glow plugs, make sure that oil, dirt etc on the outside of the disassembled glow plug does not enter into the cylinder. When mounting the glow plug, clean the engine side of the flange and make sure the glow plug is correctly inline with the thread of the cylinder head. Make sure the plug is correctly positioned and tighten it by hand until it cannot be tightened any further. Then, use a torque wrench to tighten it accurately to the proper torque.

Enlarged Tip



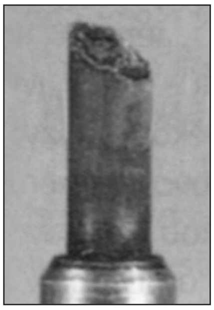
Causes: Excessive voltage eg 12-V glow plug in a 24-V system or vice versa; failure of alternator and regulator; dampness during storage.
Solutions: Check on-board and glow plug voltage; check charging system; check quality of storage conditions.

Deformed Tip



Causes: Over heating; failure of ignition unit; direction or regularity of fuel jet incorrect; wrong spraying position by faulty sealing; excessive glowing/voltage eg 24-V glow plug in a 12-V system or vice versa; failure of alternator or regulator; possible timing fault in injection unit.
Solutions: Check that the ignition unit is correctly installed; check that you are using the correct ignition unit for the vehicle model; check the glow plug installation point for carbon deposits; check contacts on glow plug regulator; check on-board and glow plug voltage; check charging system voltage; check fuel injection timing.

Damaged/Missing Tip



Causes: Failure of ignition unit; direction or regularity of fuel jet incorrect; sealing fault causing spraying position error.
Solutions: Check that the ignition unit is correctly installed; check that you are using the correct ignition unit for the vehicle model; check the glow plug installation point for carbon deposits.

Missing Tip

Causes: Ignition unit failure; direction or regularity of fuel jet incorrect; wrong spraying position caused by faulty sealing; function or timing fault in injection unit; thread damage to opening of cylinder head where glow plug is installed; glow plug insufficiently tightened causing plug to sit incorrectly.
Solutions: Check that you are using the correct ignition unit for the vehicle model; check that the ignition unit is correctly installed; check the glow plug installation point for carbon deposits; check timing of injection pump; check the opening of cylinder head for thread damage/carbon fouling.

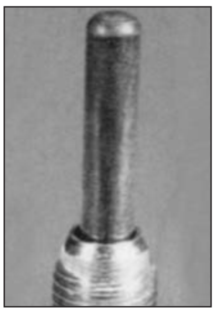
Swollen Ring on Tip

Causes: Oil in the combustion chamber, probably caused by engine wear.
Solutions: Check piston clearance in engine cylinders; check oil consumption.

Broken Tip

Causes: Excessive glowing/voltage eg 24-V glow plug in a 12-V system or vice versa; failure of alternator and regulator.
Solutions: Check contacts on glow plug regulator; check on-board and glow plug voltage; check charging system voltage.

Tip Touching Body



Causes: Over-tightened torque; wrong tool used; thread damage to opening of cylinder head
Solutions: Check the opening of cylinder head for thread damage/carbon fouling; check glow plug torque.

DENSO

Clutch Clinic S-Max

Malcolm Short, Schaeffler

The Ford S-Max is the clutch fitters' dream. With a few pointers from Schaeffler's Malcolm Short, it should be easy to beat the book time of around five hours.

Nothing out of the ordinary is needed to complete the job, the only special tools required are a transmission jack, an engine support cradle and a long axle stand. A two post ramp was used in this example, however a four post ramp may not provide enough clearance. For safety reasons it is considered best practice to disconnect the battery earth lead before commencing work. If the vehicle has alloy wheels it may be fitted with anti-theft wheel bolts, so make sure you have the key before you start.

Start by undoing the bolt (fig-1) located in the drivers foot-well that secures the steering column to the rack (It's a good idea to engage the steering lock with the wheels pointing straight before removing). Open the bonnet and remove the engine cover. Disconnect the Mass Air Flow (MAF) sensor and undo the jubilee clip securing the air-filter housing to the inlet manifold pipe. Detach the inlet pipe and unclip the wiring harness clipped to the side of the air-filter. Remove the complete air-filter housing, by pulling it upwards sharply to release it from its rubber mountings. Disconnect the reverse light switch and unclip the battery tray cover by releasing the lugs on either side.

Unbolt the earth connection located down the side of the battery tray (fig 2) and stow it to one side. Remove the two positive battery connections and stow them both to one side. Undo the battery clamp and slide the battery out of the tray. Undo the three bolts securing the battery tray to the chassis and disconnect any electrical connections attached to the tray. Remove the tray and undo the earth connection on the gearbox mounting and the wiring harnesses attached to the gearbox. Unclip the gear selector cables and release them

from the securing bracket and stow them to one side. Remove the gear selector cable support bracket and disconnect the slave cylinder (fig-3), remembering to plug both ends to prevent any leakage. Support the engine with the cradle and remove the upper bell-housing and starter bolts. The gearbox support bracket can now be removed.

Raise the vehicle and remove the nearside wheel and the single hub bolt. Lower the nearside wheel arch liner and remove the large plastic undertray. Undo and remove the rear gearbox support mount remembering that the exhaust clamp can be slackened to enable the steel cover to be removed. Undo the jubilee clip securing the intake pipe to the intercooler and unbolt the fixings running under the oil sump and move the pipe to one side.

Undo the nearside lower arm fixings to the chassis and release the arm (fig-4), so that it can be stowed to one side. Drain the gearbox fluid and remove the short driveshaft from the hub and the gearbox.

Undo the rear subframe brace (fig-5) and while supporting the subframe, slacken all the bolts securing it to the body. Lower the subframe down on the gearbox side so that there is enough space to move the gearbox across into. Remove the final bell-housing bolts and with support, slide the gearbox across allowing the subframe to support its weight. The clutch, DMF and CSC can now be worked on.

With the clutch removed, check the dual mass flywheel (DMF) for signs of heat stress and evidence of grease loss. The DMF should also be tested for freeplay and rock between the primary and secondary masses, LuK tool number 400 0080 10 is specifically designed for this purpose on all LuK manufactured DMFs. Full instructions and tolerance data for all LuK DMFs are contained on a CD which comes with this special tool.

Clean the first motion shaft splines and any debris from the bell housing (especially important when a release bearing has failed). Put a small dab of high melting point grease (not a copper based product) on the first motion shaft splines and make sure the new driven plate slides freely back and forth. This not only spreads the grease evenly but also makes sure you have the correct kit. Wipe any excess grease off the shaft and driven plate hub. Using a universal alignment tool and checking the driven plate is the correct way round ("Getriebe Seite" is German for "Gearbox Side") the clutch can be bolted to the flywheel evenly and sequentially.

Before fitting the gearbox make sure the locating dowels are in place and not damaged. Refit any that have become dislodged and refit the gearbox. Make sure the gearbox bell housing bolts are secured before lowering the jack. Refitting is the reverse of the removal.

For technical support and repair installation tips, go to www.RepXpert.com or you can call the LuK technical hotline on 0044-143-226-4264.

The misunderstood HID Bulb

High Intensity Discharge (HID) headlamp bulbs, for some mechanics, are a misunderstood product, often referred to as "scary and expensive bulbs". Ring Automotive explains the basics of theses bulbs, removing all mystery and misconception.

High Intensity Discharge (HID) headlamp bulbs, also known as Gas Discharge or Xenon bulbs, have steadily increased in usage across the automotive market. The obvious difference is that HID bulbs have no filament. Instead of a filament that glows, there is a glass capsule in the centre of the bulb containing Xenon gas. Two metal electrodes going into the glass capsule create a high voltage arc across the Xenon gas, igniting the gas which produces a bright white light. This is very similar to how fluorescent tubes work.

The bit that puts mechanics off is the start-up voltage, typically up to 24,000 volts. The high voltage is required to bridge the gap between electrodes. A ballast is required for each headlamp, converting battery voltage into 24,000 volts to ignite the bulb. After the bulb is lit, the operating voltage drops to 85v, for D1 and D2 HID bulbs, and 42v, for D3 and D4 HID bulbs.

Clearly this high start-up voltage can be potentially hazardous. By following safety instructions, HID bulbs can be fitted perfectly safely.

Types of HID Bulbs

There are 4 cap type references of HID bulbs; D1, D2, D3 and D4. These all come with a suffix of either R or S (eg D1R or D1S). Bulbs with the suffix R are designed to work in Complex Surface headlamp units. Bulbs with the suffix S are designed to work in Projector headlamps.

All HID bulbs must be fitted with a direct replacement. So if you remove a D2R HID bulb, it must be replaced with a D2R HID bulb.

D1 and D3 bulbs have the ignition/starter pack fitted to the bulb. On D2 and D4 bulbs, the ignition/starter is combined with the ballast.

D3 and D4 bulbs are recent additions to the range; they are designed to work with new compact ballasts and are already being fitted to Audi, BMW and Lexus. They contain less mercury, so have better eco friendly credentials. They also run at a lower voltage of 42v once operating.

HID bulbs and HID headlamp systems are only street legal if the bulbs being fitted are E marked, and are fitted to cars that have auto levelling to prevent dazzle and a wash/wipe to prevent the light scattering from dirt on the lens.

Benefits of HID Bulbs

HID Bulbs are 3 times brighter than a halogen bulb, they also have an incredible long life, averaging around 2,500 hours of use. They produce a crisp white light, close to that of natural daylight.

Fitting

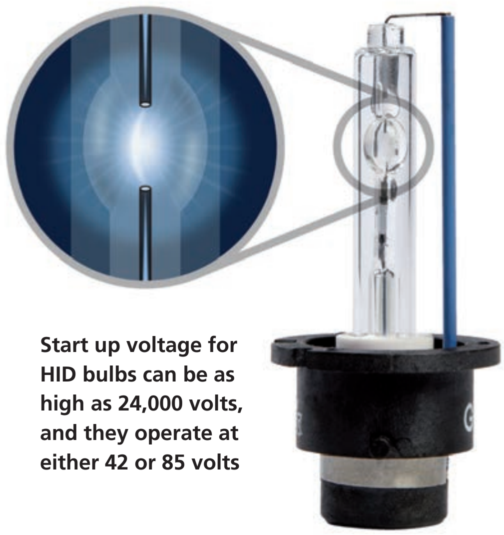
The high start-up voltage is hazardous and is understandably the main concern for mechanics. But rather than refer the owner back to a main dealer, by following these simple steps you can change HID bulbs safely.

The first thing to do is isolate the light circuit completely. Turn off the ignition and headlight switch. Isolate the headlamp circuit by removing the relevant lighting fuse. As an additional precaution, wait 5 minutes for the bulb to cool down. HID bulbs run at very high temperatures, so it is worth giving them time to cool down.

You can then proceed to change the bulb as you would do a normal headlamp bulb. Remove the bulb cover. Unplug the bulb connector and then remove the HID bulb, replacing it with the same reference type. Once the bulb has been replaced reverse the fitting process remembering to re-install the fuse.

It has always been important to replace bulbs in pairs. With HID bulbs it is key; HID bulbs should be replaced in pairs to ensure a colour match.

Xenon Capsule
Point of Ignition arc



Benefits to You

The benefit to mechanics for fitting HID bulbs is twofold. Firstly, you are not losing a customer to a main dealer, or another garage that can replace HID bulbs. Secondly, fitting HID bulbs increases your sales margin. The cost of replacing ordinary bulbs at retail prices is at least €25. The cost of replacing 2 HID bulbs at retail is - €160 to €560, depending on the type of HID lamp.
By just replacing two HID bulbs, the additional revenue is between €135 and €535.

For further information, contact Henry Bisson at Ring Automotive on 0044-113-213-7338 or email henry.bisson@ringautomotive.co.uk.

RING

Timing belt guide

Fiesta 1.4 diesel

Belt replacement on the 1.4 litre diesel engine can sometimes be problematic, so Dayco has issued a technical bulletin to guide technicians through the process and avoid some common problems.

These instructions are for the following Makes/Models:
Citroen (C1, C2, C3, Nemo, Xsara)
Ford (Fiesta, Fusion)
Peugeot(107, 206, 207, 307, 1007)
with the following Engine Codes:
DV4TD, DV4TD/L4, DV4TD/L5, DV4TED, F6JA , F6JC

Installation Procedure

- Once the engine has been cleaned and made ready for the installation of the new belt, make sure the driving shaft aligning tool (C) and the camshaft locking tool (A) are properly fitted.
- Make sure the fuel pump pinion (B) is properly aligned.
- Position the new tensioner correctly, introducing the plate in the pin located on the base and tighten the bearing fastening screw.
- Fit the timing belt in the following order: driving shaft pinion, idler, camshaft pinion, water pump pinion, fuel pump pinion and then tensioner.
- Slacken the tensioner fastening screw and remove the locking pin.
- With an allen wrench, rotate the tensioner pulley anti-clockwise, until the indicator is positioned in the centre, as in Fig. 1.
- Tighten the tensioner screw to a torque of 30 Nm.
- Remove the camshaft locking tool (A) and the driving shaft aligning tool (C).
- Make sure the fuel pump pinion is properly aligned.
- Rotate the driving shaft by 10 turns clockwise.
- Make sure the indicator is still aligned as in Fig.1.
- Make sure the above-mentioned aligning and locking tools (both A and C) can be easily re-inserted. If not, repeat the installation procedure.
- Re-assemble the other component in the reverse order to disassembly.
- Insert the tool to secure the flywheel and tighten the driving shaft pulley screw to a torque of 30 Nm + 180°.

The Dayco replacement kit includes the timing belt, tensioner and idler and carries the reference number KTB310. The kit contains a timing belt with 144 teeth, 25.4 mm wide (94923, OES 9464034380), a tensioner (ATB2236, OES 96413140) and an idler (ATB2090, OES 96415393.)A water pump kit is also available (KTBWP3100), which contains all of these items plus an OE quality water pump.

The Fiesta 1.2, 1.4 and 1.6 litre petrol engines are notable because although it is the auxiliary belt that drives the water pump, the timing belt tensioner is located on the water pump bracket and requires careful adjustment, in order to set the correct tension of the belt when a replacement is installed. However, the installation itself is a simple and straightforward process.

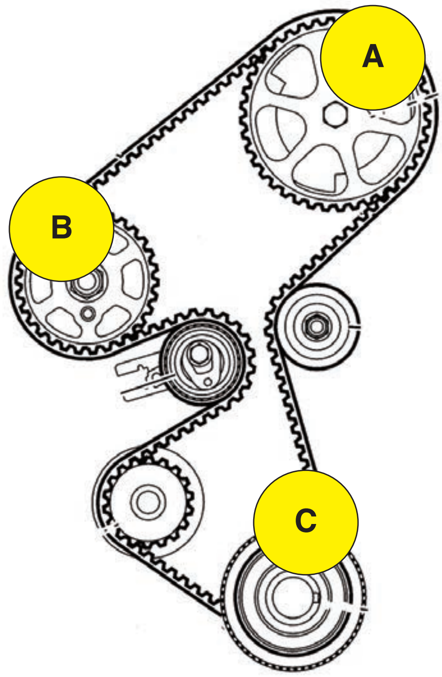
Dayco is the original equipment (OE) timing belt supplier for the Ford Fiesta and has been so for several years. From October 2010 the OE belt on vehicles fitted with 1.6-litre petrol engine was upgraded from a standard to a High Tenacity (HT) or 'white' belt.

Replacement kits for the petrol engines contain both the tensioner and belt, with reference numbers KTB461 for the standard belt and KTB764 for the HT belt for the 1.6-litre engine.

Dayco's unique Long Life + 1 year warranty is free of charge to the factor, workshop and motorist, but extends the warranty on the Dayco HT belt from the existing two years, to a market leading three-year term.

Full technical information is available through the Dayco website, www.dayco.com, or contact P R Reilly on 01-832-0006.

DAYCO®



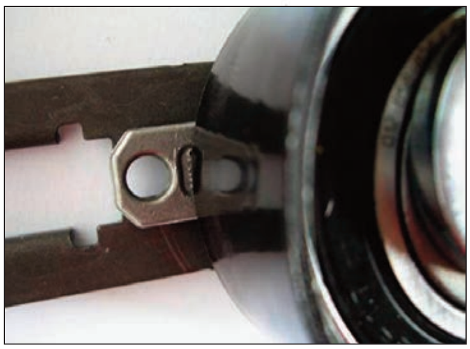
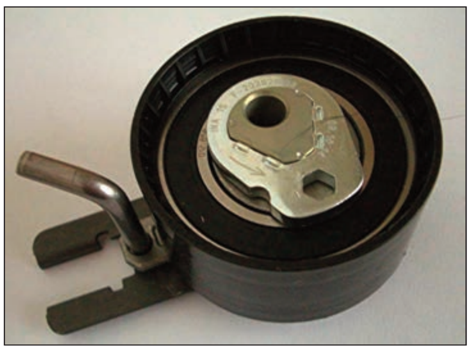


Fig. 1 A properly positioned indicator on the tensioner pulley



Tensioner with locking pin in position in the indicator. The round hole in the centre of the tensioner is for the fastening screw and the hex shaped hole is for an allen key.

A match made in rubber & metal

Vehicle chassis are becoming increasingly complex, with more importance being placed on rubber metal components. To improve the steering performance and driving stability, the rubber metal components are used as a flexible joint between the chassis and the body. They include control arms, stabiliser links, engine and gearbox mountings, and strut top mountings.

Rubber metal parts have to firmly fix their respective components in position, absorb vibrations and drive torque, whilst making a significant contribution to increasing driving comfort and noise insulation. They also improve steering and vehicle stability when the road surface is uneven and during braking and evasive manoeuvres. The elastomeric materials used in the production of rubber-metal parts are matched precisely to the technical requirements and loads of their specific fitting position.

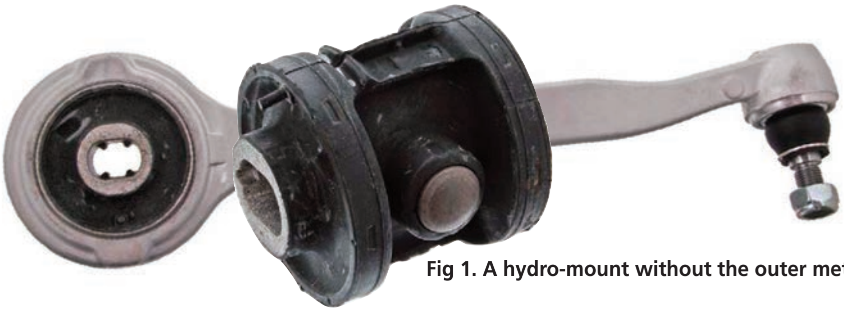


Fig 1. A hydro-mount without the outer metal sleeve

Construction and function of the hydro-mount

Despite all this, passive rubber metal components cannot absorb all the vibrations in the chassis. As a result, hydraulically damping elastomeric bearings (hydro-mounts) were developed. These enable the isolation and dampening of vibrations. A hydro-mount consists of a tubular metal inner part which is connected to a specially shaped rubber body by vulcanisation, and a metal outer sleeve. The specially shaped rubber material has embedded fluid chambers and flow channels (see fig. 1). With the additional damping characteristics of the fluid which occur in addition to the rubber core, it is even possible to achieve optimum reduction of vibrations in higher frequency ranges with smaller amplitudes. If parts with a solid rubber core are used instead of hydro-mounts, with only durability in mind, they do not absorb the vibration completely, but rather transfer it to surrounding chassis components, resulting in noises becoming more audible and vibrations noticeable.

Elastokinematics

In addition to these vibroacoustic properties, rubber metal parts are resilient and excellent for use as connection points between the individual chassis components. In a complex chassis, it is possible to achieve a specific increase in driving safety and responsiveness, because the stiffness of the elastomeric materials can be matched precisely to the suspension kinematics. These elastokinematics enable the wheels to adopt the optimum position in different driving situations, having a significant effect on comfort and safety. For example, when you apply the brakes, the wheel rotation is retarded and most of the vehicle weight transfers to the front wheels. The majority of the braking load is transferred via the lower control arm to the chassis. Most of this load is taken by hydro-mounts where fitted. So while the brakes stop the wheels, it is these control arms and their mounts that help to achieve the desired stabilisation on braking, while bringing the vehicle to a stop. If a rigid mount is fitted instead of a hydro-mount, the effect desired by the manufacturer, e.g. a change in the toe-in on braking, is significantly reduced. Although the parts may last longer, they may increase the likelihood of an accident, as the desired control is reduced.

Fitting instructions

Depending on the driving conditions, the fluid flows through the flow channels of the hydro-mount, offering the best possible potential for absorption. It is important that extra attention is paid to the correct fitting position with hydro-mounts, due to the alignment of the flow channels. In the Mercedes C class for example, the mount must be positioned in such a way that marking “a” must be pointing downwards, and the marking “b” pointing to the spherical head when the control arm is in the fitted position.

Caution must also be exercised when it comes to rubber metal parts, as they can appear outwardly identical, however a cross section reveals that the similarities are only skin deep. Some suppliers rely on a solid rubber core which does not, however, have the precise vibration and noise reducing or elastokinematic potential of hydro-mounts (see Fig. 2). Only an OE specification engineered hydro-mount fulfils the performance and comfort requirements of the vehicle. Specific high quality grade of rubber and engineered metal components, vulcanised in the correct way, is the only way to maintain the vibration absorption and acoustic characteristics of the vehicle. The cheapest is not always the best choice.

Further information may be obtained at www.bilsteingroup.com.

SWAG GERMANY

Fig 2. Comparison between hydro mounts and solid rubber mounts

Clutch Clinic C3 1.4P

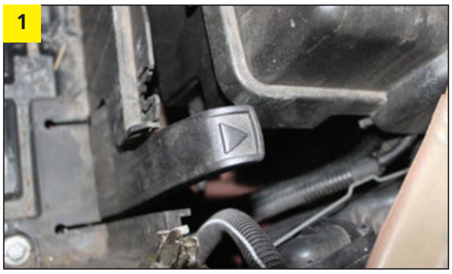
Malcolm Short, Schaeffler

Introduced in 2002, the Citroen C3 made quite an impact during its 7 year production span, then continuing with the second generation in 2009. Schaeffler's Malcolm Short gives step-by-step directions to make replacing the C3 clutch go as easily as is possible.

A clutch replacement on the Citroen can be a little tricky, but with the guidance of the LuK clutch clinic the whole process will become much easier. Nothing out of the ordinary is needed to complete the job, the only special tools required are a transmission jack, an engine support cradle and a long axle stand. A two post ramp was used in this example however a four post ramp may not provide enough clearance.

For safety reasons it's considered best practice to disconnect the battery earth lead before commencing work. If the vehicle has alloy wheels it may be fitted with anti theft wheel bolts, so make sure you have the key before you start.

Open the bonnet, remove the two piece battery cover and disconnect the battery. Lift out the battery by pulling the release tab (fig-1) and pull out the



1

ECU and stow it to one side. Release and remove the plastic divider separating the other ECU from the battery tray. Disconnect the electrical connections to this ECU and stow the wires to one side. Remove the air filter housing by turning the plastic clip (fig-2)

2

near the rocker cover, disconnecting the attached hoses and slackening the jubilee clip on the throttle body. Unbolt and slide out the battery tray and remove the attached harnesses.

Remove the end of the gear linkages by pushing together the white clips while lifting them clear of the gearbox selector arm. Disconnect the reverse light switch (fig-3) and the crankshaft sensor and stow them to one side. Undo the earth point on top of the gearbox and remove the upper bell-housing

3

bolts. Clamp the flexible part of the slave cylinder and disconnect the hydraulic connection to it (fig-4).

4

Release both gear selector cables from the supporting bracket, to do this just pull the pin (fig-5)

5

on the red side of the plastic housing and lift the cable clear. Finally while supporting the engine with the cradle, remove the complete gearbox mounting (fig-6).

6

Raise the vehicle and remove both front wheels. Remove both hub nuts and release both lower arms. Drain the gearbox oil and remove both driveshafts from the gearbox and hubs. Undo the cross member support bar and undo the rear gearbox support bracket. Remove the starter motor bolts and stow the unit to one side. Undo the bolt securing the exhaust downpipe to the gearbox, it can be quite rusty and it's difficult to get to, so you'll need to take care.

While supporting the gearbox from below, using a transmission jack, remove the remaining lower bell housing bolts and slide the gearbox back slightly and rotate it away from the sub-frame exercising care. The gearbox can now be lowered to the floor.

With the clutch removed, check the flywheel for signs of heat stress. Clean the first motion shaft splines and any debris from the bell housing (especially important when a release bearing has failed). When comparing the new and old release bearings on this model you may find that they are slightly different (fig-7). This is normal and the new bearing will work perfectly, so don't worry about fitting it.

7

Put a small dab of high melting point grease (but not a copper based product) on the first motion shaft splines and make sure the new driven plate slides freely back and forth. This not only spreads the grease evenly, but also makes sure you have the correct kit. Wipe any excess grease off the shaft and driven plate hub. Using a universal alignment tool and checking the driven plate is the correct way round (note "Getriebe Seite" is German for "Gearbox Side") the clutch can be bolted to the flywheel evenly and sequentially.

Before fitting the gearbox make sure the locating dowels are in place and not damaged. Refit any that have become dislodged and refit the gearbox. Make sure the gearbox bell housing bolts are secured before lowering the jack. Refitting is the reverse of the removal.

For technical support and repair installation tips, go to www.RepXpert.com or you can call the LuK technical hotline on 0044-143-226-4264.

Steering basics tie rod ends

Tie rod ends and ball joints take a beating on ordinary roads. On many Irish roads, the demands are even higher. Meyle's Sven Nielsen explains the basics of front suspension checking, plus a reason to consider using stronger than OE parts.

With another winter on the way, many local roads will become worn, or even more worn than they are now. Many of your customers rely on your assessment of their cars, especially when it comes to potential safety hazards. Faulty steering and suspension components are definitely safety hazards, as well as a possible cause of accelerated wear of shocks and tyres that will increase future repair bills. Follow these simple steps to keep your customer safe and save them unnecessary future repair costs.

Wear of the ball joints occurs when intense strain and high surface pressure wears on the tie rod end, creating noise and free play in the steering. Meyle's HD range offers an improved version of OE parts, by increasing the diameter of the ball head of the tie rod end, which increases the wear surface area. Their ball joints also use an ultra wear-resistant synthetic ball sockets. The redistribution of the surface pressure and decreasing friction ensures a significantly longer lifetime.

Signs of a problem

Sounds

The first sign of a worn ball joint or tie rod end can be a clunking or banging sound during cornering or when going over un-even surfaces. The sound is similar to a lump hammer hitting a large metal object. As the wear increases, the noise will become louder.

Steering

Worn ball joints and tie rod ends can affect the feel of the steering, making the steering seem either loose or stiff. This is caused by the wear in the ball joints delaying the movement of the wheel or by binding the ball in the socket.

Use a pry bar to check ball joints and tie rod ends. Any free play is too much.

Tyre wear

Worn suspension allows the tyre to move about without the steering wheel moving. As this occurs, the tread will wear in an odd fashion. Uneven wear can sometimes be seen, but to really see if the tyre tread is wearing normally, rub your hand around the tyre at a few locations, and in both directions. Anything other than a smooth feel to the tread is a sign of a problem with the suspension. One edge of the tyre wearing faster than the other is a clear sign of a worn ball joint.If both edges are wearing faster than the middle, the problem is underinflation of the tyre.

Checking Ball Joints

Visual inspection

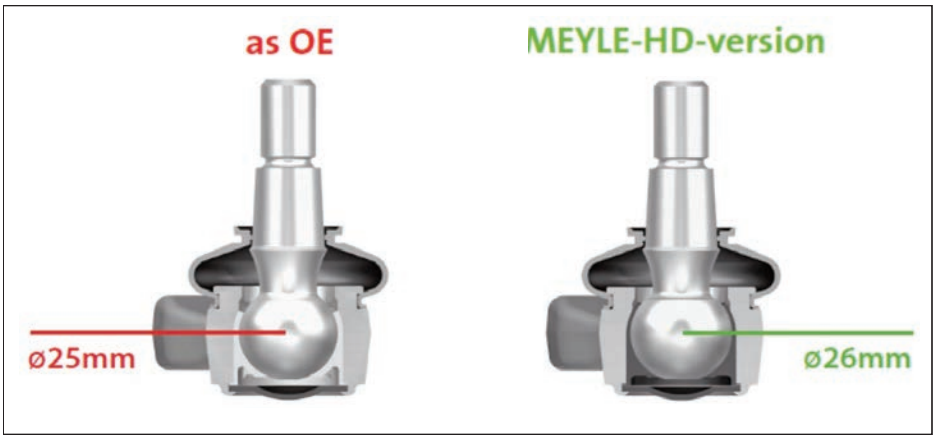
The first step in any inspection should be visual. Any cracked rubber boot or bushing should be replaced. A cracked boot may have allowed road grime and water to enter into the ball joint to cause accelerated wear. Excessive rust and physically damaged or bent parts should also be replaced without question.

Checking for play

The next step involves checking to see if there is any play or movement in the ball joints and tie rod ends. This has to be done with the weight of the vehicle still on the tyre, or in a similar condition. On some vehicles, if the tyre is raised from the ground by lifting from the frame, the front suspension drops down from its normal position. In this situation, even a badly worn ball joint may not be easily spotted. Position the jack on the lower arm or under the lower ball joint (if this is possible) as close to the wheel as possible. Only lift on a component that is strong enough to support the weight of the vehicle. If in doubt, leave the weight on all four wheels as you test for play.

With the weight of the car still on the wheel, grab the outside of the tyre and try to wiggle the tyre with your hands at the 9 and 3 positions. Any free play is too much and is most likely due to a worn tie rod end. Next, try to wiggle the tyre with your hands at the 12 and 6 positions. Any detectable free play is too much and is most likely the result of worn ball joints.

If no free play can be felt by moving the tyre by hand, it is still possible that there is a worn ball joint or tie rod end. Using a pry bar or length of a rod or pipe, apply force that would separate the lower control arm and the wheel hub. While applying this force, watch the ball joint. Any movement within the joint, or between the hub and the control arm, is too much and the joint should be replaced. Repeat this test at all of the ball joints and tie rod ends.



The Meyle HD ball joint for an Audi A4 has a larger diameter than the original OE ball joint

Fitting a tricky fuel filter

As fuel filter development progresses in parallel with vehicle engine requirements, WIX tells us more about this technology and shares one example of how to overcome a tricky installation procedure on a variety of models.

Fuel filters play a key part in the protection of the vehicle's fuel system. As car manufacturers tend to apply more and more precise solutions (engine components made with extreme care and accuracy, and fuel injectors working under extremely high pressure) the risk of failure dramatically increases, should any impurities enter the system.

All fuel, even high quality fuel, contains impurities such as: mineral dust, fuel container rust, water particles, organic particles and crystallized paraffin. Modern diesel engines have proven to be particularly prone to impurities. Additionally, manufacturers are increasingly locating filters in hard-to-reach places as car designs – especially smaller vehicle models – make the most of space around the engine.

Different filter types

There are many fuel filter types that take various shapes and forms. The majority of these are simple cartridges which fit inside a housing and are quite easy to fit. Others, such as the WF8302, are supplied in cast housings which, when fitted, become part of the fuel system of the vehicle. These filters may also include fixing points for water sensors and fuel heaters.

WIX has designed filters to efficiently deal with dirt, the effects of container corrosion, metal dust and other impurities – all of which pose obstacles to the clean and efficient work of the engine. The range is manufactured in accordance with the recommendations of the engine and vehicle manufacturer and the applied filtration media (depending on the filter type, the media can be based on natural materials and synthetic ones) provides effective fuel filtration and excellent separation of water.

The WF8302 fuel filter is common to a number of popular applications including:
Citroën C1, C2, C3, C3 II, Nemo, Xsara
Ford Fiesta V (02-) & VI (08-), Fusion/Fusion Plus
Mazda 2
Peugeot 1007, 107, 206/206 SW, 206+, 207, 307/307 SW, Bipper
Toyota Aygo.

The WF8302 can prove to be a tricky filter to fit, but simply follow the instructions to ensure the safe, quick and easy installation of a new fuel filter. The positioning of the fuel filter on the applications listed is hidden away under the engine masking frame and the air filter cover. Some models are fitted with an electronic water indicator in the filter, as well as a fuel heater connection. It is recommended that these are removed from the old filter and fitted to the new one first. The filter only has one 'in' and one 'out' fuel hose to be fitted and these locations are clearly marked on the top, while the fitting nozzles are supplied with blank caps to prevent dirt entering the filter chamber before fitting.

Replacing a (WF8302) fuel filter in 7 steps

Step 1

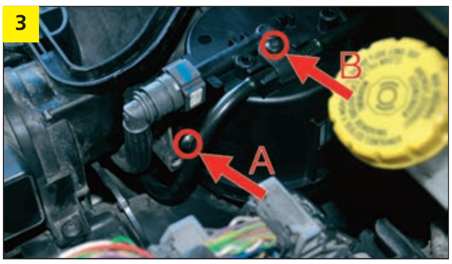
Fuel injection system elements in diesel engines are made with very strict tolerances and very little slackness. For this reason cleanliness is absolutely necessary when operating these elements.

Step 2

Remove the air filter cover (A) and the engine masking frame (B). Take the battery casing off.

Step 3

Untighten the screw that fastens the fuel filter (A) and then do the same with the screw that fastens the brake vacuum pipeline (B).

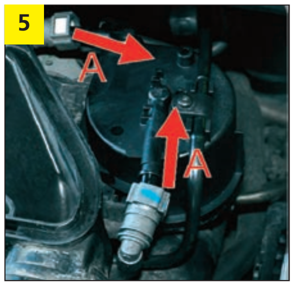


Step 4

Disconnect the fuel heater connector that is placed in the bottom part of filter (A) before opening the quick connections of the fuel hoses (B). You can then remove the filter (please note that some car models are equipped with an electronic indicator of water in the filter. In this case it is recommended to remove the water sensor from the filter).

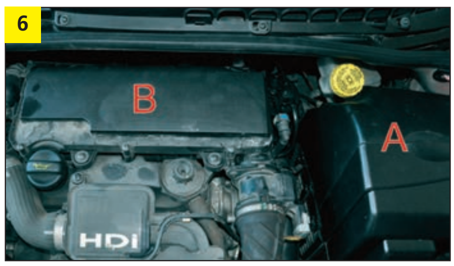
Step 5

Connect the fuel heater connector and fix the new filter in the casing. Remove the plugs and connect the fuel hoses (A) (please note that some car models are equipped with an electronic indicator of water in the filter. In this case it is recommended to install the water sensor in the filter. During installation, the sensor seat plug in the filter is pushed in, which has no negative result on the fuel filtration process).



Step 6

Tighten the screw that fastens the fuel filter (A) and screw the fastening for the brake vacuum pipeline (B).



Step 7

Fix the battery cover (A) and air filter cover (B). Start the engine, checking the fuel system for leakage, and install the engine masking frame.

Clutch Clinic

Octavia 2.0TDi

Malcolm Short, Schaeffler

After gaining a reputation for reliability and quality, the Skoda Octavia has become very popular. The Octavia is a clutch fitters dream, easy to do and with a few pointers from LuK, it should be easy to beat the book time of around five hours on the 2.0 TDI derivative.

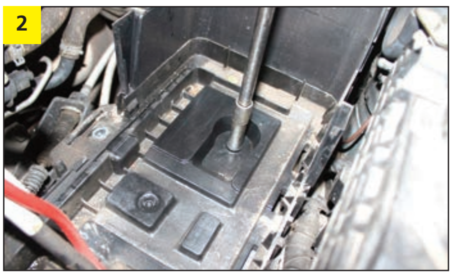
Nothing out of the ordinary is needed to complete the job, the only special tools required are a transmission jack, an engine support cradle and a long axle stand. A two post ramp was used in this example, note that a four post ramp may not provide enough clearance. For safety reasons its considered best practice to disconnect the battery earth lead before commencing work. If the vehicle has alloy wheels it may be fitted with anti theft wheel bolts, so make sure you have the key before you start.

Open the bonnet and lift off the engine cover. Remove the battery cover and disconnect the battery terminals. Unplug the Mass Airflow Sensor (MAF) and remove the air filter housing (fig-1) attached to

1

the front slam panel. Continue to remove the remainder of the housing and the air filter assembly connected to the inlet manifold. Remove the battery clamp and lift the battery out of the tray. Remove the front part of the battery surround and undo the

2



fixing bolts (fig-2) on the base of the battery tray. Remove the tray and disconnect the gear linkage cables (fig-3) and the securing bracket. Undo the small gearbox steady bracket and remove the slave cylinder. Remove the earth connection (fig-4) from the starter motor bolt head and remove the bolt. Unplug the reverse light switch (fig-5) and undo the

3

upper bell-housing bolts. Use the engine cradle to support the engine and remove the gearbox mounting bracket.

4

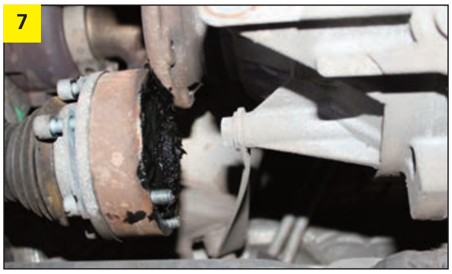
Raise the vehicle and remove both front wheels. Undo both front hub nuts and remove the intercooler pipe (fig-6) for better clearance. Undo and release the lower arm nuts and the gearbox rear

5

steady bar. Undo the lower starter motor bolt and stow the unit to one side. Remove the nearside wheel arch liner and remove both driveshafts. Remove the inspection back plate on the gearbox

6

7



and the exhaust manifold support bracket (fig-7). While supporting the gearbox, remove the final lower bell housing bolts and lower the gearbox carefully to the floor.

With the clutch removed, check the dual mass flywheel (DMF) for signs of heat stress and evidence of grease loss. The DMF should also be tested for freeplay and rock between the primary and secondary masses, LuK tool number 400 0080 10 is specifically designed for this purpose on all LuK manufactured DMF's. Full instructions and tolerance data for all LuK DMFs are contained on a CD which comes with this special tool.

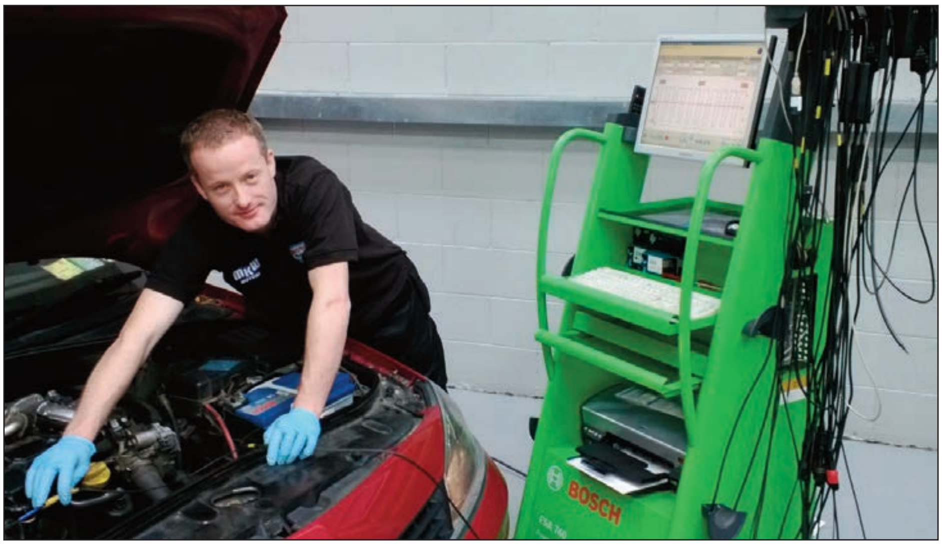
Clean the first motion shaft splines and any debris from the bell housing (especially important when a release bearing has failed). Put a small dab of high melting point grease (not a copper based product) on the first motion shaft splines and make sure the new driven plate slides freely back and forth. This not only spreads the grease evenly but also makes sure you have the correct kit. Wipe any excess grease off the shaft and driven plate hub. Using a universal alignment tool and checking the driven plate is the correct way round (note "Getriebe Seite" is German for "Gearbox Side") the clutch can be bolted to the flywheel evenly and sequentially.

Before fitting the gearbox, make sure the locating dowels are in place and not damaged. Refit any that have become dislodged and refit the gearbox. Make sure the gearbox bell housing bolts are secured before lowering the jack. Refitting is the reverse of the removal.

For technical support and repair installation tips, go to www.RepXpert.com or you can call the LuK technical hotline on 0044-143-226-4264.

Adding depth to Diagnostics

Technical training should never be viewed as a unproductive expense, it should always be seen as an investment. Getting trained on how to deal with and find faults in modern vehicle systems, keeps you and your business up to date with changing technology. It is chargeable and will create extra revenue. MKW Motor's Keith Walsh explains.



To simply plug in and retrieve a diagnostic code for a component, and then replace that component in the hope that it will fix the problem, is not usually productive.

Technicians spend many years in college to become fully qualified technicians. However, after this initial training, a large number of technicians do not further their knowledge by keeping up to date with the massive changes that are taking place with technology.

There is a growing problem out there in the trade today and it is called "Internet Mechanics", where qualified technicians, find themselves falling into "the technical brick wall" trap. This is when technicians use cheap scan tools to get fault codes, that they do not understand or know how to approach. This is all down to a lack of proper training. It all gets too much for them trying to get their head around these problems, so they resort to the internet, where all the answers are. Late nights crawling through forums, blogs, pages and pages of long text until the early hours of the morning, with your eyes held open with match sticks in the hope of finding that golden nugget or silver bullet fix. This is known to some as Google diagnostics. But it really doesn't happen, instead there are lots of expensive parts replaced, which were advised to be the fault by a faceless person with what experience?

The problem begins from lack of training, no technician after finishing his or her time, has all the knowledge to fix all the problems they will ever encounter simply because technology is changing so fast. Technicians will go out and buy cheap scan tools for between €50 to €100, and will not see the reason to spend thousands like the rest of us mad people. But this cheap tool has no depth, it is only a code reader.

Diagnostic tools should be able to access sensor and actuator live data for the system being diagnosed. Live data is a huge benefit, as it is our eyes into the control unit and it lets us see what it sees. With proper training and the correct information, we can assess live data to see if the control unit is receiving bad information from a sensor. We can use that information to give us a test point or, in other words, test the sensor we see giving the bad information. We can also use actuators within the control unit, giving the means of actually moving the actuator to see if the component and all of it's associated wiring is in good order.

Modern cars are highly technical. Under that engine cover, behind all those interior body trims, is a maze of electronic control units, wiring and sensors. This technology is increasing continuously, as a result of European emission laws reducing the pollutants cars release from the exhaust , safety improvements and customer convenience and comfort. All the vehicles electrical systems work together and are linked by a complex networking system transferring information at speeds of 500,000 to 10 million bits per second and sharing this information between all the control units on the car.

When a technician plugs in their scan tool and sees a fault code, this is by no means the fault. Far from it. Diagnostics has depth, and a fault code in the diagnostic world is only an idea, a clue, a tiny piece of information about the overall problem. So how do you actually find the problem? By experience, testing the relevant electrical system piece by piece, by using sophisticated test equipment, having the correct wiring diagrams and system working knowledge. To simply plug in and retrieve a diagnostic code for a component, and then replace that component in hope it will fix the problem, is not usually productive.

Diagnostic fault codes can be triggered as a result of a chain reaction. The fault displayed on the scan tool is only as a result of another sensor, actuator or component going faulty somewhere else in the system. Fault codes can be triggered even for components and sensors that are not actually faulty. This can be caused by a related, or unrelated, mechanical or electrical fault. When this happens it can be very confusing, even to a trained technician.

Fault codes come with explanations of why they have been triggered and each component, sensor or actuator can have 4 or more fault codes attached to it, all meaning completely different things. This means that it is crucial that you are trained and experienced to interpret this information. The codes will also have, in some cases, freeze frame data or environmental conditions. This means that some conditions of when the fault occurred have been stored in memory, such as engine and vehicle speed, temperatures ,gear position, airflow and so on. This information is very important when attempting to reproduce a fault that is intermittent.

Blogs and internet forums can be dangerous places for anyone visiting, in the hope of fixing a fault with their car, the people on these forums can't see, hear, or measure your car, so any advice is based on presumptions and can only be misleading. The end result is usually extra time and financial costs for both the technician and the car owner. Lots of technicians fall into hours wasted crawling through internet forums to finally think they have found a fix and spend lots of money on expensive parts that were not actually needed.

It would be cheaper and less time consuming if technicians got trained to keep up with technology and diagnostic procedures. Then there will be no need for looking for solutions on the internet.

MKW MOTORS

Understanding electric parking brakes

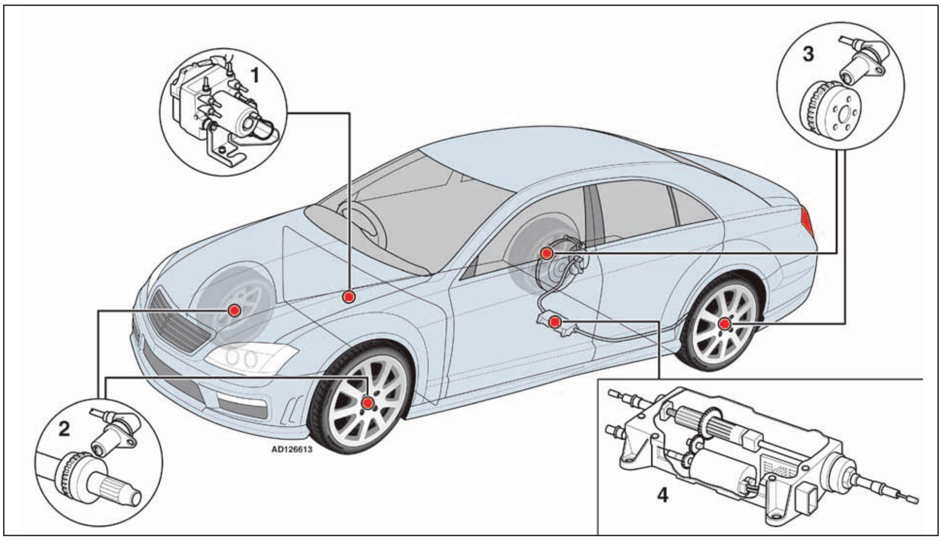
Electric parking brakes have been around for more than a few years now, and they are becoming more common. To help you better understand how they work, Autodata offers some details on the basics of the these parking brakes.

Electric parking brakes (EPB) were introduced on cars from about 2002. First on more expensive model ranges, but then becoming common on vehicles of all classes. Advantages of the system include ease of use and the incorporation of automatic functions like hill holding and automatic brake application.

There are now many variants of EPBs but they can be categorised as:

Integrated: Using a special brake calliper with integrated motor and gears and have no mechanical (cable) operation.

Electromechanical actuator: Using conventional mechanical parking brakes with their cables connected to an electromechanical actuator.



Electric Parking Brake (EPB) components: 1. ABS modulator 2. Front wheel speed sensors 3. Rear wheel speed sensors 4. EPB actuator

Integrated EPB's

The integrated option, favoured by some manufacturers, has the advantage of being compact and having fewer components, but has the disadvantage of sometimes lacking a mechanical emergency release system. In cases where the system fails for reasons other than a discharged battery, some disassembly of the calliper or brake components may be required to release the brakes. Brake pad replacement usually requires the use of diagnostic equipment to retract the calliper pistons and reset the operating software after completion. However there are now many aftermarket tools available that allow the independent garage to undertake servicing and repairs.

Electromechanically activated

The electromechanical actuator option, favoured by many manufacturers, has the advantage of allowing any model to be made with or without an EPB, without major changes to the vehicle's brake design. The actuator uses an electric motor coupled to a gear train, and is controlled by an integrated force sensor and control module. The EPB control module communicates with other control modules in the vehicle, commonly using the controller area network (CAN), and would normally require it to be programmed if replaced. Most, if not all, have an emergency release procedure that allows for both an electrical or mechanical failure. Servicing is generally simpler than the integrated type, with very few requiring the use of any special equipment.

EPB actuator

EPB switch

Calliper with integrated EPB

The operation of the system has been designed to be failsafe: after switching the ignition off (or stopping the engine), the brakes are automatically applied. When stopping in traffic or at junctions, the brake is automatically applied and then automatically released when the accelerator is depressed. Most models incorporate a procedure that allows the driver to leave the vehicle without the EPB being applied, which is sometimes needed when the vehicle is parked during low ambient temperatures, likely to result in the brakes being frozen on. Different lamps are used to warn the driver of the status of the EPB, the selected function(s) of the EPB or a system malfunction. Most vehicles use the ABS hydraulics in the event of an emergency. Continuous operation of the EPB switch will signal the ABS modulator to operate all of the brakes, to bring the vehicle to a safe stop.

The system, depending on model application, can also include driver convenience features such as 'hill holding'. When selected, the brakes will remain applied until the vehicle starts to move off, thus ensuring that the vehicle does not 'run back' when restarting on gradients.

Autodata

Fault finding with an oscilloscope

When a 2006 Opel Vivaro with the 1.9 F9Q engine was towed into the workshop, the customer was expecting a quick “plug-in” to fix the fault. As everyone in the trade knows, this is rarely the case, and this van was no exception. A.D.S recounts the steps needed to get this Opel running again, and how an oscilloscope was key to finding the root cause of the fault.

The Vivaro was intermittently stopping and not restarting, unless the vehicle was left to cool down for about 2 hours. Once restarted, it would run again for up to ten minutes.

Initial Check

A Vedis 2 diagnostic system scanner was connected to the Vivaro, but many attempts to connect to the engine control module failed. An attempt to communicate with the ABS and airbag systems showed no problem and that communication was ok. The fact that the vehicle was running proved that the engine ECU was being powered up, so we suspected a fault in the link between the engine ECU and the DLC. We used a tool called the DLC CAN Test Box to check all power supplies, earths, CAN-bus and K-line signals to the OBD connector.

Continuity Test

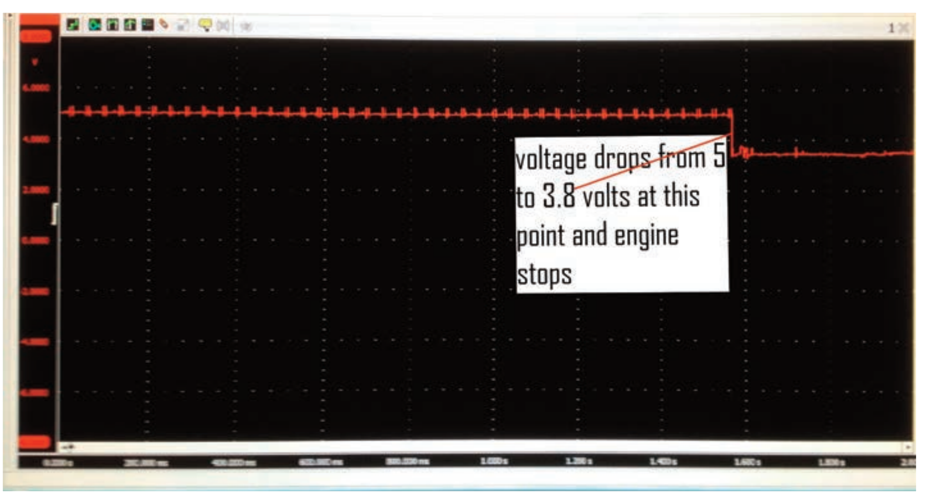
A wiring diagram showed that pin 7 in the diagnostic socket was the diagnostic link to the engine ECU. After stripping down the ECU covers to gain access to the ECU connector plugs, a quick continuity test showed an open circuit between DLC pin 7 and the engine ECU. Running an external wire to DLC pin 7 proved that communication was fine. After some wire tracing, a broken wire underneath the fuse box was found and repaired. An easy repair once the fault was found.

Half way there

The broken wire was not causing the van to stop, but at least we could now check the fault codes and read live data. The faults showing were P1620 Sensor 1 voltage supply low input (Fig 2) accompanied by P0191 fuel rail pressure sensor, P0100 Mass air flow sensor, P0105 boost pressure sensor circuit and P0120 accelerator pedal position. These faults were all present when the van stopped and would not clear until the van was left to cool down, when the engine would start and run fine again.

Signal Scope

It is almost impossible that all of these sensors could be going faulty at once, and seeing the P1620 fault suggested a voltage supply fault. Fig 1 shows the oscilloscope trace of the 5 volt supply to the fuel rail pressure sensor. It captures the moment the engine stops and shows the 5 volt supply being dragged down to 3.8 volts. When tested on the other sensors, for which the faults were present, the same results were found. The next step was to disconnect the fuel rail, air mass, boost pressure and pedal position sensors, in turn with the scope still connected to see if the voltage returned to 5 volts. Even with all of these sensors disconnected, the supply voltage still remained at 3.8 volts.



Voltage supply to some sensors dropped from 5v to 3.8v whenever the engine stopped

> “ P10FA, but the real fault code is P1620 (A) Sensor Voltage Supply Low Input ”

More Research

At this stage we were down to either another sensor being faulty, causing the voltage drop without logging a fault, or a wiring or engine control unit fault. Before going stripping wiring looms or inspecting the ECU, the OE manufacturer’s information and wiring diagram was consulted.

It was discovered that the same 5 volt supply from the ECU powered the position sensor for the EGR valve. Disconnecting this sensor caused the supply voltage to immediately rise back to 5 volts, and the engine started straight away.

Conclusion

Strangely, no fault code had been logged for the EGR valve, but a short in the EGR valve position sensor was causing the voltage for all these sensors to drop. The voltage drop at the fuel rail pressure sensor was the cause for the engine stopping.

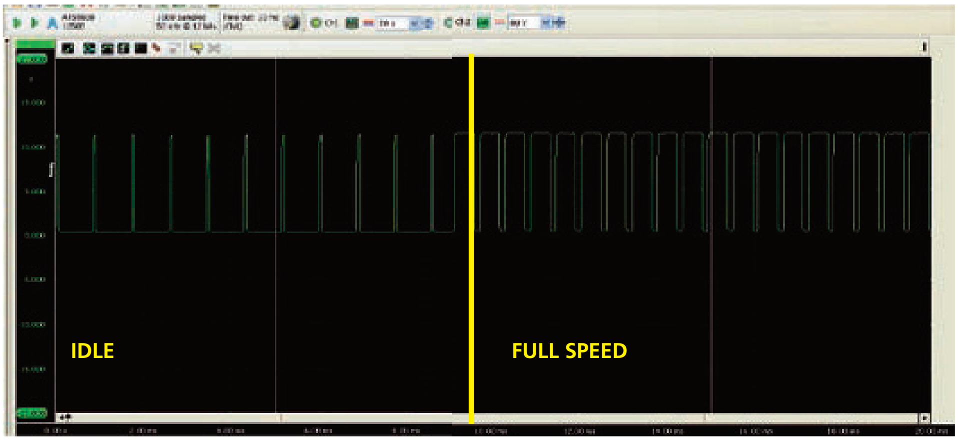
The EGR valve was obviously being affected by heat, as the fault only occurred after the engine was running for a long time. A replacement EGR valve was fitted, an easy fix in the end, but getting to the fault was the hard part. An oscilloscope and OE information proved invaluable in this case, saving a lot of time and trouble replacing the wrong parts in an attempt to fix the problem.

A.D.S
Automotive Diagnostic Services

Diesel engine EGR Feedback

Diesel Exhaust Gas Recirculation (EGR) is different in some respects to petrol engines, but it still works in the same basic way. This Institute of the Motor Industry (IMI) guide to CI, or diesel EGR feedback systems, will help you understand how it works and how to diagnose and repair faults.

Compression ignition (CI or diesel engines) use EGR to control NOx. Unlike the spark ignition (SI or petrol engines), EGR can be up to 60% of the intake air. Too much EGR will show itself under acceleration as excessive black smoke. Diesel engines rely on an accurate MAF value to monitor EGR. In many systems, EGR feedback is determined as the difference between calculated gas flow (EGR + air)) and measured airflow. The gas flow is calculated based on engine capacity, speed, air pressure and temperature. This shows how important the airflow value is. If the airflow meter gives an air flow value greater than actual airflow, EGR would be commanded to increase, and the engine would be starved of air and black smoke will come out of the exhaust.

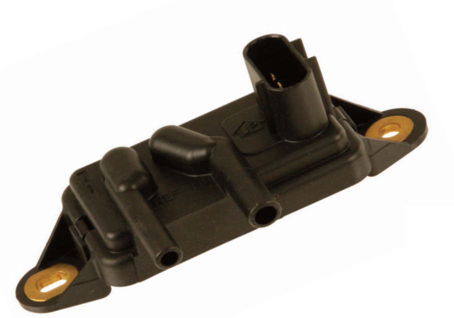


A typical PWM (pulse width modulated) signal from an EGR Controller at idle, on left, and at full speed, on right

Actuators

When diagnosing EGR systems, most people are more comfortable checking the mechanical bits first. Fortunately, that's where most problems are. For this you are going to need a vacuum gauge and vacuum pump, or in the case of motorised actuators, a scan tool. Apply a vacuum to the actuator diaphragm. There should be a "clunk" sound when the vacuum is released. For peace of mind, remove the EGR valve for a bench test. It will give you an opportunity to inspect the insides, especially the valve seat and passages. Inspect all of the vacuum lines of the EGR system to make certain there are no leaks, kinks or other obstructions. For EGR systems with electrical sensors or controls, make certain that all of the wiring is connected properly and firmly.

Another problem that can occur with an EGR valve is an internal vacuum leak. With the engine turned off, apply approximately 500 mbar to the EGR valve. The EGR valve should hold this vacuum for 5 minutes. Repeat this test with the engine running and fully warmed up. If the car is equipped with an EGR Valve with two diaphragms, the test must be conducted at each port separately. When applying the vacuum load to the EGR valve, watch for movement of the valve rod, when possible. It should move along with increasing vacuum, and then return smoothly when the vacuum is released.


Some EGR systems control vacuum supplied to the valve based on various sensor inputs

The most common problem is clogging of the EGR valve. This can happen naturally over time, without any faulty condition in the EGR, or very quickly when a fault does occur. Think about the problem with the fault airflow meter, too much EGR produces high levels of particulates, which then re-enter the engine through the EGR system. The particulates act as seeds for bigger particulates to grow on. This process goes into a vicious cycle of black smoke making even more black smoke. The valve eventually clogs with carbon, which can cause it to stick, open or closed, or simply becomes slow to react. EGR valves respond well to a good de-coking, but look further into the conditions that caused it to clog in the first place.

When all the passages are clear, and the valve opens and closes properly, then the task is to determine if the valve is operating as commanded, and if the commands are based on good sensor data. Understanding the operating strategy will help. Check the electro-pneumatic valve for operation, resistance and proper insulation. Use a vacuum gauge to check the vacuum supplied from the vacuum pump (on a diesel engine) or manifold (on a petrol engine).


An EGR Valve this heavily fouled will not be capable of working correctly, but after cleaning it may be fine

Here is a quick check that can be made with a scan tool: With the engine running at idle and fully warmed-up, look at the live data to see what the mass air flow value is. When you disconnect the EGR vacuum pipe, you should see a sharp rise in inlet air flow. When you reconnect the pipe to the EGR valve, you should see a sharp fall.

Check the PWM signal

If all these tests check out, then the EGR strategy comes under the microscope. Any unstable signal output of the sensor values, especially mass air flow, can cause the EGR to operate out of parameter and trigger a DTC, or cause a driveability problem. It is worth mentioning at this point, that some head scratching faults in the EGR and fuelling area can only be resolved by a re-flash of the ECU. As always, it is worth checking for technical service bulletins specific to the vehicle you working on.

IMI
THE INSTITUTE OF THE MOTOR INDUSTRY

Changing colours of coolant

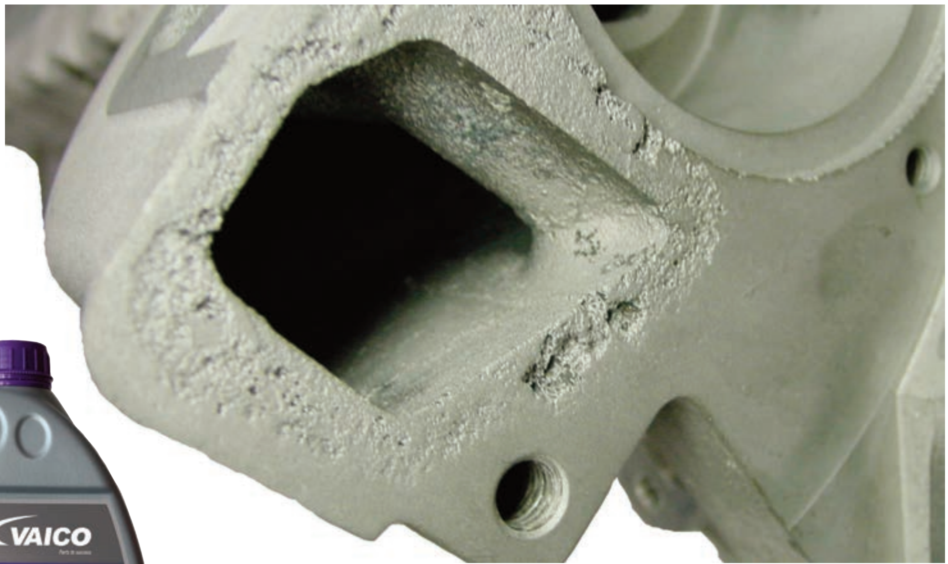
The days when coolant was the same from car to car are long gone. The reason for the differences in coolant comes down to simple chemistry, as Vaico explains.

For many years, the same basic coolant was used for every vehicle on the road. This was an improvement over the very early days of motoring, when a driver would drain the water from the cooling system, if there was a danger of it freezing. The driver would then have to refill the cooling system the next time it was started. Glycol was the first additive used in cooling systems, to both lower the freezing temperature, but it also raised the boiling point of the fluid. It was probably at this time that the terms coolant and anti-freeze were first used. Of course, they are the same thing, as coolant and anti-freeze are different names for the same fluid.

In older engines, the engine block was cast from steel and ordinary corrosion was the biggest concern, after preventing the coolant from freezing or boiling. Over the years, coolant became more advanced as silicates, phosphates and borates were added to the ethylene glycol based coolant. These additives were all chosen to enhance and extend the service life of the coolant. As long as ethylene glycol coolant remains alkaline (the opposite of acidic), corrosion is controlled and the cooling system is protected. Over time, the corrosion inhibitors will be depleted and the corrosion protection is lost. It is for this reason that the older type green antifreeze should be changed every two years or so.

Advances in engine building and design, fuelled by the never ending quest for more power and higher reliability, resulted in aluminium engine blocks, radiators and other cooling system components. The standard ethylene glycol coolant was not completely suitable for aluminium components, so a new type of coolant was required. While it is commonly believed that aluminium can't corrode, this is simply not true. Aluminium corrodes very easily when it is exposed to certain chemicals. So new materials in the components of the cooling system require a new type of coolant.

The first thing that mechanics would have noticed about this new coolant was it's colour. While the older ethylene glycol based coolant was green, the newer coolant was pink or red. This type of coolant was first seen in asian cars.



This cylinder head was destroyed by corrosion caused by using the wrong type of coolant. Using the specified coolant type at all times will avoid this costly problem

As engine design and technology advanced, newer types of coolant became available, including propylene glycol, organic acid technology (OAT), hybrid organic acid technology (HOAT) and others. While some of these coolants can be mixed, it was never considered best practice. For instance, you could put the older green glycol coolant in any car, even a new high tech one. It would work as a coolant in a manner, but will takes it's toll by corroding aluminium at a much higher rate and will have a much shorter useful service life. In the end, the cheaper coolant will have a much higher cost to replace severly corroded parts. To make it a bit easier to see that there are differences, there are many different dyes that are added to coolant to help identify what type it is. As there are over 15 vehicle specific coolant types, care should be taken to ensure that the proper type is used for each car.

Advances in engine and coolant designs continues to modern cars, and a mechanic should take care to follow the manufacturer's requirements for the type of coolant and service intervals. Failure to follow these basic instructions will only result in a shortened service life, damage to the cooling system (and engine) or both. To steer clear of this potential problem, a mechanic only has to follow a simple rule: use the type of coolant that the manufacturer has specified and never mix different types of coolants.

Volkswagen introduced a new type of coolant, known as G12. G12 does not have any phosphates or silicates, which would cause long term problems to a VW engine. Other types followed, G12++ and G13 so far. There will definitely be more types in the future. Vaico makes a coolant that is fully compliant with the requirements of VW engines that specify G12 coolant.

It is common for your customers to think of coolant at this time of year, as many drivers only think of it as anti-freeze, and that it is only necessary during the winter. Help your customers prepare their cars for winter, and the rest of the year too. Use only the specified type of coolant, follow the service intervals and procedures for each Make/Model and you will not have to worry about future cooling system problems.

Clutch replacement for Toyota MMT

A Multi Mode Transmission (MMT) is a type of sequential manual gearbox offered by Toyota. Instead of a conventional automatic, which uses a torque convertor, the MMT has a regular clutch, controlled electronically. Blue Print provides all you need to know to complete this job.

To fit a MMT clutch kit, you will need to reset the parameters of the servos and the actuator. A scan tool such as a Toyota IT2 can facilitate this procedure. If you do not have access to an appropriate scan tool, you can override the procedure by following the process outlined here.

When removing or fitting the clutch, you will need to move the actuator to clutch clamp position. This ensures that the clutch is fully released. Failure to do this could cause damage to the automatic adjustment mechanism.

This is the process that you must follow.
1. Ensure the ignition is switched off and the gear selector is in the 'N' position.
2. Use a jumper wire to connect terminals 4 and 13 of the DLC3 (or OBD Socket) as shown in figure 2.
3. Turn on the ignition switch with brake pedal released.
4. Pump the brake pedal 7 or more times within a 3 second period.
5. Release the brake pedal. A buzzer should sound twice with an interval of 0.25 seconds.
6. Depress and hold the brake pedal down.
7. Keeping your foot on the brake pedal, shift the gear lever in the following sequence.

1	2	3	4	5	6	7	8	9	10	11	12	13
N	E	M	+	M	+	M	+	M	+	M	E	N

8. Release the brake pedal.
9. Depress and release the brake pedal again. A buzzer will sound once to confirm the clutch has moved to its clamped position. If the buzzer does not sound, turn off the ignition and wait at least 15 seconds before starting the process from the beginning. Only proceed if the buzzer has sounded.
10. Pump the brake pedal 3 times or more within 2 seconds. Release the brake pedal. The buzzer will sound twice with an interval of 0.25 seconds.
11. Depress the brake pedal and hold while shifting the gear lever into the ' – ' position.
12. Release the brake pedal.
13. Turn off the ignition and wait for a minimum of 10 seconds.
14. Disconnect the jumper wire.
15. Replace the clutch.

After you have replaced the clutch you will have to initialise the ECU, clutch and transmission
16. Ensure the ignition is switched off and the gear selector is in the 'N' position.
17. Re-connect the jumper wire as shown previously in point 2.
18. Wait at least 10 seconds before turning the ignition to the ON position.
19. Pump the brake pedal at least 7 times within a 3 second period and then release it. The buzzer will sound twice with an interval of 0.25 seconds.
20. Now you are ready to initialise the ECU. Depress and hold the brake pedal down and shift the gear selector in the following sequence:

1	2	3	4	5	6	7	8	9	10	11	12
N	E	M	-	M	-	M	-	M	-	E	N

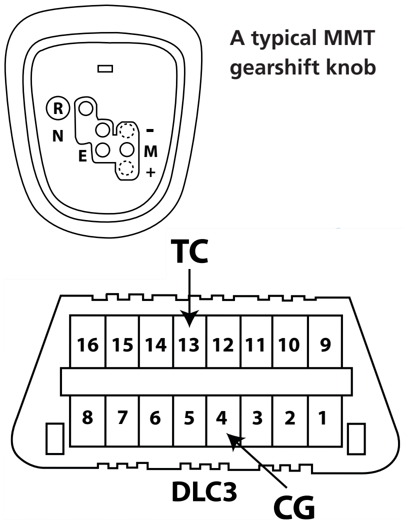
Release the brake pedal, then press and release it once more. A buzzer will sound twice to confirm initialisation of the ECU.
21. Now initialise the clutch...
Depress and hold the brake pedal down and shift the gear selector in the following sequence:

1	2	3	4	5	6	7	8	9	10	11	12
N	E	M	+	M	-	M	+	M	-	E	N

Release the brake pedal, then press and release it once more. A buzzer will sound three times to confirm initialisation of the clutch.
22. Now initialise the transmission.
Depress and hold the brake pedal down and shift the gear selector in the following sequence:

1	2	3	4	5	6	7	8	9	10	11	12
N	E	M	-	M	-	M	+	M	+	E	N

If the buzzer does not sound, turn off the ignition and wait at least 15 seconds before starting the process from point 16.
23. Pump the brake pedal 3 times or more within 2 seconds. Release the brake pedal. The buzzer will sound twice with an interval of 0.25 seconds.
24. Turn the ignition switch to OFF and wait at least 10 seconds. The initialisation will now be complete.
25. Disconnect the jumper wire.
26. Ensuring the gear selector is in the 'N' position, turn the ignition to the ON position and wait at least 40 seconds.
27. With the brake pedal depressed, start the engine, The shift N position indicator on the dashboard should blink when the engine starts.
28. Wait at least 10 seconds. The initialising should now be complete.
When the vehicle is started and drive is engaged, with your foot off the brake pedal the vehicle should creep forward, this confirms the initialisation has been successful.
29. The vehicle must now be road tested to allow the transmission to learn gear position and synchronisation. Drive the vehicle in the (M) manual mode and move through the gears leaving at least 2 seconds between changes.



A typical MMT gearshift knob

Jumper these terminals on the OBD terminal when following these instructions

Only parts that pass all of the tests are given top marks.

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