AUTOBIZ

TECH TIPS

7th Issue
April 2016

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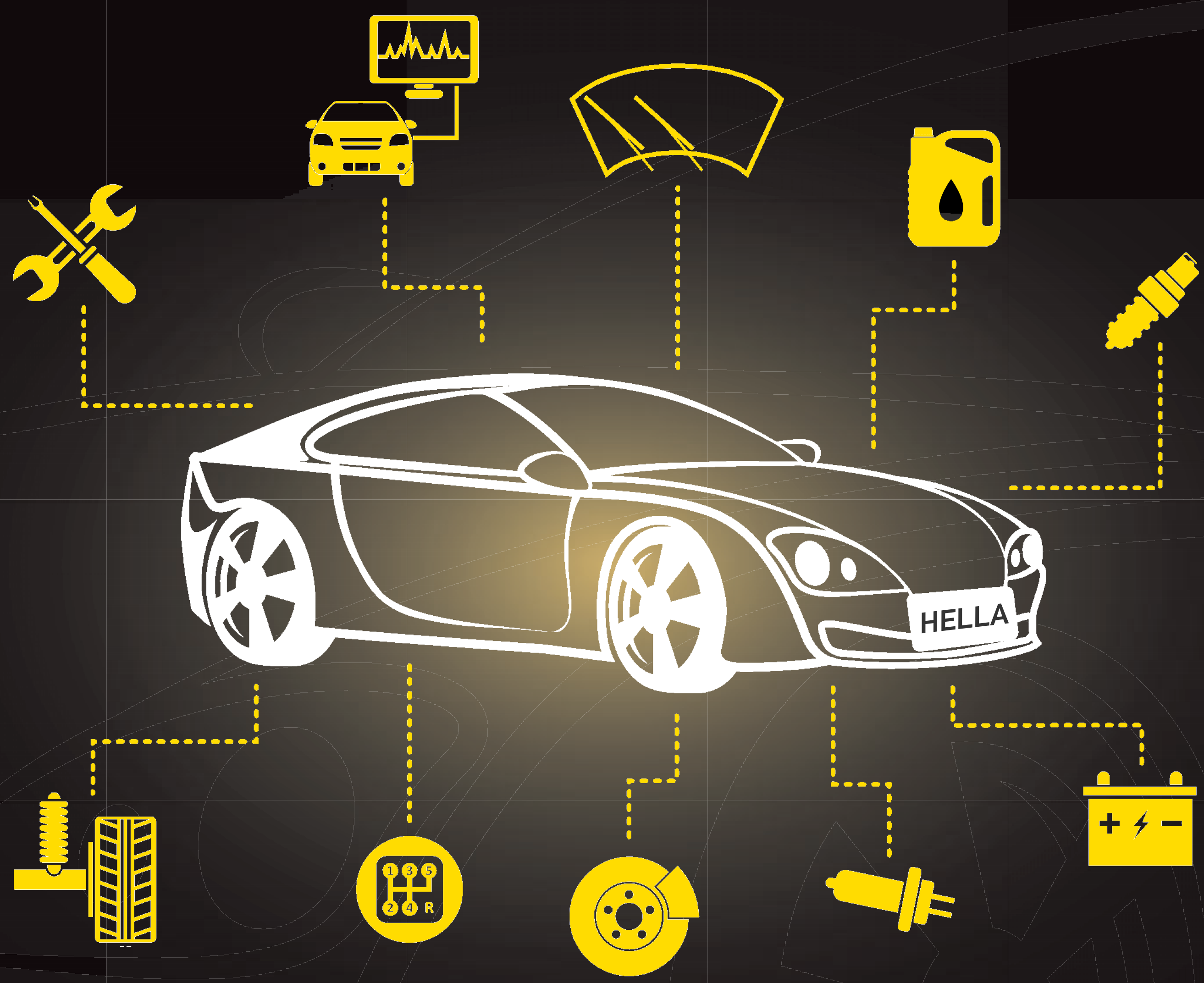

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TECH TIPS

Let's get technical...

This 7th issue of Tech Tips has a roundup of all the Tech Tips that were published in Autobiz since June 2015.

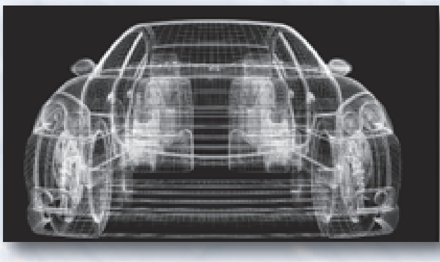
The advancement of technology used in cars by the manufacturers has not slowed down. To stay in the game a mechanic has only one real choice - to continue to learn. The opportunities for training are many, Eure!Car, HELLA Training Academy, Bosch training provided by MKW Motors, to name but a few. All of these courses, and any other's that may come up, can be found on www.autobiz.ie/training. Bookmark that page and see what is on offer that will make you a better mechanic.

www.techtips.ie has over 2,300 documents online right now, with more being added every week. With the help of the Aftermarket, we have grown this trove of technical information substantially, providing a comprehensive bank of technical information that garages can access anytime, quickly and easily.

Logon to ***www.techtips.ie*** or www.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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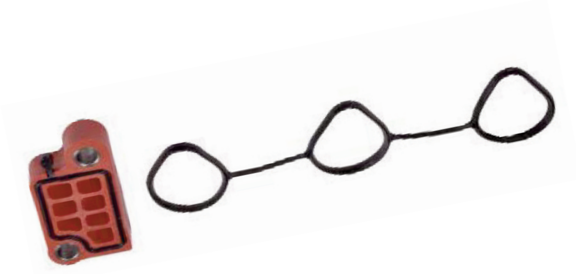
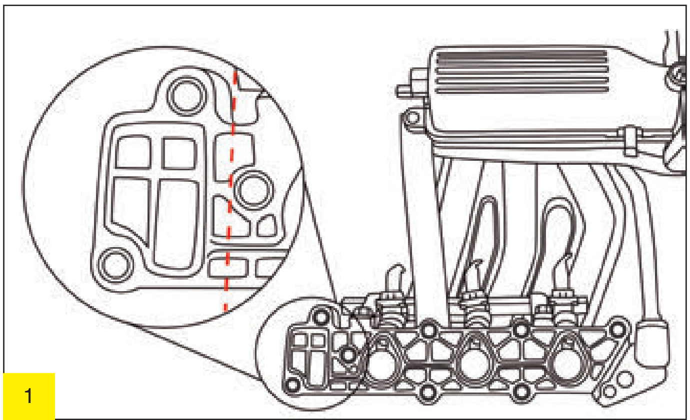
Matiz 0.8 litre manifold repair kit



A common problem on the 800cc Daewoo/Chevrolet Matiz is corrosion to the alloy cylinder head and warping of the plastic inlet manifold, ventually resulting in a coolant leak between the two. Blue Print explains how this problem can be easily overcome to get the engine running properly again.

The plastic inlet manifold on this three cylinder engine includes a 'blanking plate' moulded to the end, which seals against a waterway on the cylinder head. Over time the plastic deteriorates, eventually resulting in a coolant leak. ADG06290 is an inlet manifold repair kit to give a long term cure to this particular problem, comprising of a high quality blanking plate and modified manifold gasket. Carrying out the modification is straightforward and is illustrated below.



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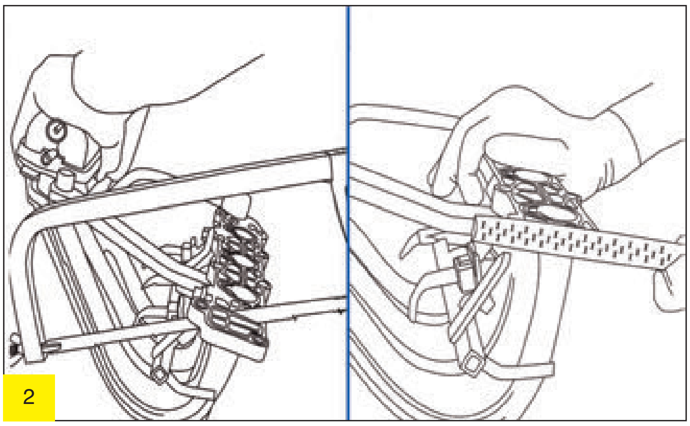
Once removed from the car, hold or carefully clamp the plastic inlet manifold. Mark the coolant blanking section of the manifold that you are about to saw through, making sure that you mark a section slightly larger than the size of the new blanking plate (fig. 1). This is to ensure there is no interference between the manifold and new blanking plate when they are fitted to the engine. Check twice – cut once!

Plug the three outlet ports to prevent debris falling into the



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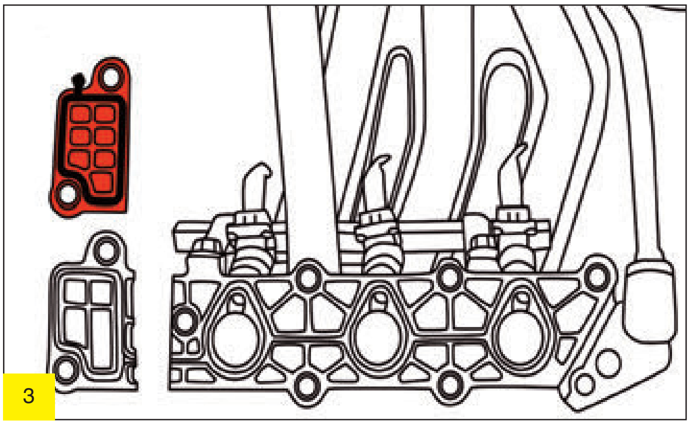

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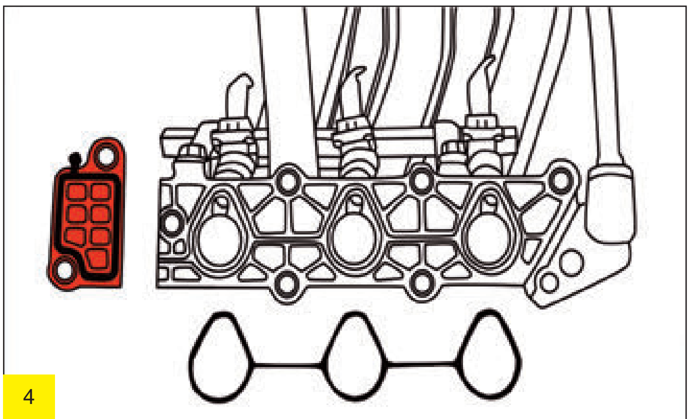
manifold. Carefully saw through the manifold and remove the old blanking section. Trim/file the rough edges of the manifold to ensure a flat mating surface is maintained and clean as necessary (fig. 2).

Ensure that the mating surface of the cylinder head is clean and refit the manifold using the new manifold gasket supplied (fig. 3). Fit the new blanking plate onto the cylinder head, using a little RTV if required (fig. 4). Tighten all manifold nuts to the manufacturer's specifications (15-19Nm).



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Additional points

Re-connect everything. Top up engine coolant as necessary. Run engine and re-check for coolant leak.

Repair time:

Manifold replacement = 1.2hrs

Allow further 20>30mins for modification.

Malcolm Short, Schaeffler

Clutch Clinic
VW Transporter

It's hard to believe that the Volkswagen Transporter was first introduced way back in 1950 - more than 60 years of production. A clutch replacement on the Transporter can be a little tricky, here LuK have some helpful advice.

Nothing out of the ordinary is needed to complete the job; the only special tools required are a transmission jack, an engine support beam and a long axle stand. A four post ramp was used in this example, but a two post ramp may also be suitable.

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, unclip the nearside plastic battery cover and disconnect the two battery terminals. Release the battery clamp and lift the battery out of the engine bay. Undo the two screws securing the coolant header tank and safely stow this to one side. Unclip the wiring harness from the plastic battery surround, then undo the two bolts securing the surround and lift it out.

Remove the four quick release hoses from the top of the fuel filter and lift it out by releasing the clamp ring with a pair of pliers. Release the rubber air inlet pipe at both ends, by pulling out the relevant clips on the hose. Once these clips are released, the hose will dislodge when pulled. Unplug the mass airflow sensor and lift the whole assembly out. Release the gear linkage cables and lift them off. Remove the starter motor electrical connections and unbolt the motor. Release the slave cylinder (Fig 1) and the two gear linkage bracket bolts that you can get to. Set up the engine support beam and undo the upper bell housing bolts.

Remove the road wheels and the hub nuts on both sides. Remove the large plastic undertray and lower it down carefully. Unplug the reverse light switch and release both front lower suspension arms (Fig 2). Remove the last bolt holding the gear linkage bracket and remove it.

2

Undo the two bolts securing the offside driveshaft support and remove the shaft. Undo and release the nearside driveshaft by undoing the bolts and lift it out. Undo the rear engine mount steady bar and remove it. Undo the four bolts securing the steering rack to the subframe and release the engine mounting attached to the subframe, by undoing the single bolt. While supporting the subframe, undo the bolts securing it and lower it down to gain access.

Undo the two exhaust bracket support bolts (Fig 3) and undo the three bolts securing the gearbox support bracket (Fig 4). Remove the lower bell-housing bolts and lower the gearbox to the floor carefully.

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 remove all debris from the bell housing (especially important when a release bearing has failed). Remember that if the bearing or sleeve is made of plastic, there is no need for lubrication. If both parts are metal then a high melting point grease should be used, but do not use copper based products.

Put a small dab of grease 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.

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Ford Focus 2.0-liter 16V timing belt guide

Significant errors are frequently committed when changing the timing belt. ContiTech Power Transmission Group provides fitters a step-by-step explanation of how to change the belt correctly in a Ford Focus 2.0-liter 16 V with engine code EDDB, EDDC, EDDD.

The manufacturer recommends inspecting and, if necessary, changing the timing belt and tensioning pulley at 160,000 km or after 10 years. Tip: Replace the tensioning pulley, idlers and water pump at the same time as changing the timing belt. Although the water pump is driven by the multi V-belt rather than the timing belt, in this engine the pump is mounted behind the timing belt drive, and the timing belt idler is attached to the water pump. Should the water pump fail later, the entire process has to be repeated using new parts, since Ford has forbidden the continued use of used timing belts in this case. It is essential, therefore, to change the water pump as part of the package, in order to avoid later failures with unnecessary costs.

The labor time is 2.2 hours. Fitters need the following special tools for the procedure:

1. Camshaft locking tool - OE (303-376)
2. Crankshaft locking tool - OE (303-574)
3. Counterhold - OE (205-072)

Preparatory work

Identify the vehicle using the engine code.

Disconnect the vehicle battery.

Do not turn the crankshaft and camshaft once the timing belt has been removed.

Turn the engine in the normal direction of rotation (clockwise) unless otherwise specified.

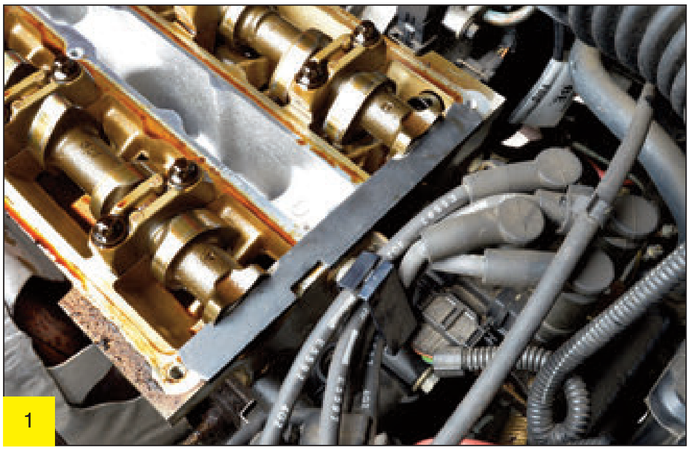
Turn the engine only at the crankshaft pulley, not at any other sprockets.

Comply with all the manufacturer's tightening torques.

Jack up and prop the front of the vehicle, so that the front engine mount is not under strain.

Removal

Power steering reservoir (do not detach hoses), ancillary unit belt, coolant expansion reservoir (hoses do not need to be detached), water pump belt pulley, upper and lower timing covers, front engine mount, supporting engine to do so. Middle timing cover, spark plugs, heat shield, hose for crankcase ventilation system and valve cover. (Note loosening order! Unscrew in cross-cross sequence from outside to inside.)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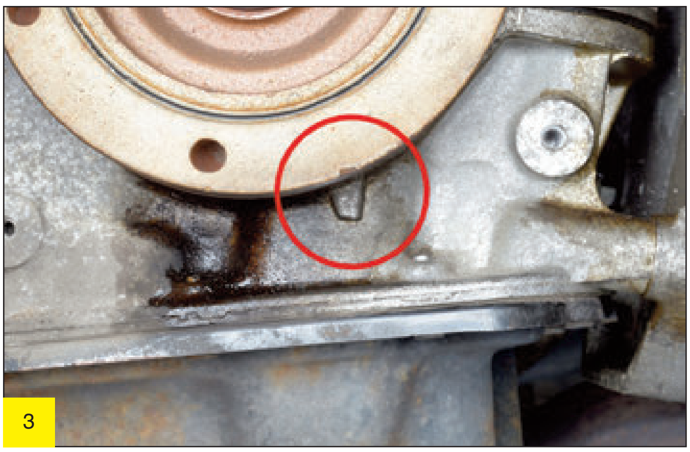
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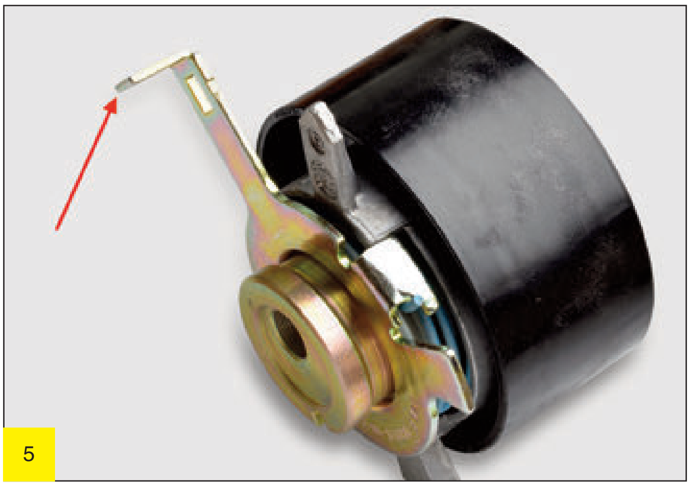
Removal – camshaft belt

1. Set valve timings to TDC mark of cylinder 1.
2. Locate camshaft locking tool - OE (303-376) on camshaft (Fig. 1).
3. Insert crankshaft locking tool - OE (303-574). To do so, unscrew plug from engine block and screw in locking tool (Fig. 2). Observe mark on crankshaft belt pulley (Fig. 3).
4. Loosen tensioning pulley bolt and release tension in timing belt/tensioning pulley. To release tension, turn tensioning pulley hexagon socket clockwise.
5. Remove crankshaft belt pulley.
6. Timing belt can now be removed.

Installation – camshaft belt

1. Loosen camshaft sprocket bolts. To do so, use counterhold OE (205-072) (Fig. 4). Check or reset valve timing settings in same way as for removal (items 1 to 3).
2. Fit new components. Ensure that tensioning pulley retaining bracket (Fig. 5) is correctly seated in metal cover recess (Fig. 6)).
3. Fit timing belt counterclockwise, starting at crankshaft pulley. Take care to ensure that timing belt is not kinked during fitting. Timing belt must be tight between sprockets on tight side.
4. Tension timing belt counterclockwise using tensioning pulley, until tensioning pulley marks are aligned (Figs. 7 and 8). Tighten tensioning pulley bolt to torque of 25 Nm.
5. Refit crankshaft belt pulley. Please use counterhold when doing so, and tighten to torque of 115 Nm.
6. Remove locking tools and tighten bolts of exhaust camshafts to torque of 68 Nm and intake camshafts to 68 Nm.
7. Turn engine by hand through two revolutions in direction of engine travel. Set engine to TDC cylinder 1. Insert camshaft locking tool and crankshaft locking tool. If locking tool cannot be inserted, correct valve timings. Check timing belt tension again.
8. Remove locking tools, screw plug (24 Nm) back into cylinder block. Remove holding tool and fit components in reverse order of removal.
9. Fitting: Cylinder head cover (bolts 1st stage 2 Nm, 2nd stage 7 Nm), spark plugs, upper timing belt guard (10 Nm) together with lower timing belt guard (7 Nm), water pump belt pulley (24 Nm), ancillary unit belt. Engine mount bolts (bolt(s) 48 Nm; nut(s) 80 Nm, engine bracket bolts 50 Nm) and engine mount.
10. Record changing of original ContiTech timing belt on sticker supplied and stick this in engine compartment.

Then carry out a test drive.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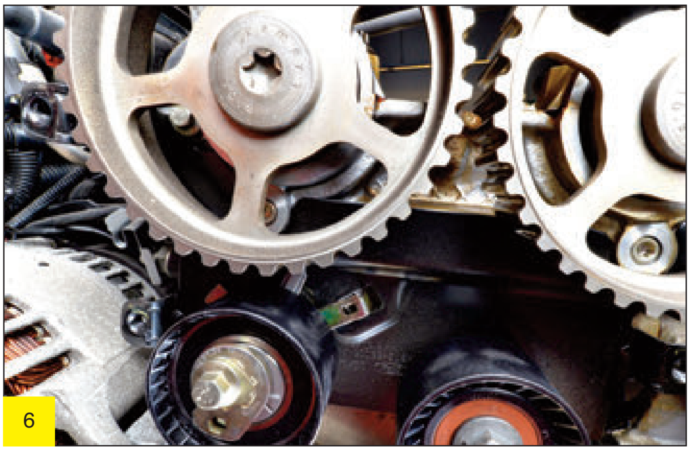
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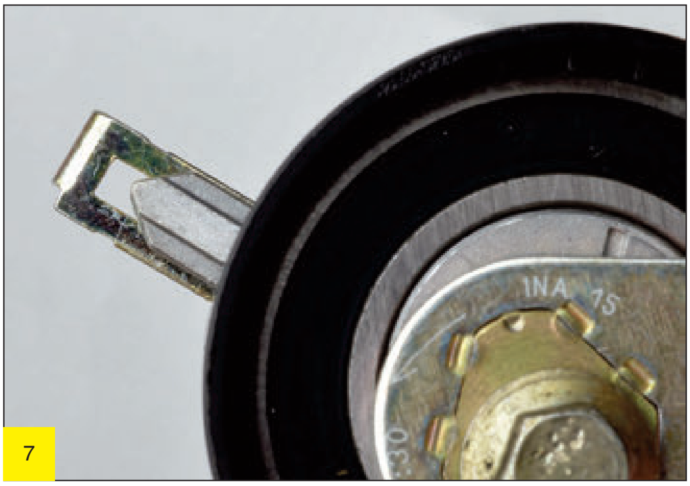

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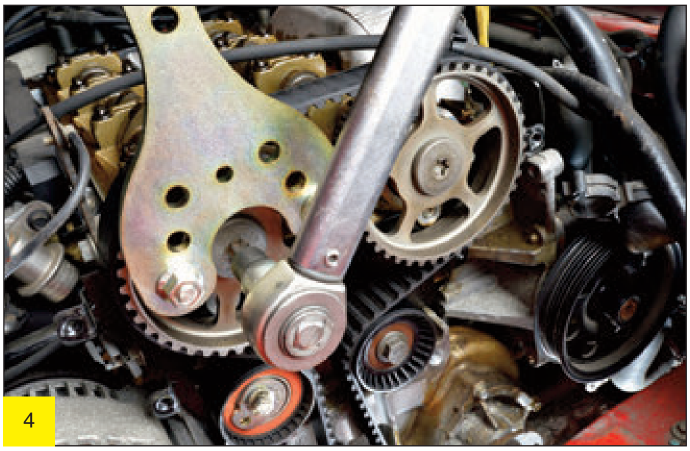
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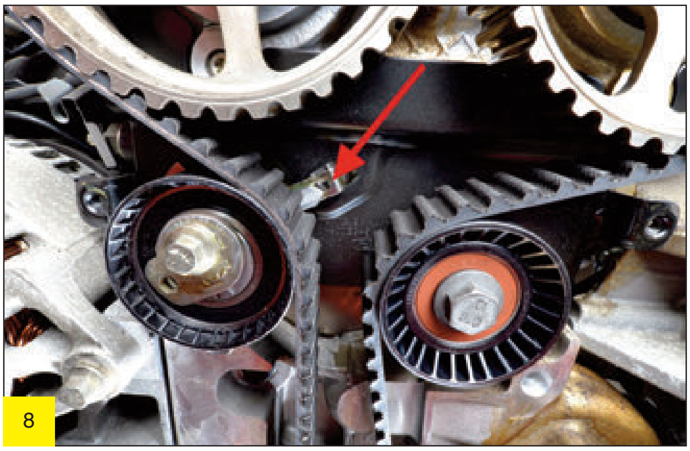
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Fiat Ducato 2.3D timing belt guide

The 2.3-litre diesel engine is used in the popular Fiat Ducato since 2002 and equivalent Iveco Daily from 1999. Dayco recommend that all the systems' components - timing drive and auxiliary drive - be replaced at the same time. This step-by-step technical guide will help technicians through the process, to avoid complications and ensure a first-rate job.

As with all primary drive system jobs, the work should be undertaken when the engine is cold, so ideally the vehicle will not have been run for at least four hours.

From under the vehicle, remove the case to expose the air conditioning compressor and outer auxiliary belt, followed by the cowling under the right-hand wing, to gain access to and remove the belt.

By using a spanner on the automatic tensioner to reduce the tension on the inner auxiliary belt (figure 1), remove the belt, then the tensioner and the idler,


1

followed by the crankshaft pulley, which is secured by four bolts.

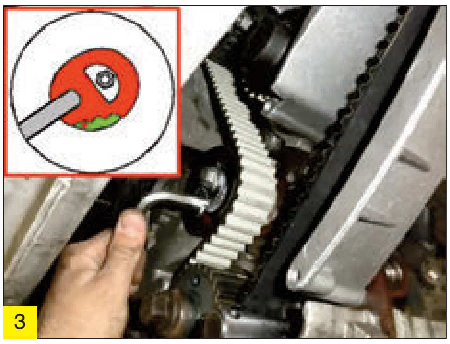
Remove the valve cover on top of the engine and, in order to move them out of the way, detach the coolant and steering fluid reservoirs from the bracket and then remove the bracket to access the top engine mount. Suitably support the engine


2

from below and remove the top mount and then the plastic timing belt cover, to expose the timing drive system.

To aid the removal of the existing timing belt, remove the front right headlamp unit, and then insert the crankshaft timing tool into the hole adjacent to the crankshaft pulley (figure 2) and the two camshaft timing tools through the holes in the top of the valve cover. Secure the camshaft pulley with the appropriate tool and slacken the pulley bolt, which while remaining centred, should allow the pulley to rotate on the camshaft end.

Slacken the tensioner bolt and remove the belt, followed by the tensioner and the toothed idler. Replace the old toothed idler with the new one in the Dayco KTB339 kit, and tighten the bolt to 35Nm of torque, then install, but do not tighten, the new tensioner.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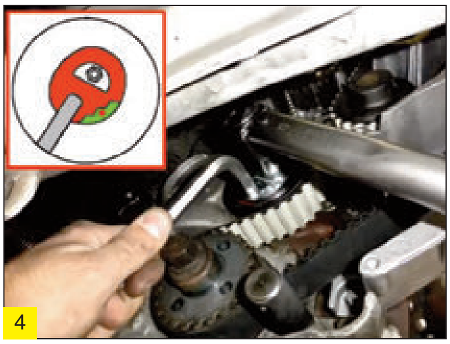
Secure the camshaft pulley with a 5mm Ø pin and fit the new HT belt with the timing mark on its back, aligned to the timing mark on the camshaft pulley and following the direction of rotation arrows, leaving the slack side of the belt facing the tensioner. Then remove the camshaft pin and using an allen key, rotate the tensioner so that the small red dot is in the position shown (figure 3) and temporarily fasten the tensioner.

Again using the appropriate tool, tighten the camshaft pulley to 90Nm of torque and then remove the crankshaft and camshaft timing tools, rotate the engine eight complete rotations by hand and reinsert the timing tools.

Rotate the tensioner so that the small red dot is positioned in the secondary position (figure 4) and tighten the fastening bolt to 35Nm of torque. Remove the timing tools, rotate the engine another two complete rotations by hand and check that the timing tools can be reinserted, which will ensure that the valve timing is correct. Naturally repeat the process should the tools fail to locate correctly.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Once the correct timing has been achieved, remove the timing tools and reassemble the components. Replace the auxiliary belt crankshaft pulley (Dayco DPV1031), idler (Dayco AVP1074) and tensioner (Dayco APV1075), plus the two auxiliary belts (Dayco 7PK1076 and 4PK903EE) and reassemble the remaining components.

For more information regarding the OEM quality power transmission products in the Dayco range, please email info.uk@dayco.com or visit www.dayco.com.

DAYCO®

Tech Tips

Strut top mount replacement

Often overlooked, until it's obviously worn out, the strut top mount has an effect on many other parts and overall safety. Here febi explains some problems that can be avoided by changing them in time.

The strut top mounting contributes to a car's suspension system and its ability to absorb shocks and road vibration. As the strut's upper centre of rotation, it links the shock absorber with the chassis, and affects the front axle settings for camber and castor.

Rotation and Shock Absorbing under Continuous Load

As a rebound stop, the strut top mounting limits the shock absorber's rebound path and must absorb substantial forces over a short distance. These parts wear until they fail completely due to the constantly changing stresses (Fig. 1) which increase due to poor road conditions. A strut top mounting should be checked every 12,000 miles and replaced every 60,000 miles.

Construction and material

In modern production vehicles, the strut top mounting consists of a rubber-metal element that is very sturdy. The Shore hardness determines the quality of the rubber: If it is too hard, the vehicle is no longer comfortable to drive; if it is too soft, it wears faster. febi strut top mountings adhere strictly to the OE specifications in their construction and material. The ball bearing, also part of the strut mounting, allows the strut to rotate in relation to the chassis. febi carries both components - rubber-metal mounts and ball bearings separately and as repair kits.

Fig 1. Tension and compression movements have an impact on the strut top mounting

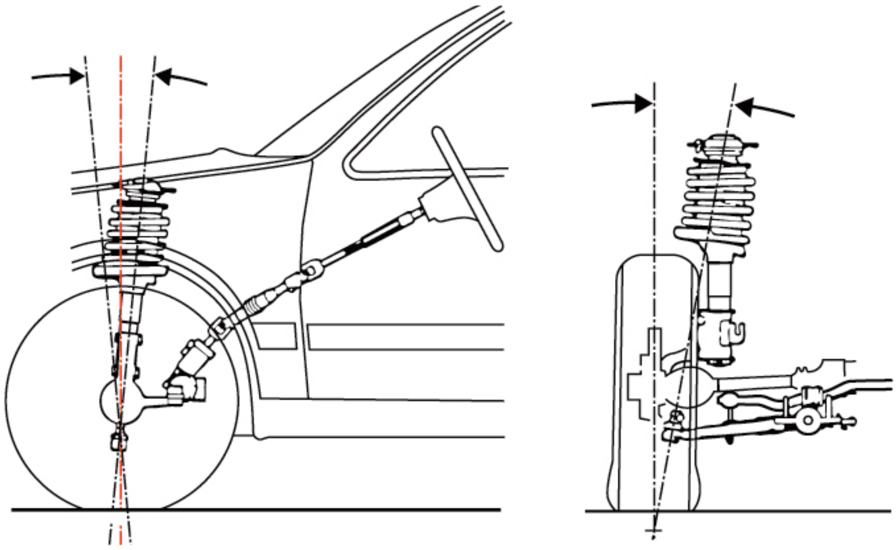


Fig 2. The effect of the strut top mounting on axle geometry

Age and Wear are Safety Risks

When rubber-metal parts age, the material becomes brittle and cracks are formed. Fluctuating temperatures and contamination due to oil intensify this effect. The rubber parts of the strut top mounting wear, causing loss of rebound even if the shock absorber is still intact. The consequences can be anything from steering wheel vibration and knocking noises to rolling on bends and tyre damage.
Worn bearings also impair the axle geometry and the necessary front axle settings for camber, castor and steering-axis inclination (Fig. 2). Continuous steering corrections may be necessary to keep the vehicle on track when a strut top mount is worn. This is because a worn strut mounting causes friction; the steering power required may increase by up to 20%.

The service life of these parts is also shortened by a worn strut top mount:

- Shock absorbers
- Tyres
- Springs
- Connecting rods and steering rods
- Tie rod ends

No Half Measures

Strut top mountings should always be checked during an inspection, and replaced if necessary, because of the safety aspects mentioned. The strut top mountings should always be renewed in pairs, particularly when replacing the shock absorbers. As the steps required are largely the same as those for changing the shock absorbers, it seems obvious to replace the strut top mounting at the same time at no extra cost for labour.

Small Parts with a Big Impact

Dust caps, buffers and rubber blocks are hidden chassis components and their importance is often underestimated. Everything that can be said of strut top mountings also applies to what we refer to as protection kits: Their wear has similar adverse effects on driving safety. Every pothole, every bump and every kerb strike places stress on the microcellular foam of the buffer, which becomes increasingly softer and shorter. The function of rubber blocks is to absorb vibrations from the road surface. As the rubber eventually becomes less elastic, the vibrations are increasingly transmitted to the car's interior. Protection kits should also be checked during an inspection and should be replaced whenever the shock absorbers are replaced or no later than every 60,000 miles. febi supplies kits to fit most common European car makes in OE quality.

More information on febi's range of chassis components, and an online parts search, can be found at www.febilive.com. You can also contact the febi Technical helpline on +44 1977 691105 or at enquiries@febiuk.co.uk.

febi bilstein

Malcolm Short, Schaeffler

Transit Mk 5 wheel bearings

Into its fifth generation since 1965, there are many Ford Transits on the road today. In this Tech Tip, LuK shows the easiest way, on the latest generation Transit from 2006, to replace a wheel bearing, a job some garages have been struggling with.

For the repair you will require a torque wrench, a suitable press and a puller, as the old bearing will need to be extracted from the hub. The Sykes-Pickavant removal and installation tool 08254500 was developed specially, following complaints from garages. We used it in this repair, with the vehicle on a two-post ramp.

You must determine the correct bearing for the application, as two types are available, depending on the payload (up to 1750 kg and up to 1850 kg). The bearing diameter is different, and you will not be able to interchange them. You will find the payload for the vehicle on the nearside door pillar.

Raise the vehicle safely and remove the LH wheel. Remove the brake calliper by carefully squeezing the piston back and then removing the two securing bolts. Stow the calliper using a bungee tie, ensuring no strain is applied to the brake hose in the process and attach it to the coil spring securely. Unclip the ABS sensor lead and stow safely. Remove the split pin and castellated cap and release the hub nut.

Remove the five torx bolts that hold the bearing to hub assembly and suspension arm. To remove the hub assembly, install the three legs by fastening them to the hub studs as equally as you can. Install the impact plate onto the legs and secure in place with three top nuts. Now install the slide hammer assembly through the centre hole of the impact plate and hold in place using one large washer and nut either side of the plate. With the hub ready to be removed, slide the hammer away from the hub as many times as required until it becomes free. This procedure should be done with two people so the hub can be removed safely rather than letting the hub and tool drop suddenly.

With the hub assembly removed, the brake disc will need to be removed before the bearing can be released from the hub. Release the five hexagonal bolts using a good quality socket, taking care not to round the bolt heads as they will be solid and rusted. With the brake disc removed, the bearing can now be pulled from the hub.

Push the five legs of the puller through the hub from the stud side, and secure in place with the nuts provided. Attach the impact plate to the legs by lining up the five recessed holes. Insert the slide hammer assembly rod through the centre hole and then through the drive shaft hole. Keep one of the larger nuts on the impact plate side. On the other end of the slide hammer shaft, use the two large washers and the remaining large nut, making sure that as many threads are engaged as possible and tighten against each other (fig 1).

Secure the hub assembly and slide the hammer towards the back of the impact plate several times and then re-tighten the nuts as they will become lose with each strike. Alternate between the slide hammer action and the tightening of the large nuts until the bearing comes free (fig 2).

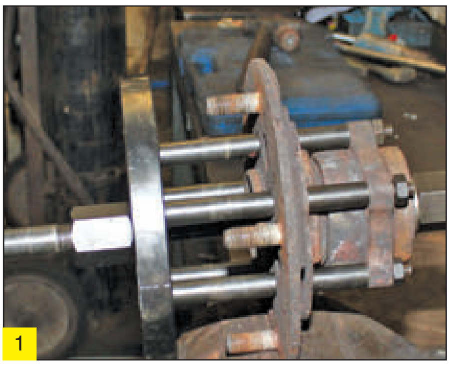
To remove the inner race, first install the backing ring to the bearing then position the bearing separator with the profiled sharp edges located between the back of the bearing and the hub. Tighten the nuts equally, but not too tight, as you do not want to grab onto the drive flange. Install the five legs to the impact plate with the nuts provided and then install the legs through the hub from the stud side. Insert the slide hammer assembly through the impact plate and centre of the hub and attach the two large washers and nuts as before. Make sure the five legs are pressed squarely against the backing ring with pressure.

Tighten the large nuts against each other until the bearing becomes free from the drive flange. You may need some assistance while using the slide hammer. During this process, ensure that the large washers are centred, as they can become caught on the bearing during removal.

Clean the hub and the drive flange, removing any dirt and rust before pressing the bearing into place. Install the bearing in the correct way and press onto the drive flange applying the pressure to the inner race (fig 3). Clean the contact surface of the hub and brake disc and refit the disc to the hub, tightening them evenly and sequentially to the manufacturer's tightening torque of 53 Nm. Re-attach the hub carrier to the drive shaft and suspension arm , then install the new hub nut. Do not tighten fully. Refit the brake calliper and tighten the bolts to 175Nm.

As the brake calliper has been removed, it is advisable to pump the brake pedal a couple of times to allow the piston to return to its correct position. Refit the wheel and lower the vehicle. Tighten the hub nut in two stages; the first stage is 250 Nm and then rotate the wheel hub by five turns. The second stage is 500 Nm, and then rotate the wheel hub by five turns. Refit the new castellated cap and split pin.

Schaeffler's FAG, LuK clutch and INA tensioner brands are backed by technical support and repair installation tips through its RepXpert web site, www.RepXpert.co.uk, and a technical hotline at +44 (0)1432 264264.



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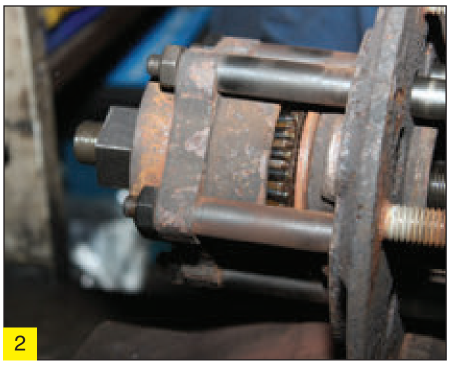

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Tech Tips

Keeping a new turbo healthy

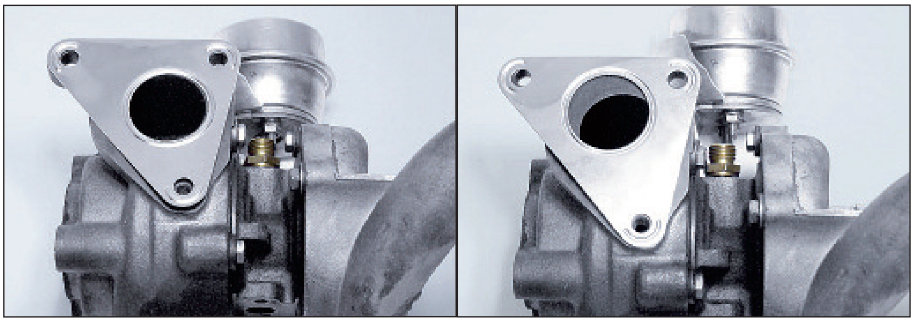
The causes of turbocharger damage generally do not lie in the turbocharger itself. If the actual cause of failure is not remedied, then the new turbo will probably fail. In order to save time, nerves, and money, it is advisable to identify the actual cause of damage for every failure. MAHLE provides some useful guidance.

Suspicious Noises: Whistling and Clanging

When whistling noises occur immediately after installation, it is often hastily concluded that a crack in the turbocharger or a manufacturing defect is the cause. However, an examination of returned turbochargers usually reveals something else:

- A gasket inserted the wrong way around. This reduces the diameter and therefore also the flow rate, which can lead to whistling noises and/or a decrease in performance.
- Incorrect fit of the hoses/components of the charge air line. This can cause air to escape and as a result, whistling noises.
- Incorrect mounting of the housing. For certain types of turbochargers, the compressor housing is adjusted by loosening and tightening the mounting screws. If the screws are not tightened correctly, they can become loose during engine operation. The resulting angle of the housing causes the impeller to strike the housing, audible as "scratching" or whistling noises.

Metallic or rattling clanging can indicate a detached piece of metal in the exhaust manifold. Important: the error must be eliminated immediately to avoid major turbocharger and consequential damages.



An incorrectly positioned gasket, at right, can cause a whistling noise and loss of performance

Blockages: Smoke and Oil Loss

Smoke emissions and loss of oil are among the most common reasons for an unnecessary turbocharger replacement. Here a little background knowledge is necessary. Almost all series turbochargers have hydrodynamic bearings, where oil acts to "separate" the moving parts. An adequate supply and removal of oil is therefore essential for the durability and operation of the turbocharger.

If the oil supply is hindered or the oil pressure is too low, an adequate lubricating film cannot form and friction occurs between the shaft and the bushing, resulting in major turbocharger damage. Clear indications for inadequate lubrication include a loose nut on the impeller, a broken shaft or discolouration due to high temperatures. If the defect is not remedied prior to the installation of a new turbocharger, then it will also become damaged immediately after installation.

A blocked return line or excessive crankcase pressure can clog the oil return.

A carbonised oil return line may cause a replacement turbo to fail

Because the oil can no longer flow out into theoil sump after lubricating the bearings of the turbocharger, it accumulates in the bearing housing. At the same time, the oil pump supplies fresh oil to the bearing points for lubrication and cooling. The oil must now somehow flow out of the bearing. However, since the return flow is blocked due to the clogged line, it searches for another path: despite the sealing piston rings, it is forced into the compressor and turbine side where it is carbonised, or is burnt in the combustion chambers via the intake air and the exhaust system via the turbine.

Poor Performance

In the event of poor performance, the turbocharger is also suspected much too often. The possible actual culprits are:

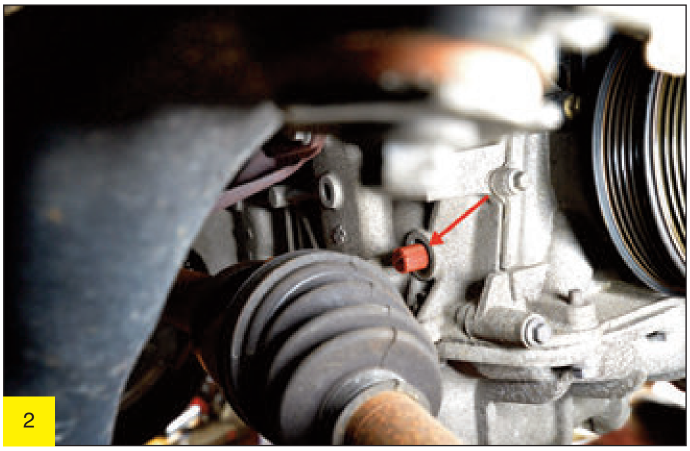
- **The exhaust gas system:** The various exhaust gas after-treatment and recirculation systems used in modern vehicles, create many contact points where throughput can be reduced. If the exhaust gases cannot flow freely, similar symptoms to a turbocharger fault occur. Only close examination of the exhaust gas tracts will unveil the real culprit.
- **The recirculation air valve:** The boost pressure control valve enables fast responsiveness, prevents abrupt braking of the rotor when the throttle valve is closed, and protects petrol engines from overspeeding. When these adjustments aren't made and if a pronounced turbo lag is noticeable, often the complete turbocharger is replaced. But in many cases, the valve can be replaced separately (ideally promptly, in order to prevent damage to the turbocharger).
- **The air mass flow meter**: It determines the air volume flowing into the engine. The engine control unit thus calculates the optimal quantity of fuel and additional values for the air-fuel ratio. An incorrect measurement can lead to poor performance and even to dry running symptoms, which could also mimic a defective turbocharger. A glance at the measurement values of the air flow meter helps to find the actual cause.
- **Cracks in the air-guiding area:** These can lead to unfiltered air entering into the system within specific speed ranges. The result is an inadequate air-fuel ratio, along with a noticeable lack of performance and gradual wear of all mechanical parts. A leak detection spray is recommended for quick identification of the leak points.

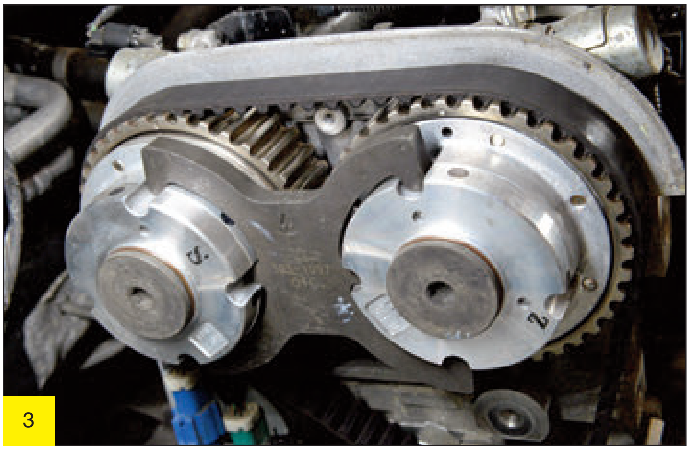
MAHLE

For more information or general advice, please contact the MAHLE Technical Team on +44 (0)845-688-5006 or email technical.bilston@gb.mahle.com.

Focus C-Max 1.6 Ti timing belt guide

Significant errors are frequently committed when changing the timing belt on a Focus C-Max 1.6-liter Ti with engine code HXDA or SIDA. ContiTech experts provide a step-by-step explanation of the correct changing procedure to help you avoid any potentially costly mistakes.





The manufacturer recommends inspecting and, if necessary, changing the timing belt at 160,000 km or after eight years. The labor time is 2.9 hours. Replace the tensioning pulley and water pump at the same time as changing the timing belt. Although the water pump is driven by the multi V-belt rather than the timing belt, in this engine it is mounted behind the timing belt drive, and the timing belt tensioning pulley is attached to the water pump. Should the water pump fail later, the entire change procedure has to be repeated using new parts, since Ford has forbidden the continued use of used timing belts in this case. It is essentia therefore, to change the water pump as part of the package in order to avoid later failures with unnecessary costs.

Fitters need the following special tools for the procedure:

1. Camshaft locking tool: OE (303-1097)
2. Crankshaft locking tool: OE (303-748)
3. Flywheel locking tool: OE (303-393)
4. Flywheel locking tool: OE (393-393-02)
5. Counterhold: OE (205-072)
6. Tensioning pulley fixing stud: OE (303-1054)

Preparatory work

Identify the vehicle using the engine code. Disconnect the vehicle battery. Do not turn the crankshaft and camshaft once the timing belt has been removed. Turn the engine in the normal direction of rotation (clockwise) unless otherwise specified. Turn the engine only at the crankshaft pulley and not at other sprockets. Comply with all the manufacturer's tightening torques. Jack up and prop the front of the vehicle so that the front engine mount is not under strain.

Removal

Remove front right wheel and fender shield, power steering reservoir (do not detach hoses) and alternator, ancillary unit belts (these are elastic belts!). To remove, cut with a knife or diagonal cutting pliers or remove using special strap from ContiTech Uni-Tool Elast kit. Detach cowl, starter motor, multi-plug connector from power steering pressure switch, coolant expansion reservoir (hoses do not need to be detached), water pump belt pulley, right engine mount and bracket and then remove upper timing belt guard, cylinder block screw plug for holding crankshaft (to do so, remove drive shaft bearing block (Fig. 1) and fit engine support beam or support engine.

Removal – camshaft belt:

1. Set valve timings to mark shortly before TDC of 1st cylinder until marks on camshaft sprockets are at 11 o'clock. Slot mark can be seen on exhaust camshaft sprocket and dot mark on intake camshaft sprocket.
2. Insert crankshaft locking tool – OE (303-748) into cylinder block (Fig. 2) and then slowly continue turning crankshaft clockwise until crankshaft is in contact with tool. Two marks on camshaft sprockets must now be at 12 o'clock.
3. Locate camshaft locking tool – OE (303-1097) on camshaft. Mark on camshaft sprockets must be aligned with outer edge of camshaft locking tool (Fig. 3).
4. Insert flywheel locking tool – OE (303-393 and 303-393-02) into starter motor opening (Figs. 4, 5 and 6).
5. Then remove crankshaft pulley. It is essential to use counterhold – OE (205-072) here and loosen bolt of crankshaft pulley.
6. Remove lower timing belt guard (Fig. 7).
7. Loosen tensioning pulley bolt and release tension on timing belt/tensioning pulley until tensioning pulley fixing stud – OE (303-1054) can be inserted into tensioning pulley.
8. The timing belt can now be removed.

Installation – camshaft belt

1. Check or reset valve timing settings in same way as for removal (items 1 to 4).
2. Fit new tensioning pulley and, if appropriate, new water pump.
3. Fit timing belt on exhaust camshaft sprocket, starting clockwise. Take care to ensure that timing belt is not kinked during fitting! Timing belt must be tight between sprockets on tight side!
4. Withdraw fixing stud from tensioning pulley.
5. Refit lower timing belt guard.
6. Fit crankshaft pulley using new bolt. Note: Two bolts of different lengths are available! Up to model 2005/08 M12x29 (40Nm+90°), from model 2005/09 M12x44.5 (40Nm+90°). You are recommended to check depth of threaded bore with suitable measuring tool to determine which new bolt to use since model year and day of registration can sometimes differ. Depth 42mm = M12x29mm; depth 52mm = M12x44.5mm. Use counterhold – OE (205-072)!
7. Remove locking tools.
8. Turn engine through two revolutions in direction of engine travel. Set engine to TDC cylinder 1. Insert camshaft locking tool and crankshaft locking tool. If locking tool cannot be inserted, correct valve timings. Check timing belt tension again.
9. Remove locking tools, screw cylinder block screw plug (20Nm) back into cylinder block. Remove holding tool and fit components in reverse order of removal.
10. Fitting: Timing belt guard (9Nm), water pump pulley (27Nm), change ancillary unit belt if it was cut. Use of ContiTech Elast Tool F01 and Uni Tool Elast is recommended for fitting elastic belts; engine mount bolts (to engine bracket 80Nm; to body 90Nm) and engine mount, engine compartment underpanel, front right wheel, engine compartment underpanel right.
11. Record changing of original ContiTech timing belt on sticker supplied and stick this in engine compartment, then carry out a test drive.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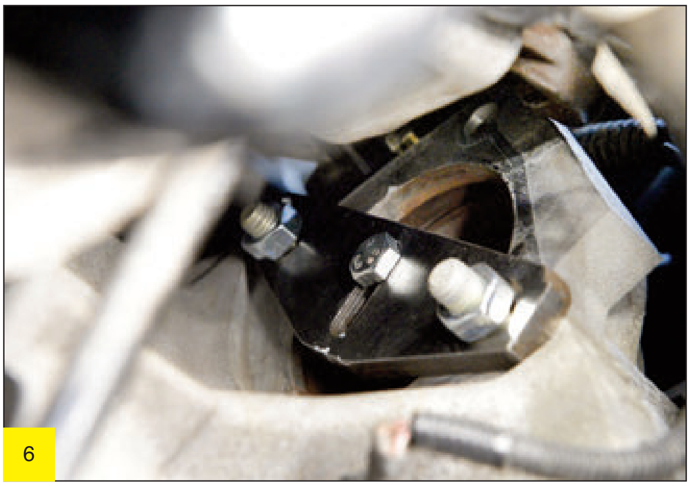
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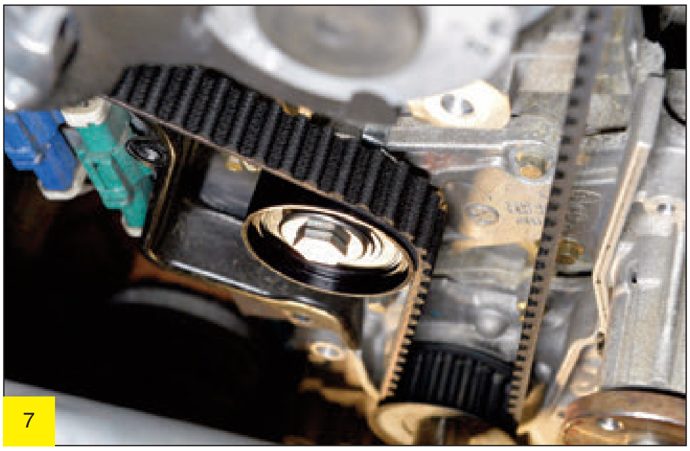
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Jim Gilmour - Blue Print Technical Consultant

Sensing a commercial issue

An Isuzu N series fleet vehicle was giving trouble while being driven. The Isuzu 3 litre four-cylinder common rail engine was fitted with a 24V electrical system, which proves no problem to either G-Scan or G-Scan 2. Blue Print Technical Consultant Jim Gilmour explains how he diagnosed and fixed the problem with the N Series truck..

The complaint was that when driven, the engine would run for only a short time before losing power and coming to a halt – at idle the engine would sometimes surge then stall. Because the company did not have any suitable serial diagnostics, they had someone come in to read any stored codes. They retrieved codes relating to EGR (exhaust gas recirculation) faults.

The vehicle was driven into the workshop and the engine tone was rather odd. The G-Scan2 was plugged in and the codes were read. Sure enough, the G-Scan2 picked up codes relating to EGR. I then noticed that the exhaust brake was switched on. This would explain the strange engine tone and possibly the EGR related codes.

EGR is monitored in a number of ways, one of which is by using an air mass meter. Diesel engines do not use a throttle to reduce the pressure in the manifold, so the intake air mass is a function of engine capacity, intake air temperature, air pressure and engine speed. The engine control module (ECM) calculates the air mass reading based on this information. EGR fills the cylinder with as much as 60% exhaust gas, which by-passes the air mass meter, so increasing EGR will show as a reduction in air mass intake. The codes P0400 and P0402 were present, indicating excessive EGR. This would likely be a consequence of reduced air flow caused driving with the exhaust brake on.

There are 48 parameters on this engine, so to quickly get a picture of what was going on, the G-Scan 2 was set to record all parameters, then the engine was restarted. Fortunately, I did not have to wait too long to see a problem - after about 30 seconds of normal idle, the engine began to surge, then faltered and stalled.

Here's what I found: (figure 1): By sliding the bottom cursor on the G-Scan2, I navigated to when the engine started to falter and the flurry of data changes drew my attention to the fuel rail pressure. I selected the data that I wanted to look at in graph form (Figure 1). There were some very obvious discrepancies in actual and desired rail pressure values.

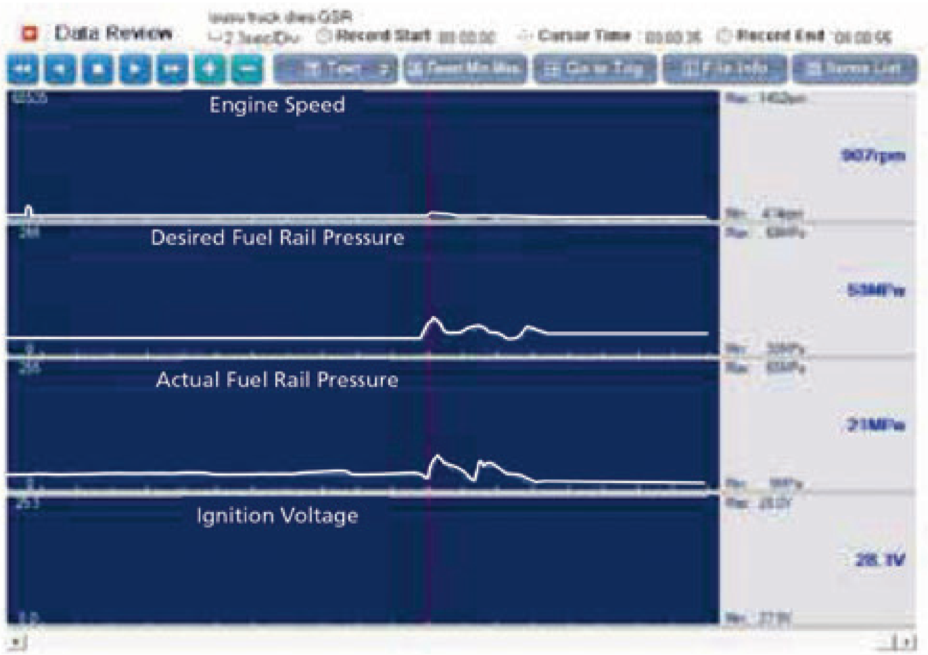

Figure 1 - Discrepancies between desired and actual fuel rail pressures provided the first clue to solving the problem.

When rail pressure falls below the value required by the system, a number of possibilities arise:

Delivery pressure

A reduced or restricted delivery to the pump would cause a drop in rail pressure; the metering system would try to compensate by opening the fuel rail pressure regulator (also known as the Suction Control Valve).

Suction Control Valve (SCV)

The SCV Is fitted in the high pressure pump and is a linear solenoid valve controlled by Pulse Width Modulation (PWM). Any interruption in the electrical control of the valve would cause changes in rail pressure.

Sticking or unresponsive SCV solenoid

Just like any other solenoid device, the electrical windings can short or open circuit, or

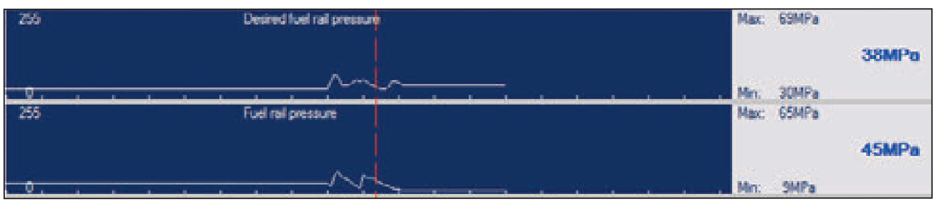

Figure 2 - The actual fuel pressure sometimes exceeded the desired fuel pressure

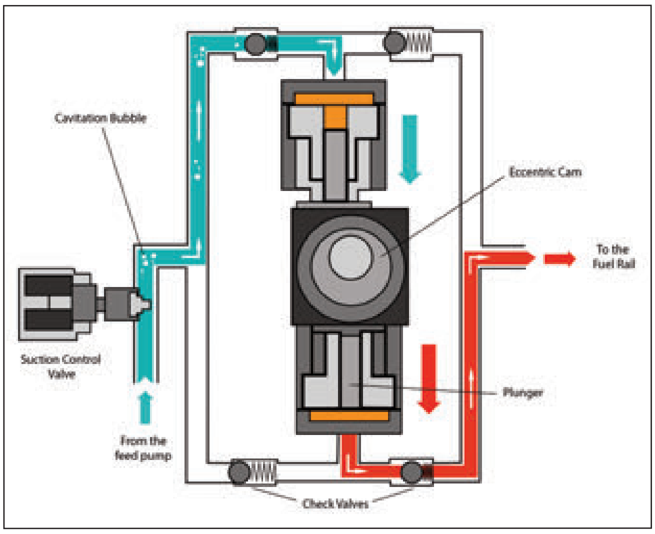

Figure 3 - The actual fuel pressure sometimes exceeded the desired fuel pressure

have a high resistance. Additionally, the mechanical movement of the device can become erratic, due to wear or contamination from debris.

Fuel rail pressure sensor fault

If the pressure sensor provides incorrect values, the SCV will respond accordingly.

The fuel system

The Isuzu is fitted with the Denso HP3 system, that uses fuel inlet metering to control the pressure in the rail. The high pressure pump, driven by the engine, has two plungers on opposite strokes driven by an eccentric cam. A low pressure feed pump in the high pressure pump draws fuel from the tank, at below atmospheric pressure, to provide a delivery pressure to the plunger chambers. The SCV controls the flow of fuel to the plungers, so that the chambers are not completely filled during the induction stroke. This causes cavitation (creation of a vacuum) in the plunger chamber, causing the fuel delivery to the rail to become a function of SCV control and pump/engine speed. A fuel rail pressure sensor fitted to the fuel rail provides information to the ECM, which then controls the rail pressure via the SCV. The benefit of this system, over high pressure regulation, is that the drive load of the pump is reduced.

The Diagnosis

Measuring delivery pressure requires installing a pressure gauge, which is intrusive and time consuming. To try and avoid this, I analysed the data in more detail.

Looking at the relationship between desired and actual fuel rail pressure, I noticed that at times the actual pressure exceeded the desired pressure (Figure 2).

This data is unlikely to be caused by a reduced low pressure delivery volume, so my next step was to repeat the test and monitor the control of the SCV.

The G-Scan 2 has an excellent and easy to use built in oscilloscope and multi-meter, so I back probed the SCV solenoid. There are only two wires on the SCV, one is a 24V supply and the other is the ground controlled by the ECM. One wire was green the other green and red and a quick look at the other sensors in the engine bay showed that the green wire was common to all and likely to be the supply voltage, so I chose the red and green. It's not exactly of bomb disposal importance, but when working in such a confined area, the fewer frustrations, the better.

The engine was started and sure enough, after a short while the engine surged, faltered and stalled.

The engine control module controls the SCV by varying the duty ratio ('on time' as a percentage of the period) the SCV is a normally open type, meaning that when disconnected it is fully open and maximum delivery is achieved and pressure is increased. The on time of the duty cycle controls the closing of the valve, so the longer the on time the lower the fuel pressure. The scope was connected to the switched ground wire; consequently the on time is when the solenoid is switched to ground. Figure 4 shows the duty ratio when the rail pressure was maintained at a normal idle pressure of 300 bars. Figure 5 shows the duty ratio commanded to increase to try and compensate for loss of fuel pressure, causing the engine to die. The two images also show the SCV control signal and the ground to be good. The SCV windings were checked for resistance and insulation and were within specification.

Things seem to be pointing to a sticking SCV which is not an uncommon problem; but what about the fuel rail pressure sensor?

If the fuel rail pressure sensor gives a lower signal than normal, the SCV would be commanded to increase rail pressure; consequently injection pressure would increase which, would cause the engine speed to rise, the ECM would control engine speed by reducing the injection duration; this would be accompanied by increased diesel knock and plausibility codes relating to rail pressure being stored - but the engine never knocked.

Based on the information I had, I concluded that the SCV was sticking, which caused the erratic fuel pressures recorded by the G-Scan.

A new SCV was ordered and fitted, which cured the problem completely.

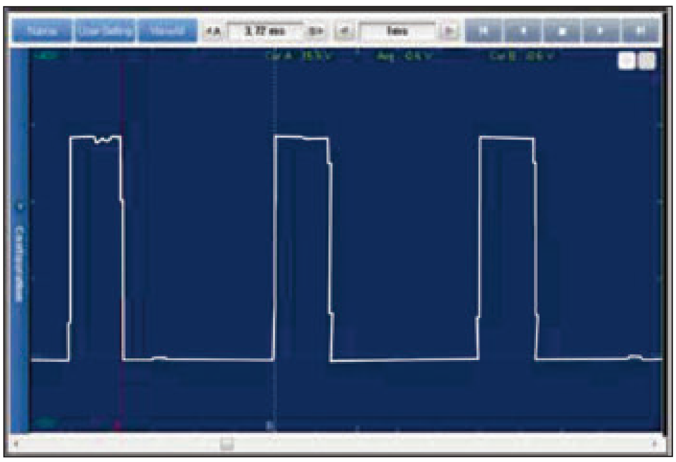

Figure 4 - The SCV duty cycle with the engine at idle

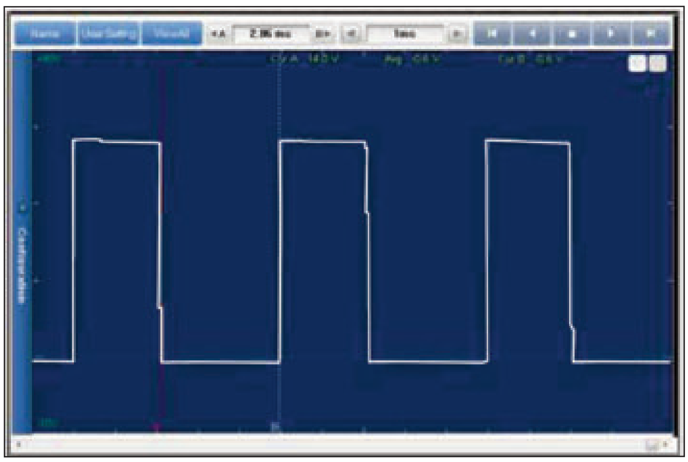

Figure 5 - The SCV duty cycle increased, to try and compensate for loss of fuel pressure, causing the engine to die.

Clutch Clinic

Malcolm Short, Schaeffler

Kia Cee'd 1.6 CRDi

The Kia Cee'd is a small family hatchback with various engine and body styles. Launched in 2006, it has become increasingly popular on Irish roads. LuK technical takes a closer look at a clutch replacement and offers some handy hints to garages looking to undertake this repair.

In this example we used a two post ramp, an engine support beam, two long axle stands and one transmission jack. The vehicle may also be fitted with alloy wheels, so make sure the locking tool is available before starting the repair.

Remove the engine cover and disconnect the battery cables. Disconnect the MAF sensor switch and ECU cables and stow them carefully. Remove the air filter housing and ECU as one complete unit. Disconnect the speed sensor and reverse light plugs, and stow safely out of the way.

Remove the locking pins holding the gear change cables in place (fig 1) and carefully pop off the gear change cables and stow. Remove two bolts from the shift linkage bracket, enabling you to remove it from the gearbox as a complete unit. Unbolt the

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battery earth cable from the top of the gearbox (fig 2) and stow. Install the engine support beam and remove the two accessible starter motor bolts, one of which holds a bracket for the wiring loom. Remove the bolts from the top gearbox mount, raise the vehicle, remove nearside the front wheel and plastic wheel arch lining. Drain the gearbox oil.

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Remove the under tray and then the turbocharger pipe, secured by two brackets on the sump. In this repair, we avoided removing the sub frame completely. Support the sub frame with two long axle stands. Unbolt and remove the four bolts securing the steering rack in place. Disconnect the exhaust support bracket from the sub frame (fig 3). Remove the two front sub frame bolts

3

completely, and slacken the rear sub frame nut and bolts just enough, so the front of the sub frame can be lowered on the transmission jacks.

Remove the nearside ball joint bolts, and disconnect from its position and remove the drive shaft. Remove the front and rear gearbox mounts. Remove the bracket that secures the hydraulic pipe to the gearbox (fig 4) and remove the two bolts that hold the external slave cylinder in position, and carefully stow away from the working area.

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Support the gearbox with the transmission jack. Remove the bottom starter motor bolt and three bottom bell housing bolts from the rear of the gearbox; one bell housing bolt is hidden behind a plastic cover (fig 5). Remove the remaining bell housing bolts from the front, then carefully separate the gearbox from the engine. You should have enough clearance inside the wheel arch to position the gearbox inside and support it using the transmission jack safely.

Remove the clutch and release bearing. Check the bell housing for any debris and oil contamination, and rectify before refitting the gearbox. The release bearing should always be changed during a clutch replacement. The release arm should be checked for smooth operation and for wear on the ball pivot.

Check the flywheel for signs of heat stress, such as hairline fractures or cracks. The surface of the flywheel should be checked to make sure it is within the manufacturer's wear tolerance. If the surface of the flywheel is to be skimmed, make sure that the same amount is taken from the clutch bolting surface. Failure to check and rectify these areas may cause the clutch to operate incorrectly. Before fitting the new clutch disc, make sure the input shaft is clean and free from any wear. Smear a little high melting point grease on the splines, then slide the new clutch plate up and down the splines a couple of times, before removing the plate and wiping off any excess grease.

Refitting the gearbox is the reversal of removal, remembering to refill the gearbox oil to the correct level when the gearbox is refitted.

Check out the latest in online support at www.RepXpert.co.uk or contact the LuK technical hotline at +44 (0)1432 264 264.

5

Frank Massey, Autoinform

Petrol Injection systems explained

While there has been a significant swing to diesel engines, both diesel and petrol engines have been changing, as more restrictive emissions standards come into effect. Autoinform's Frank Massey explains some aspects of petrol injection, which is set to become more common in the near future.

I was surprised, if not shocked quite recently, during a direct injection training course when I asked delegates how often they deal with petrol injection problems, more specifically problems with direct injection. The common consensus indicated that very rarely if not at all.

This concerned me on several counts, did customers avoid bringing such problems due to poor marketing, or a previous inability to resolve problems of that nature. Or did the technicians deliberately avoid or discourage taking on such work due to a lack of knowledge or confidence?

Whatever the reason, it was clear that developments in petrol injection systems had evolved to such an extent, that a genuine fear or reluctance to take on such work demanded a redress.

Around 80% of our garage's work related to diagnosis and repair of diesel systems. I feel a little like one of those American storm chasers that you see in the movies, chasing after tornados for no apparent reason. The reason being is I feel a storm coming in the industry for a number of reasons, which I hope this topic will illustrate, or warn you to take shelter.

Higher status

Fun apart, lots of good things have developed in recent years, most of which I believe have elevated the use of petrol powered vehicles into a clear advantage over diesel vehicles. To that extent my current petrol powered vehicle has replaced a previous diesel variant. This is mainly due to the better performance, cost, maintenance, and Euro 6 Selective Catalyst Reduction (SCR).

So where is the forthcoming storm coming from in relation to direct injection? Well I hate to say it, but it will pretty much be the same reason and direction; emission reduction related regulations. I have made this statement before and will reinforce it again, I am in total favour of harmful emissions reduction regulations. In fact, I believe it is not robust enough or enforced proficiently in its current form.

Where is direct petrol injection currently at? Pressure control, like common rail diesel, is either volume or pressure regulated, by an actuator mounted on a mechanically driven hydraulic high pressure pump, that is usually ground switched.

Pressure regulation is independent of engine speed, this excludes some crude mechanical systems, and follows an increasing technical demand for ever more power and lower emissions. Pressures vary between 50 bar at idle, to 180 bar at full load. Fuel transportation is a complex variation, taking into account some or all of the following control modification.

The point of delivery may vary from the bottom of the intake stroke around 300 degrees BTDC, to approximately 60 degrees BTDC. This, in effect, determines if the engine is under the control of homogenous or stratified fuelling.

Additional to this are split or dual injection strategies, which employ both of the above within the same intake charge events. This is used to quickly heat the catalyst, reducing the formation of harmful emissions or compensating for flexible fuelling strategies.

The intake air or swirl is modified to enhance efficient combustion, mix EGR and form stratified charge control. The piston crown, fuel delivery pressure and injection timing determine penetration.

Service regime

Ignition angle is matched for a number of reasons, not just simply to avoid detonation, or to satisfy poor combustion properties when running on ethanol based fuels, but it is also modified to regenerate the NOx accumulator and saturation due to sulphur contamination. Yes, I have just stated the need to regenerate the NOx accumulator using serial control and dynamic drive cycles

Flexible fuelling also demands a modified servicing regime, due to an increased contamination of the lubricants, a modified high pressure fuel pump, inlet manifold, cold start injector and an even more complex dual injection regime! Why? Well petrol evaporates at temperatures ranging from 40 to 200 °C. Ethanol however, only evaporates at 78°C and only at this temperature due to its molecular structural behaviour. At all other temperatures, it becomes a contaminate, especially on the cylinder walls.

How does the engine PCM know ethanol fuel is used, and just as important what percentage ethanol is present? Another sensor of course, mounted under the floor pan after the in-tank pump and before the injectors, that employs a small current across a sensor which is effected by the dielectric reaction of the fuel. This reaction is converted into a frequency, which represents the ethanol content.

AUTOINFORM

Timing belt guide

Volvo XC90 2.4D

Malcolm Short, Schaeffler

The Volvo XC90 has proven to be a very popular vehicle since it was launched in 2002. The technical team at INA takes a look at the timing belt replacement guide and offer a few handy tips to assist the Irish independent aftermarket garage network.

The timing belt system may look a little tricky, but with a little know-how and the appropriate tools, it will prove to be an ideal repair for any independent garage.

The engine has been identified as an interference type, so in the event of a timing belt failure, the likelihood of engine damage is extremely high. It is important to install a new timing belt system on an engine at ambient room temperature. Always adhere to turning the engine in the normal direction of rotation unless advised otherwise by the OEM installation instructions. Recommended torque values should always be used. It is recommended that all the tensioners and pulleys be replaced at the same time as the timing belt.

Nothing out of the ordinary is required to complete the job. For the repair we used a four-post ramp, however a two-post ramp would also be suitable.

For safety reasons it is best practice to disconnect the battery earth lead. The vehicle may also be fitted with anti-theft locking bolts, so make sure the locking key is available before commencing the work.

Remove offside front wheel and remove the locking clips that hold the front half of the wheel arch liner. A second splash guard will be behind the wheel arch liner which can be completely removed. Fold the wheel arch liner, carefully behind the suspension arm to reveal sufficient working space. Remove the engine strut brace and engine top cover.

Remove the auxiliary belt cover and release the auxiliary belt tensioner. It is quite tricky to install the locking pin to hold the tensioner, due to the limited amount of space between the engine and body. To overcome this problem, we used a torx bit on the tensioner body to release the tension, enabling the removal of the auxiliary belt.

Remove the timing belt cover that is held by four clips and one bolt. Rotate the engine in a clockwise direction until the timing marks become aligned both on the crankshaft and camshaft. The camshaft mark is a very small indent on the pulley, which aligns with a small notch on the rear protection cover (fig 1). The crankshaft alignment is a little more straight forward, as a rivet on the crankshaft pulley should be positioned at the 12 O`Clock position (fig 2).

Rotate the engine a quarter turn clockwise, and then release the crankshaft centre bolt and four outer bolts. Remove the crankshaft pulley. Refit the centre bolt and rotate the crankshaft

2

anti clockwise until the timing marks are aligned on the camshaft (fig 1) and on the crankshaft (fig 3).

Slacken the tensioner pulley bolt and using a 6mm Allen key, rotate the tensioner until at 10 O`Clock position to release the tension. Remove the tensioner bolt, tensioner pulley, timing belt and the guide pulley.

Install the new tensioner, making sure the Allen key adjustment hole is positioned at 10 O`Clock, and tighten by hand the tensioner bolt. Install the new guide pulley and tighten the bolt to 25Nm. Install the timing belt in an anti-clockwise direction, starting at the crankshaft pulley. Ensure that the belt is kept taught between the pulleys as you install it.

Rotate the crankshaft by a small amount of movement in a clockwise direction, to apply tension to the belt between the camshaft and crankshaft pulleys. Rotate the tensioner pulley anti-clockwise until the pointer is positioned just past the right hand side alignment mark of the tensioner back plate.

Slowly rotate the tension clockwise until the pointer becomes aligned centrally between the alignment marks (fig 4). Tighten tensioner bolt to 27Nm. Press down on the non tensioned side to make sure the pointer is able to move freely. Rotate the crankshaft two turns clockwise and check that the timing marks are still aligned, and the pointer is still in the central position. If not then the tensioning procedure must be repeated.

The installation of the remaining parts is the reverse order of removal but it is strongly advised to check the condition of the auxiliary belt and driven components for excessive wear and consider replacing them. Finally, it is advisable to rotate the engine by hand a number of times before starting the engine to check for any interference or noise.

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.

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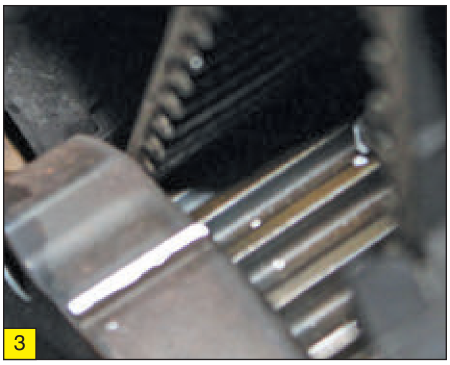

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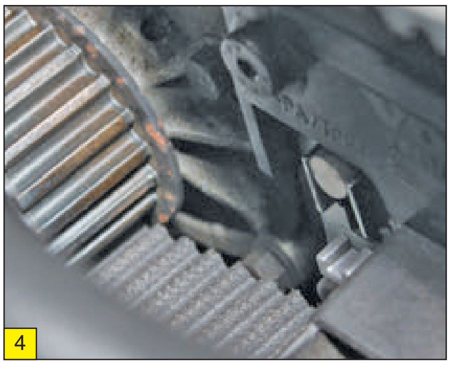

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A Mazda without a spark

Charles Figgins - Blue Print Technical Consultant

A Mazda MX-5 (MK2) was coming out of hibernation to enjoy the brief spring sunshine. The owner noticed that their pride and joy was not performing as well as it should. After a bit of tinkering, changing the spark plugs and the air filter, they decided to take it to a garage. Blue Print's Charles Figgins explains how he diagnosed and cured the Mazda.

A visual inspection was carried out under the bonnet, to check for anything obvious. A vehicle being stored for long periods of time can be prone to rodent's gnawing at wiring, plug leads and even nesting in the engine bay. In this case, everything looked to be in place and in good condition.

Before road testing the car, I carried out a quick check for fault codes and had a look at any data that may give me a clue to the symptoms described by the owner. This car was not equipped with an EOBD (European On-Board Diagnosis)16 Pin socket, so I had to use the Mazda 17 Pin connector (Blue Print part number BPTE1022) on the G-Scan 2 to access the information I needed.

The engine management had three fault codes stored; air mass, engine temperature and crank position sensors, which were all caused to being unplugged and plugged back in again at some time in the past. All of the codes were stored on the G-Scan for the owners report before erasing. On inspecting the four pages of data provided, there was nothing obvious as the engine idled quite happily.

On a road test of mixed driving, the owners concerns were proven to be correct. Under hard acceleration the engine did not perform as well as it should, possibly due to an engine misfire. Diagnosis to determine where the issue stems from is not always as easy as you may think. As this car is pre EOBD, there is no misfire detection and the ignition system is not monitored by the ECU to give you any fault codes to point you in the right direction. It was necessary to consider the relationship between fuelling, compression and timing.

Because the engine was running smoothly at idle and at partial load, I did not think it was a mechanical issue and turned my attention to the ignition. The purpose of the ignition system is to ignite the air-fuel mixture in accordance with the demands throughout the engine's operating range and the voltage levels that are required of it.

Diagnosis can be a complicated process of elimination; you turn from mechanic to crime scene investigator, to find the cause of the vehicle's problems.

Before making a start, it is always good to consider what type of systems you are going to work on; five minutes of research can save you hours of wasted time. I started my investigation with the ignition system. The ignition system fitted to this vehicle is a distributorless ignition, with two twin spark coils bolted to the rear of the cylinder head on a bracket, with an integrated ignition driver end stage built in to switch the primary coils.

The engine management calculates the optimum ignition point on the basis of the stored map, for which engine speed and load are influential. Other correction variables include engine air intake and coolant temperature, along with the knock sensor feedback for any pre-ignition or detonation.

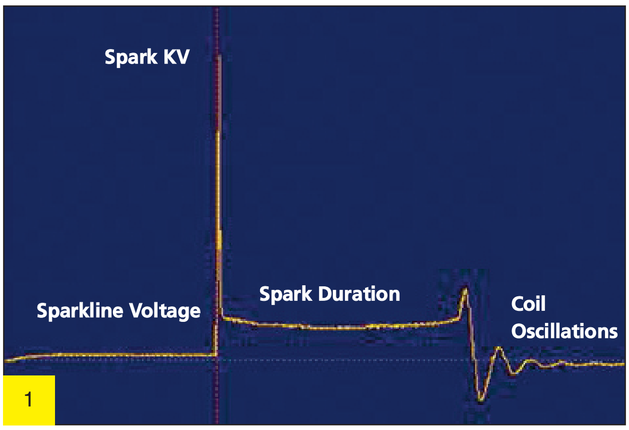
With this in mind, I browsed the serial data from the G-Scan 2 once more to see if I had over looked anything. It all seemed ok, so now was the time to do some component testing using the oscilloscope functions built into the G-Scan 2.

With the ignition system design fitted to this vehicle, I had to consider which parts could be tested; these were the ignition coil supply voltage and ground, the ECU trigger pulse, primary current, secondary output voltage, and the resistance for the secondary windings and plug leads.

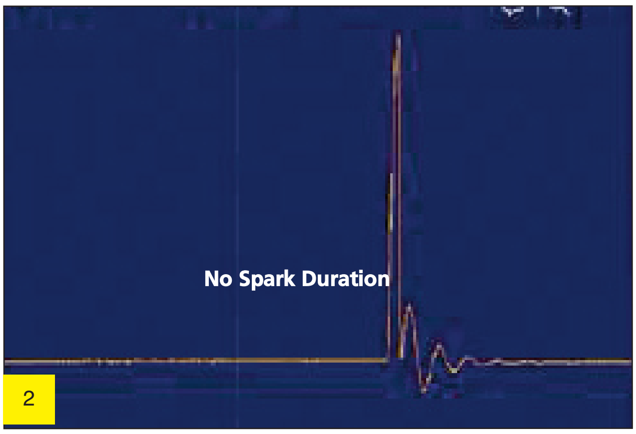
I started measuring the secondary ignition voltage with the G-Scan 2 oscilloscope with the HT lead adaptor (Blue Print part number BPTE1057), mainly because of ease of access to the plug leads. On analysis of all four secondary ignition patterns at idle, all seemed OK (Figure 1).

I carried out a snap throttle test to simulate load. On opening the throttle quickly, a large amount of air is induced on the induction stroke, causing a sudden increase in cylinder pressure and temperature, along with an increase in required ignition voltage, putting the ignition system under stress.

On doing this I noticed a slight misfire; measuring all four secondary voltage outputs again under this test, it was quite clear there was an issue with No. 4 cylinder (Figure 2). All the ignition energy was being used for the initial jump



A normal secondary ignition pattern as seen on an oscilliscope

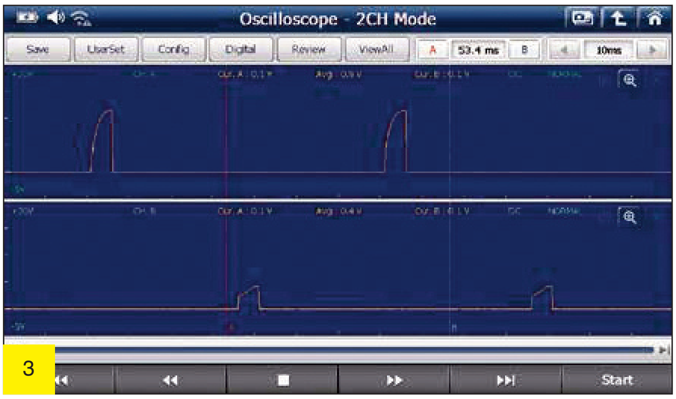


There wan't any spark duration in cylinder number 4 across the spark plug gap, with nothing left to continue the spark duration. But what was causing it?

Could it be as simple as a plug lead or a spark plug? On inspection of the new spark plugs (including checking the specification of the engine), they were correct. I then tested the very short plug lead of No.4 for resistance which was within tolerance of 1-5 KOhms. As I had already removed No.4 plug lead, I then removed No.1 plug lead and checked the secondary winding resistance (between both secondary outputs on this coil), yet again it checked out alright, measuring between 8.2 – 12.4 KOhms. The resistance test of the secondary windings told me they were intact.

I turned my attention to the other side of the ignition coil. Mazda, in their wisdom, fitted the connector to both coils on top of the engine, making it nice and easy to access for testing.

One advantage of having two separate coils is that you have one to compare against. First, I separated the connector for inspection; it was very clean and had no corrosion to cause a high resistance. I then used a break-out lead to save using back probes. I checked both the coils supply voltage and grounds under operating conditions - both were good. Then I checked the ECU trigger pulse and compared the signal for both coils. The pulse to the coil for cylinders 1 and 4 had a different pattern and a



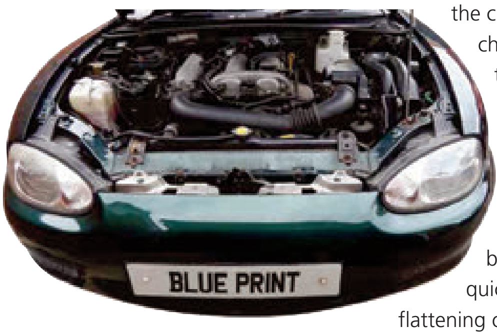
The coil pulse to cylinders 1 and 4, on top, had a higher voltage, as well as a different shape

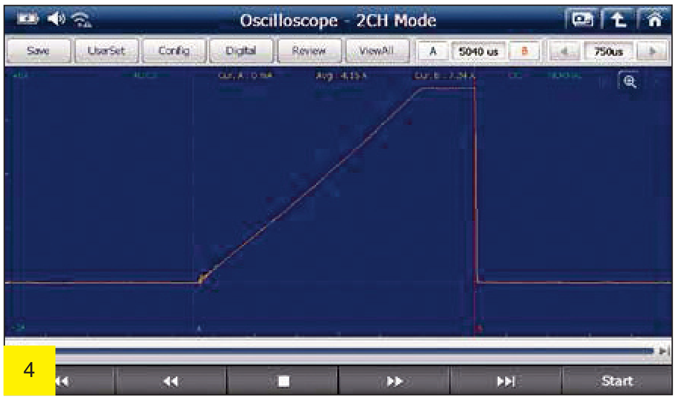
higher voltage (Figure 3).

As I was measuring between the ECU and the coils, I was measuring the voltage in a series circuit between two resistances. Did this mean I was looking at a high resistance on one of the coils?

To prove this I measured the primary ignition current of both coils under load using the current clamp (Blue Print part number BPTE1065), set to the 20 amp range. I measured the current on what I suspected to be the good coil for cylinders 2 & 3 first for reference (Figure 4).

The primary current is switched by the integrated driver end stage in this application. This provides an earth path to complete the circuit for the current to flow to charge the coil. On the oscilloscope pattern, it shows the current rising sharply to 7.24 amps. This shows that the coil is being charged quickly and is then flattening off as the coil is

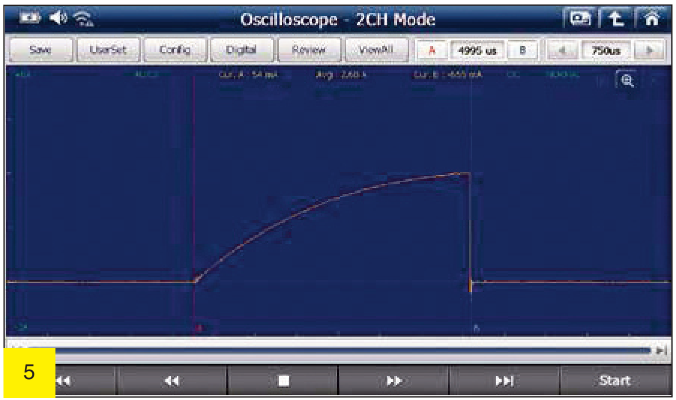




The coil for cylinders 2 and 3 charged up quickly to a maximum current of 7.24 amps

saturated. It is then being controlled by the ECU and switched off abruptly to ensure a very quick collapse of the magnetic field that generates the secondary ignition voltage.

On measuring the suspected faulty coil for cylinders 1 & 4, the dwell time was the same, but the coil was slower to charge and it only had a peak of 4 amps. With this information I concluded that the misfire was due to a high resistance in the integrated driver end stage. With this affecting the primary circuit, it will then affect the secondary ignition voltage. Quoting ohms law, if you have a high resistance, less current will



The coil for cylinders 1 and 4 charged up slowly, and only reached a maximum current or 4 amps

flow (Figure 5).

I replaced the coils on the bracket (which come as a pair), carefully removing the old plug leads. The No.3 plug lead was seized in the coil due to corrosion. This did not show up in any of my electrical tests, which meant it had a good contact and any resistance was not affecting the secondary ignition on that cylinder. However, it meant I had to replace the plug leads as well.

Diagnostics prove that even when you have diagnosed one problem, another issue sometimes comes along that you weren't expecting.

After replacing the faulty parts and road testing, the MX-5 was back to being a fun drive. A report was prepared using the G-Scan 2 utility software for the enthusiastic owner, which gave them complete satisfaction that their pride and joy had been diagnosed and repaired to a high standard.

An Astra lacking power

A 2003 Opel Astra 1.7DTI was lacking power, and the customer had been told that the engine ECU was suspected of being faulty, as it wasn't switching the boost control solenoid. Seamus Ryan of Ryans Automotive recounts how the true cause of the problem was easily determined and fixed.

On the initial test drive the Astra was indeed slightly low on power. A scan for DTC showed that no faults were present.

The next step was to check the turbo boost pressure on live data with the Tecnomotor Socio 600. The boost reading with the key on but engine off, was 1001 mbar, the atmospheric pressure, proving the sensor was at the correct starting point. The maximum boost pressure reading was checked while driving at full load, and reached 1400 mbar, showing the turbo was providing 400 mbar of boost above the atmospheric pressure of 1000 mbar. At the same time, the Socio 600 indicated the desired boost value was 1900 mbar, well below what the turbo was actually producing.

It is always a good idea to have a visual look around all of the parts and components. The turbo on this engine had a waste gate, and not the more popular variable geometry turbo. A waste gate dumps boost when demand drops rapidly, such as during gear changes. Most waste gate controlled turbos have a small boost pressure pipe connected to a waste gate actuator. When boost reaches the maximum desired pressure, the excess boost pressure overcomes the spring in the actuator, opening the waste gate and reducing boost pressure.

This Astra engine did not work on excess boost pressure to open the waste gate, it was controlled by vacuum operated boost control solenoid. When full boost was required, the solenoid has no vacuum, and the actuator keeps the waste gate closed. When boost reaches the desired pressure, the ECU provides vacuum to the control solenoid, causing the actuator to open the waste gate and reduce boost.

A quick test of the boost control solenoid and actuator confirmed they were working properly, confirming that the ECU and the boost control solenoid and circuit were working as designed.

The next step was to determine why the boost was so low. The next diagnostic step in a situation like this is to check for boost leaks with a smoke machine. The smoke machine was used to fill the entire air intake system with smoke. Any leak would have been visible by looking for smoke escaping from the intake system. But on this Astra, no leaks were seen, and the flow meter on the smoke machine see (fig.1) showed the system was tight. This proved that the EGR valve was making a good seal. If the EGR valve was stuck open, there would not have been any visible smoke from the intake system, but the flow meter would be high because of smoke escaping out the exhaust.

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A smoke test is quick and very informative and can be performed in about 5 minutes. It can reveal leaks that would never be seen, unless you knew exactly what and where you were looking for.

The next step was to check the actual boost pressure with a digital turbo pressure tester. As there was nowhere to tap into the turbo system on this car, a small needle was inserted into the rubber turbo pipe. The needle was inserted in the direction of air flow (fig 2) through the pipe so that after the needle is removed, the turbo pressure closes the hole made by the needle, eliminating any risk of causing a leak in the system. The pressure tester showed that the maximum turbo boost reached was 820 mbar (fig 3) meaning that the turbo was actually generating 1820 mbar within the system. This proved that the turbo was working as it should, and that the problem was most likely a sensor not reading the existing pressure correctly.


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Because the turbo was developing much higher boost than shown on the diagnostic tool, and therefore the ECU, the next step was to remove and examine the turbo boost pressure sensor. The problem became instantly obvious on inspection (fig 4). The turbo boost pressure sensor was badly blocked with carbon, as was the intake manifold. On cleaning the manifold and replacing the boost pressure sensor, full power was restored to the car.


4

Conclusion

Its very important to spend time studying any system first, and understand how it works before diving in. Don't allow the customer to pressure you into making a decision on what they think is wrong, or make a quick, un-informed decision, just because they may not want to pay for your diagnostic time. Nine times out of ten, you will be saving the customer money by charging for your skilled diagnostic time, and changing fewer parts.

RyansAutomotive

Clutch Clinic
VW Crafter CR 35TDi

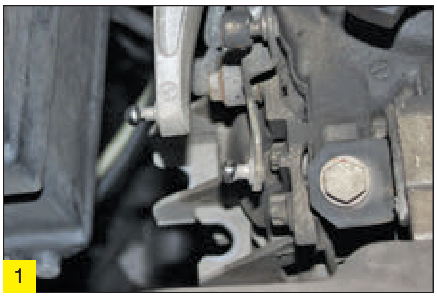
Malcolm Short, Schaeffler

The Volkswagen Crafter, launched in 2006, is becoming a popular commercial vehicle on Irish roads and is available in many model ranges. LuK takes a look at the CR35TDi LWB in this handy guide on clutch replacement.

The Crafter is a re-badged Mercedes Sprinter, but with a VW powertrain. The clutch replacement is pretty straight forward, with no special tools required for the repair. In this article we used a four post ramp, a long axle stand and a transmission jack.

Disconnect the battery earth lead and raise the vehicle. Remove both gear link cables by popping them off the linkage arms and stow to the side (fig 1). Remove the gearbox cross member support, held in place by a four nut and bolt arrangement to the chassis and two bolts into the gearbox (fig 2).

Mark the propshaft position and remove the centre support bearing bracket. Remove the bolts for the propshaft on the gearbox side and disconnect from the gearbox. Secure the propshaft to the side, as you do not need to remove it completely to lower the gearbox.



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Remove the support bracket for the DPF, attached to the exhaust and gearbox (fig 3). A wiring harness is also attached to the bracket, held by one bolt which you will need to remove (fig 4). Remove the hydraulic pipe and using a blanking plug, block the pipe so you do not lose any fluid. Cut the cable tie holding the oxygen sensor cable to the gearbox (fig 5).

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Remove the 13 bell housing bolts and keep them in order of removal, as they are all different lengths, so keeping them in order will make it easier when putting the gearbox back. Carefully lower the gearbox to the floor and remove the worn clutch.

Remove the worn clutch cover and clutch plate. In this example, the dual mass flywheel (DMF) was also replaced with the clutch and bearing. However, in most cases you have no need to replace the DMF, as it's condition can be checked in-situ for signs of heat stress and evidence of grease loss. The DMF should also be tested for free play and rock between the primary and secondary masses. LuK tool number 400008010 is specifically designed for this purpose. Full instructions and DMF tolerances can be found by searching 'DMF data sheet' on www.schaeffler-aftermarket.com.

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 (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 'getriebeseite' 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 are 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.

Check out the latest in online support at www.RepXpert.co.uk or contact the LuK technical hotline at +44 (0)1432 264 264.

LuK

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Turbo failure: causes and repair

Damage to the turbine is one of the primary reasons behind poor turbo performance, or even complete component failure. Mahle explains how contamination, of some form, is generally responsible, and steps to take after a failed turbo has been replaced.

Oil Matters

If oil carbon enters the bearing case, (Fig. 1) it can result in any or all of the following: blue smoke, loss of engine performance, loss of engine oil, contamination of the charge-air cooler, clogged exhaust gas cleaning system and with adjustable turbochargers, blocked control mechanisms.


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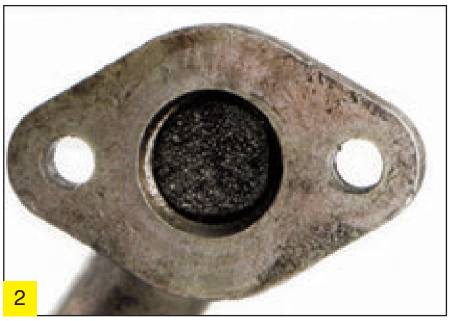
Generally, these effects are caused by poor quality engine oil, an overheating turbo or the immediate shut down of a hot engine. Therefore it is vital to use the correct grade of oil as specified by the vehicle manufacturer (VM) and to let a hot engine run for at least a minute before shutting it down.

In addition, mechanics must thoroughly clean the oil pan, and flush the oil following turbocharger damage to ensure that no foreign deposits enter the lubrication circuit. Mechanics must also pay close attention to the necessary installation instructions and performance measures during engine tuning.

Naturally, observing the VM's oil change intervals and replacing the filter with an OE replacement is a prerequisite.

Oil carbon deposits in the oil pipe (Fig. 2) can have similar effects to oil carbon in the bearing case, but can also lead to excessive turbocharger noise, and even total turbocharger failure.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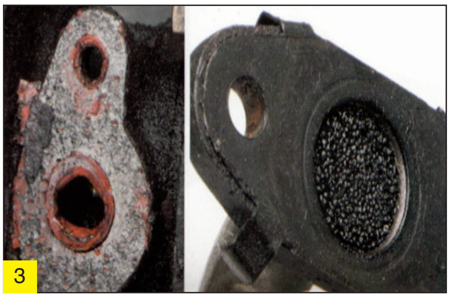
Additional causes include an overdue oil change, incorrectly installed oil pipe or a missing heat shield. Subsequent additional remedies include replacing the oil pipe and ensuring its correct installation and replacing the charge-air cooler and particulate filter if the turbocharger has been replaced.

Excessive oil consumption can often be due to a problem with the oil return pipe (Fig. 3), which in common to the aforementioned oil related issues, means that oil can be forced into the turbine and the compressor, which can affect the operation of the internal components and can collect in the charge-air cooler.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Probable causes include constriction or a bend in the oil return pipe, the use of sealing compound rather than a gasket set, the failure to replace the engine connection when replacing the return pipe, or even simply too much oil in the engine.

Mechanics therefore need to ensure that the return pipe is thoroughly cleaned, if it is to be reused, and whether reinstalled or replaced, a new gasket set must be used. In addition, the turbo must be replaced if any its internal components (VTG, by-pass, waste gate etc.) have become stiff.

Compressor Related Problems

When it comes to the air intake side of the equation, contamination of, or stress to, the compressor wheel or compressor itself will result in blue smoke (or black in the case of stress marks on the compressor wheel), excessive noise or whistling and contamination inside the charge-air cooler.

The causes can vary, but can include contamination entering the system from the crankcase vent (Fig. 4), a build up of ice or even a leak in the system from, for example, a split turbo hose.


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When it comes to the compressor wheel, stress is generally caused by dirty or an insufficient oil supply to the bearing, an increase in exhaust back pressure or a clogged air filter.

To remedy these situations, mechanics must carefully clean the entire intake system, replace the air filter with an OE replacement, clean or renew the crankcase vent and check the system for leaks. In addition, if fitted, the air compressor's cylinder head must be dismantled and cleaned. Also following the replacement of the turbocharger and charge-air cooler, the mass air flow sensor must be checked.

If the compressor wheel bearing is damaged (Fig. 5), its clearance on the rotor shaft must be checked, the engine oil flushed, a new OE filter fitted and refilled with the correct grade of engine oil, as specified by the VM.

MAHLE

For more information or general advice, please contact the MAHLE Technical Team on +44 (0)845-688-5006 or email technical.bilston@gb.mahle.com.


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Eure!Car Tech Blog highlights

The Eure!Tech Blog covers a number of problems that mechanics are facing on a daily basis. The Blog can be read at www.euretechblog.ie, and is updated on a regular basis. Here are just a few of the problems and solutions posted recently.

Kia Sorento and Santa Fe
Engine jerks or stops during driving.

A common failure in 2001-10 KIA Santa Fe 2.0 CRDi and Kia Sorento 2.5 CRDi is characterised by engine jerks and even engine stops. In this post we explain how to resolve it.

Symptoms

During acceleration, the engine responds with some unusual jerks, and may even stall completely and may be difficult to restart.

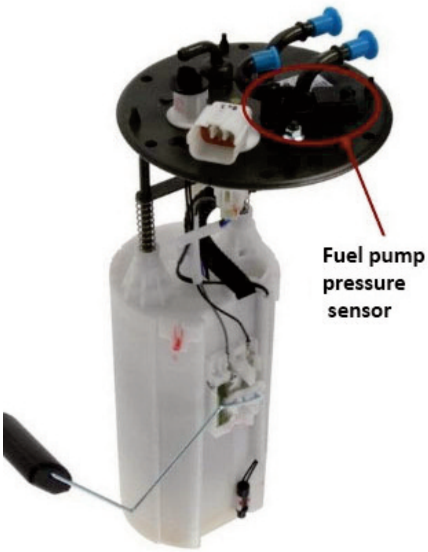
The engine light comes on and the following DTC may be stored in memory:

P1181 – Fuel pressure too low

Some other code might also be displayed, but they are probably caused by the engine stopping

Diagnosis

- Check the condition of the fuel filter. In these vehicles the replacement period is 30,000 km.
- Check the pressure of the injection rail. Power, earth and signal of the injection rail pressure sensor when the engine is working properly is shown below:
  - PIN1: Ground
  - PIN2: Sensor signal (0.5 Volt on contact / 1.2 Volt with idling engine / 2.4 Volt with engine at 3,000 rpm)
  - PIN3: 5 volt power supply.



Access the fuel gauge located under the rear seats. Check that there is no dirt or shavings inside the fuel tank. In these models, there is a problem with the paint that coats the inside of the fuel tank; its loosening causes the generation of waste, interfering with the fuel intake of the fuel pump.

Paint sludge inside the fuel pump assembly

Remedy

Clean the inside of the fuel tank, the gauge and the incorporated filter. Replace the fuel filter and also the pressure sensor within the fuel pump itself.

Difficulty or Delay in Warm Start-up in VAG Group Vehicles

This problem affects VAG group vehicles such as Audi, Seat, Volkswagen or Skoda with TDI technology, usually in BKD, BKC and 3.0 TDI engines.

Symptoms

With the engine warm, the vehicle takes too long to start.

Possible Causes

The most probable causes are:

- The battery is not in good condition.
- The starter has lost power.
- Programming Error in the Electronic Control Unit of the engine.

Diagnosis

First of all, you have to ensure the correct functioning of the first two possible causes. In most of the cases, the reason for the problem is that the internal programming of the engine ECU has changed.

This programming is what authorises the engine to start at a certain rpm (approx. 230 RPNM depending on the engine). When this error occurs, the programming has changed and now it authorises the engine to start at another number of revolutions, for example at 300 rpm, and it will not allow the engine to start as it did before.

Remedy

You have to reprograme the ECU in order to restore the default settings. In this way, the vehicle will start again at the correct crankshaft revolutions specified by the manufacturer.

The affected engine control units are made by BOSCH and they belong to the EDC family: EDC16.U1, EDC16.U31 and EDC16.U34.

The ECU type can be read off the label

Alfa MiTo 1.4 TB petrol timing belt guide

The 1.4-litre TB petrol engine used in the MiTo, features a timing belt driven water pump. As replacing the belt also requires the auxiliary drive system to be removed, Dayco recommend that all the systems' components - timing drive and auxiliary drive - be replaced at the same time. This step-by-step technical guide from Dayco will help you through the process, avoiding complications and ensuring a first-rate job.

As with all primary drive system jobs, the work should be undertaken when the engine is cold. Ideally, the vehicle will not have been run for at least four hours.

Remove the cowling from under the engine and the driver's side front wheel arch to expose the auxiliary belt system. Slacken the auxiliary belt tensioner with a spanner and take off the belt, then remove the crankshaft pulley. This will reveal two electrical connectors, which need to be disconnected, followed by the tensioner.

Take off the upper engine case, loosen the fasteners on the air filter hoses and then remove the complete air filter housing to access the timing case cover. Undo the screws of the timing case, while taking care

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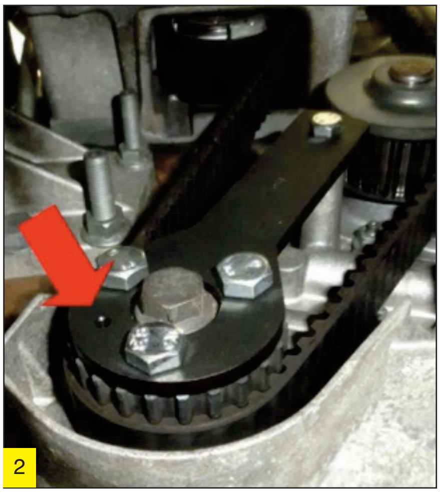
to detach the wiring connected to the upper half (figure 1) and remove both parts of the timing case.

At the opposite end of the head, remove the oil vapour collection housing, followed by the vacuum pump mounting bracket and then the pump itself, to allow the installation of the camshaft timing tool (2000034400). Returning to the timing drive end, install the crankshaft timing tool (2000004500) ensuring that the pin in the pulley is located correctly (figure 2).

After suitably supporting the engine from underneath, remove the upper engine mount and bracket to reveal the entire timing drive system. Loosen the tensioner



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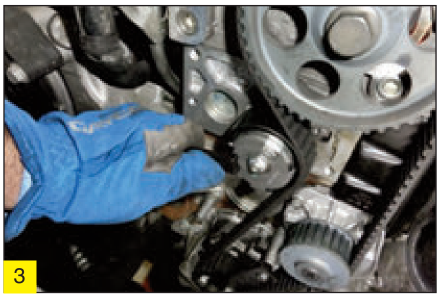
bolt. Remove the tensioner and belt, followed by the water pump.

Ensuring that the cooling system has been flushed through and no debris is present, install the new water pump from Dayco kit KTBWP2853, complete with a replacement seal.

Hold the camshaft pulley and loosen,



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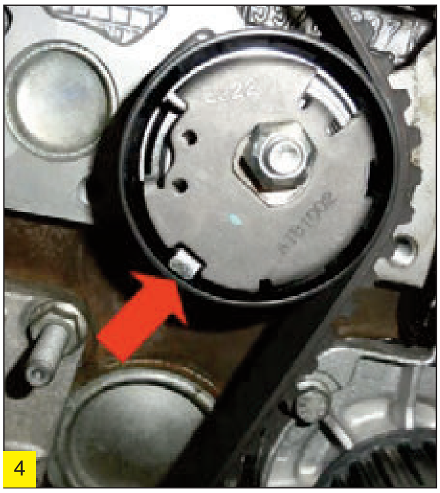
but do not remove its bolt, so the pulley can rotate on the shaft. Replace the tensioner and the belt with the new ones from the kit and using tool (1860987000), rotate the tensioner anti-clockwise to the end of its stroke (figure 3) and tighten the nut to 27Nm. Making sure the camshaft pulley doesn't move by holding it with a suitable tool, tighten the bolt to 132Nm.

Remove the camshaft and crankshaft timing tools, and by using the crankshaft pinion, rotate the engine several times and reinstall the tools. Then, while holding the tensioner with the tool, loosen the fastener and rotate the tensioner until its index is centred in the reference window (figure 4), then retighten the fastening to 27Nm.



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Remove the timing tools and refit all the components in their reverse order, but check, and if necessary, replace the alternator pulley with Dayco ALP2440, crankshaft pulley with Dayco DPV1028 (the fasteners for which should be tightened to 28Nm) and the auxiliary belt tensioner with Dayco APV1079. However, Dayco recommend the auxiliary belt 5PK1150S should always be replaced.

For more information regarding Dayco OEM power transmission products, please email info.uk@dayco.com or visit www.dayco.com.

Correctly diagnosing turbo overspeeding

When a turbocharger fails, the failure is almost certainly the result of some external fault or pressures. Melett explains the causes of turbocharger overspeeding and how to diagnose them.

Common Turbo Failures
Common turbo failure modes create much discussion between customers and our technical department. To help identify common failures, and to provide advice on how to prevent future failures from occurring, we have created a series of helpful guides.

Overspeeding is a term used when a turbo is operating well above its normal operating limits.

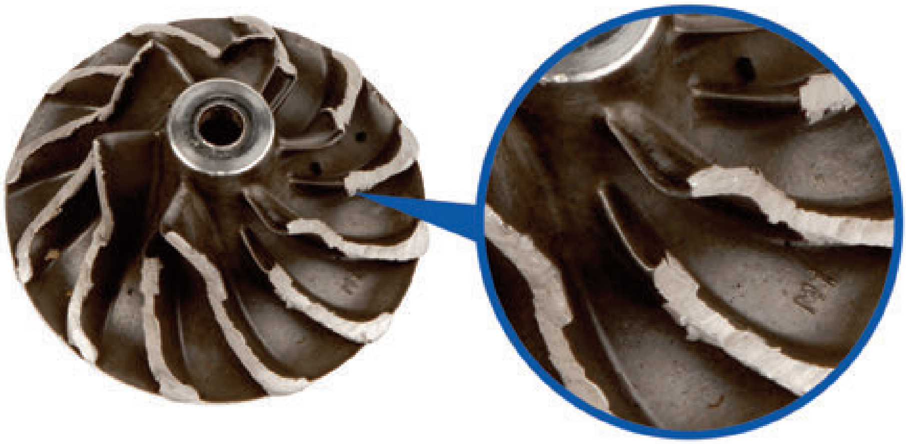
What causes overspeeding?
The most common causes of turbo overspeeding are:

- Engine modifications, including 'chipping' or 'over-fuelling'
- Inconsistent flow of air into the turbo - this can be caused by a tear in the air hose or it becoming completely detached, or by restrictions in the air intake filter or pipe work
- The wastegate or VNT mechanism has been set incorrectly
- Worn injectors
- Installing an incorrect turbo
- Loss of signal to the SREA (Simple Rotary Electronic Actuator) for the wastegate or VNT control

Visual effects of overspeeding
The most common visual indicators of overspeeding are:

- The 'orange peel' effect
- Inducer blade damage, which can be a consequence of housing rub
- Staining due to oxidation
- Partial loss of blades
- Burst wheel

The 'orange peel' effect explained
'Orange peel' effect on the back face of the compressor wheel is created by expansion and contraction. When the compressor wheel overspeeds, it grows in size. This expansion causes cracks between the grain boundaries of the metal. In mild cases, the inducer returns back to its original state (like elastic, but in most cases, these cracks begin to grow and eventually part of the hub can break away.)



During overspeeding, the inducer can grow in size and rub against the housing

Orange peel on the back of the inducer is another sign of overspeeding

Quite often, overspeeding is overlooked as a cause of the turbo failure, as the symptoms of other failures can occur as a result of this overspeeding. Material transfer and discolouration of parts may indicate a lack of lubrication. Scoring to parts could indicate oil contamination, however the particles that have caused the scoring could have broken away from the bearings as a result of the overspeeding and may also create an imbalance in the turbo.

This imbalance can also cause compressor rub and turbine wheel rub in the housings, which in turn can lead to the shaft snapping and loss to part of the inducer blades.

All in all, overspeeding causes a lot of damage and is often the primary failure mode. Recognising these features when diagnosing a failed turbo can save time and money.

For further information on this subject, contact Melett at: sales@melett.com.

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QUALITY REPLACEMENT TURBOCHARGER PARTS

Clutch Clinic

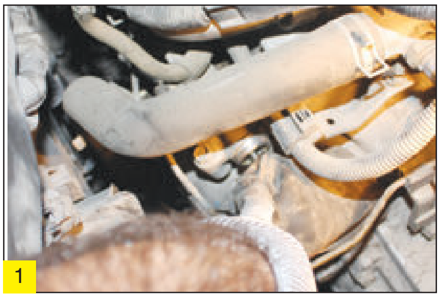
Honda Jazz II (GD) 1.4P

Malcolm Short, Schaeffler

The Honda Jazz has been around since 1982, with various engine options including a hybrid. LUK's Malcolm Short takes a look at the 02-08 Honda Jazz II (GD) 1.4 petrol, installing LUK Repset 619308900, and offers handy hints to carry out the repair within the replacement time of 4.5 hours.

For this repair we used a two post ramp, two long axle stands, engine support and a transmission jack with cradle. You will also require a driven plate alignment tool. Before starting the repair, if the vehicle is installed with alloy wheels, ensure the wheel nut locking tool is available. Disconnect the battery cables and stow them carefully and remove the battery and battery tray.

Disconnect the air sensor cable on the air filter box and remove the air filter box as a complete unit, to expose the top of the gearbox. Carefully remove the two bolts that hold the slave cylinder in place and remove the bolt that holds the hydraulic clutch line. Take care not to tear the protective push rod boot (figure 1). The slave cylinder and pipe does not require complete removal and can be stowed carefully, making sure the pipe is not bent in anyway (figure 2).



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Disconnect the reverse light switch and unclip the two clips securing the cable and stow carefully. The gear linkage cables can now be removed. Remove the clip that secures the cables in the bracket and remove the clips that hold the cables onto the linkage arm on top of the gearbox. Pop off the cables and stow carefully without bending them. Disconnect the speed sensor and oxygen sensor and stow. Install the engine support. Remove the upper transmission mount bolt and finally remove the top transmission mount bracket.

The vehicle can now be raised, and the engine under tray can be removed. Drain the transmission oil. The next stage is to remove the drive shafts, which means disconnecting the ball joints and stabilizer links on both sides. Remove the drive shaft nut, then by suitable means, push the drive shafts inside. Using a 5mm Allen key and 14mm ring spanner, release the ball joint pin (figure 3) and separate the stabilizer links from the stabilizer. Remove the spring clips and castle nut and separate the lower arms from the knuckle and remove the cotter pin and nuts and separate the ball joints. Once this has been done, remove the three bolts and heat cover and remove both drive shafts, taking care not to damage any seals from the gearbox.

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The sub frame will need to be removed next. The steering rack is attached to the sub frame, but the rack can stay attached to the vehicle as you have no reason to remove completely. Remove the two sub frame stay bolts. Detach the rack from the sub frame and gearbox by removing the bolts and brackets. Finally remove the three rear transmission mount bracket bolts.

Support the sub frame using the long axle stands and remove the sub frame mounting bolts and carefully lower the sub frame. Support the gearbox using the transmission jack and remove the rear transmission mount and bracket. Remove the protection cover from the gearbox (fig5) and then remove the front transmission mount. The starter can remain in position for this specific vehicle. Remove the bell housing bolts and air cleaner bracket and carefully separate the gearbox from the engine and lower to the floor. Remove the worn clutch, bearing and fork.

Check the flywheel for signs of heat stress or excessive wear. If the surface of the flywheel is to be skimmed, make sure that the same amount is taken from the clutch bolting surface. Failure to check and rectify these areas may cause the clutch to operate incorrectly. Clean the bell housing and remove any debris. If any oil leaks are visible, then these must be repaired before refitting the gearbox.

Before fitting the new clutch disc, make sure the input shaft is clean and free from any wear. 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 away 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.

Make sure any dowels have not become dislodged or damaged, and replace any that have. Install the gearbox and make sure the bolts are secured and all mountings are refitted before removing the supporting transmission jacks. Refitting the remaining components is the reverse of removal.

Check out the latest in online support at www.RepXpert.co.uk or contact the LuK technical hotline at +44 (0)1432 264 264.

Tech Tips

MINI radiator fan failure

The radiator fan resistor on the BMW Mini (2001 - 2006) can fail, resulting in one or both of the fan speeds no longer working, potentially causing overheating issues. Blue Print explains the steps to fix this problem.

The resistor is attached to the radiator fan and cowling assembly and is not available separately from BMW. Blue Print has the solution in the form of ADB111402.

Allow approx 1.4 hours to remove and refit the fan cowling, and a further 30 minutes to replace the resistor.

Tools required to replace the resistor:
(not including those to remove the fan and cowling):

- 8mm spanner or ratchet and socket
- Wire cutter/crimping tool
- Heat gun

Replacing the resistor pack

First you will need to remove the radiator fan assembly from the vehicle in order to gain access to the resistor pack.

Once removed, you will see the resistor pack on the top of the cowling, which is held on by two 8mm screws. (Figure 1)

Remove the two screws to release the resistor pack and then remove its cover. (Figure 2)

Next, cut the three wires as close to the terminals as possible and strip the ends of the wires ready for connecting to the new resistor pack. (Figure 3)

Locate the new resistor (without cover) into place on the fan cowling and cut the wires to length, allowing for the connectors and a little slack, and strip the ends of the wires.

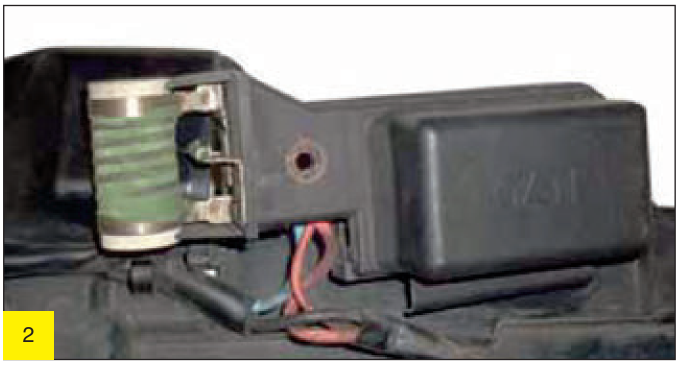
Using the supplied heat shrink butt connectors, connect the following wires together (Figure 4):

- The solid red wire of the new resistor to the larger of the two red wires of the original harness.
- The red wire with black stripe of the new resistor to the smaller of the two red wires of the original harness.
- The green wire of the new resistor to the blue wire of the original harness

Once firmly crimped, apply heat to the connectors to activate the heat shrink and form a waterproof connection. (Figure 5)

Fit the resistor's cover and tighten the two 8mm screws.

Refit the fan assembly to the vehicle.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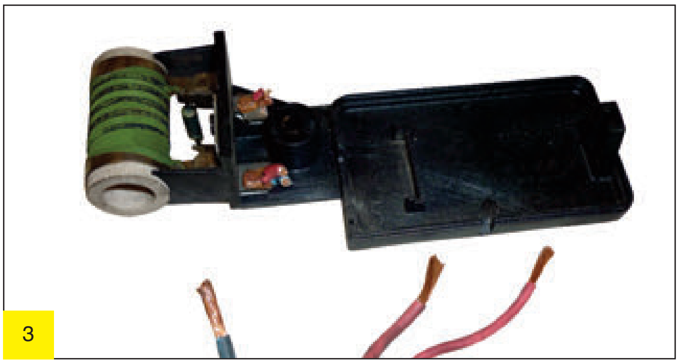
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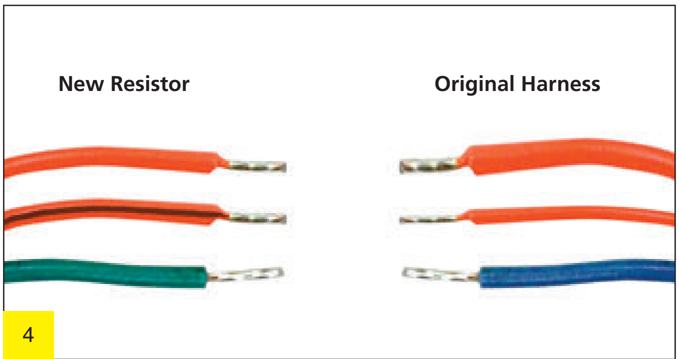

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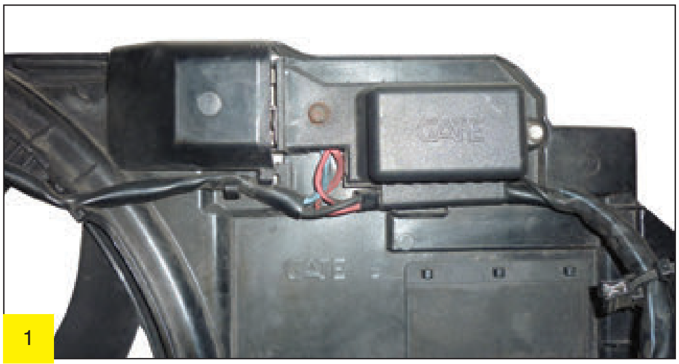
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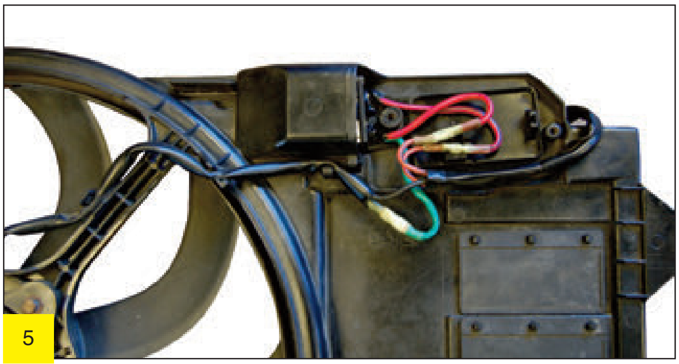
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Tech Tips

Timing belt clinic

Malcolm Short, Schaeffler

Peugeot 206 1.4 HDi 8HX/8HZ

Timing belt replacement is due every 140-160,000 miles, or 10 years whatever comes first, depending on date of manufacture, but always check the manufactures recommendations. INA takes a closer look at this popular model.

The 1.4 HDi engine was exclusive to Peugeot and Citroën, but in 1998 a joint venture between PSA and Ford produced a range of new diesel engines. The joint venture makes identical engines which are fitted to a variety of vehicles from many manufacturers including Peugeot, Citroën, Ford, Toyota, Mazda and Suzuki.

The timing belt system may look a little tricky to change, but with a little know-how and the appropriate tools, it will prove to be an ideal repair for an independent garage.

The engine has been identified as an interference type, so in the event of the timing belt failing, chance of engine damage is extremely high. It is important to install a new timing belt system on an engine while it is at ambient room temperature. Always adhere to turning the engine in the normal direction of rotation unless advised otherwise by the OEM installation instructions. Recommended torque values should always be used. It is recommended that all the tensioners, idlers and fixings are replaced as advised by the manufacturer during the timing belt replacement.

A two post ramp is ideal for carrying out timing belt replacements, it is also vital that the appropriate timing belt replacement tools are available and used, and these are readily available from most motor factors. If the vehicle is equipped with alloy wheels, it's a good idea to locate the adaptor key before you start.

Once the vehicle is on the ramp, for safety reasons and best practice, we disconnected the negative battery lead.

Remove the O/S/F wheel and wheel arch liner; this gives access to a plastic shield which can then be removed. The auxiliary drive belt is now fully visible and accessible (fig 1), make a note of routing if required, rotate the auxiliary belt tensioner clockwise to the released position, lock with a pin, remove the auxiliary belt and check for wear and deterioration. Replacement is advised during timing belt replacement.

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This vehicle was also fitted with an Over Running Alternator Pulley (OAP) which should also be tested for correct operation and replaced if necessary. At this point, unclip the wiring harness from the lower timing belt cover that goes to the crank sensor and detach from the crank sensor and remove the auxiliary belt tensioner.

Lower the vehicle close to ground level, unclip the wiring and fuel pipes from the top timing belt cover, support the engine either by means of an engine brace or engine support beam, remove the engine control unit from the engine bay, remove the engine mount cover, rubber bump stop and the engine mount. Undo the five bolts in the top timing belt cover and remove.

Raise the vehicle, insert the crank locking pin from the back of the engine through and into the back of the flywheel (this is a locking device not a timing location), located in a central position (fig 2). Undo the centre bolt on the crankshaft pulley and remove pulley and locking pin, remove the crankshaft position sensor and shield. Undo the five lower timing belt cover bolts and remove the cover. Refit crankshaft pulley bolt and rotate engine until crank, cam and fuel pump locations align. Lock crank, cam and fuel pump with pins (figs 3 and 4), slacken the tensioner and remove, and then remove the timing belt.

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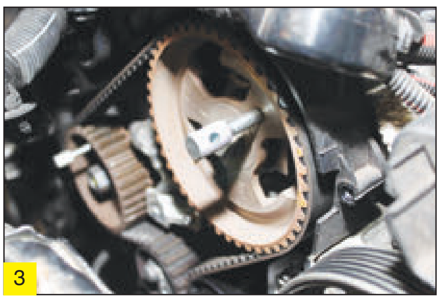

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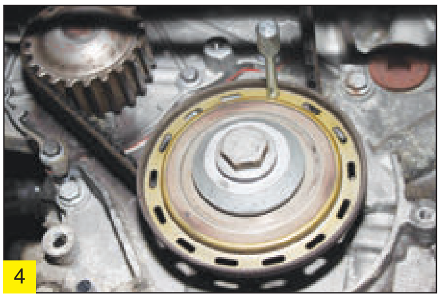

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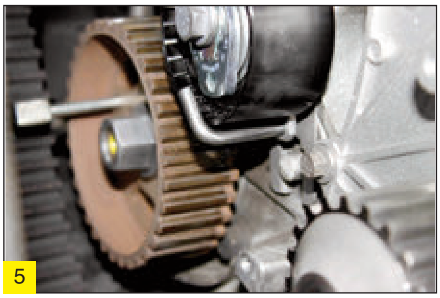
Carry out a thorough inspection of the timing belt area including pulleys and water pump. Replace the timing belt tensioner, making sure it is located correctly (fig 5), idler and fixings supplied. Replace the tensioner bolt, the idler and stud. Fit the new timing belt in the following order, crankshaft, idler, camshaft, water pump, fuel pump and then the tensioner. Tension the belt by aligning the marks on the tensioner and torque bolt. As per instructions, rotate the engine ten revolutions and recheck timing and tension, (when we carried this out the fuel pump locking pin did not line up, after two more rotations it all aligned and locked with the pins).



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Refit all components, reconnect battery lead and remember to reset the clock, radio code, electric windows and remote locking. Run the engine to ensure all is correct.

Check out the latest in online support at www.repxpert.co.uk or contact the LuK technical hotline on + 44 (0)1432 264264.

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