SOMETHING IN THE AIR

Once mainly deployed on expensive high-power vehicles, the turbo is now a mainstream component, and understanding how to deal with them with definitely help you

The drive towards greater engine efficiency has meant that more and more vehicles employ a turbo. They are great when they work, but when they go wrong the garage needs to provide a cost-effective solution.

More traditional garages may want to shy away from what they see as a niche technology, but with the right kind of support, there is nothing to worry about.

According to Phil Wilson from BTN Turbo, increasingly complex turbochargers are essential in helping vehicle manufacturers cut emissions for diesel engines, without compromising power: "One of the routes to greater efficiency is to combine two, three or even four turbos, which use low pressure and high pressure forced induction to precisely match engine speeds and loads. These units were previously used just on performance cars and are now being used on standard road cars."

Two-stage turbocharging

"BorgWarner's two-stage R2S turbochargers are used on Volkswagen's 2.0 litre turbo diesels," says Phil, "connecting two turbos in series. At lower engine speeds, exhaust gases drive a small high-pressure variable turbine geometry (HP VTG) turbo. As engine revs build to medium speeds, this turbo's wastegate opens to supply a larger, water-cooled turbo optimised for low-pressure exhaust gas recirculation (LP EGR). The exhaust gases are enriched with fresh air, feeding the LP turbo's compressor.

"As engine speeds increase further, a bypass valve cuts the supply to the smaller HP turbo and the larger LP turbo takes over. Although some exhaust gases keep the small turbo spinning, the large turbo now provides all the charged air pressure.

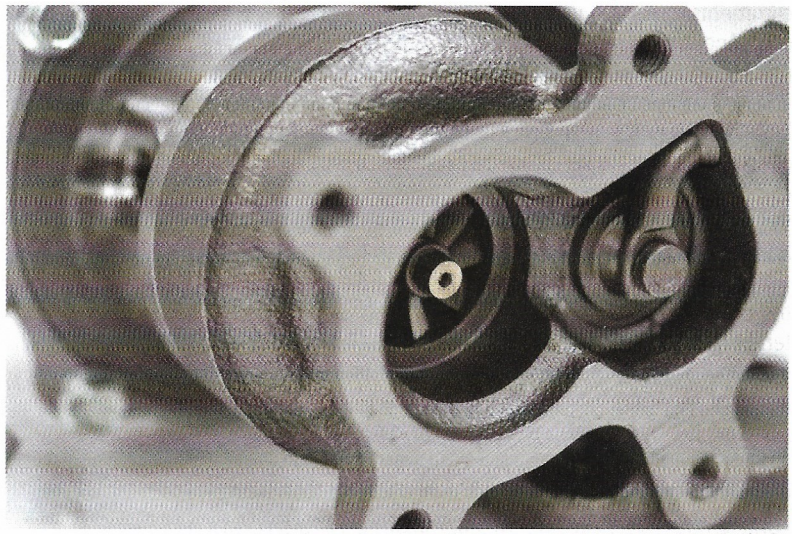
"This system improves response, with almost instant acceleration at lower engine speeds and more consistent delivery at higher speeds, and more efficient, cleaner combustion throughout."

Triple turbo

Going one step beyond, Phil explains triple turbos: "For its R3S turbochargers (used in BMW's M-Performance 3.0 litre diesel engines), BorgWarner combines two electrically-controlled VTG HP turbos with one wastegate-controlled LP turbo.

"In this triple turbo, the individual units come into play sequentially. At lower revs just the first HP turbo operates, providing immediate charge air pressure for optimum dynamic response. As engine speed and loads increase, intake air enters the large LP turbo and gradually this turbo's wastegate opens, allowing exhaust gases to drive the second HP turbo, reaching maximum charge air pressure.

"The benefits of the extra turbo are dramatic. When fitted to the same 3.0 litre diesel engine, the R3S triple turbo produces 25% more performance and 8% lower fuel consumption compared to the R2S two-stage turbo."



Above:
Turbo in detail

Quad turbo

Then there is the quad turbo. Phil comments: "BorgWarner's quad turbo is fitted to the BMW six-cylinder diesels used in their 750d XDrive, 5 Series, X5, X6 and X7 models. Based on the same principle as the R2S, it has two HP turbos plus two smaller LP turbos. The first HP turbo quickly generates charged air pressure without turbo lag. As engine speeds increase, the LP turbos come on stream, both smaller units working together. At higher speeds, the final HP turbo is introduced, for maximum output. This approach produces an even faster response from the turbos, providing extra power and smooth torque curve without increasing the system's weight."

The increased intricacy of the system has a real-world pay-off in terms of better emissions says Phil: "These are

complex systems, but with their technology means more becomes less. Impressive gains in efficiency are balanced with lower emissions, helping to keep diesel engines competitive at a time when many purchasers are moving away to petrol, hybrid or electric power."

Phil adds: "The complicated nature of these turbos, particularly the precise operation of their VTG, wastegate and bypass valves, mean they require specialist knowledge from turbocharger experts."

Commenting on the increasing prevalence of turbochargers, David Eszenyi, Commercial Director at Ivor Searle says: "The market for turbochargers continues to increase as this technology becomes more mainstram within the vehicle parc. The growth in the popularity of diesel cars and light vans that has taken place over the last two decades is a key driver behind this growth. Today, all of these diesel vehicles are turbocharged."

While diesel engine sales have taken a bit of a hit, all those millions of diesel vehicles out there will continue to need support from the aftermarket for some time to come. David observes: "As the mass of diesel vehicles progressively get, there will be an inevitable increase in the number of turbo failiures. This will mean greater driving demand for replacement units."

It's not just diesel though, as we know. David comments: "It is also interesting to note that we are seeing a gradual increase in demand for turbos on petrol-engined vehicles, in line with the introduction of more compact gasoline engines that are designed to be highly efficient."

Failure

Discussing the causes of turbo failure, David observed: "Contamination, resulting in problems such as restriced oil supply, is the root cause of turbo failiure. Particles from incomplete combustion can build up in the turbo over time, causing faults such as the vanes sticking in variable geometry tubos. This initially results in power loss and can eventually lead to component failure."

There are anumber of causes, and problems with other components can manifest in the turbo according to David: "Contamination can also be sent upstream into the turbo due to problems exhaust system, such as blocked or restricted DPF. With this in mind, we always recommend that workshops replacing a customer's turbo always check the vehicle's DPF at the same time and, if necessary, get it professionally cleaned. Physical damage can also occur due to debris being ingested into the compressor housing, damaging the turbo's compressor blades."

Remanufacture

In many instances, a remanufacted turbo may be the best option. David explains why remanufacturing can be a popular choice: "Costing up to 40% less than original equipment options, Ivor Searle remanufactured turbochargers provide independent workshops with a competitive advantage in today's price-sensitive market. This is without compromising on quality, warrany protection or customer service. In order to achieve this, we employ the same quality-focused ethos from over 70 years of engine remanufacturing expertise in our turbo remanufacturing facility, which is certified to ISO 9001:2015."

David adds: "For peace of mind, all Ivor Searle turbochargers are provided with a transferable two-year unlimited mileage parts and labour warranty. We also hold comprehensive stocks to minimise vehicle downtime and provide free next day UK mainland delivery on stock items ordered before 3.30pm."

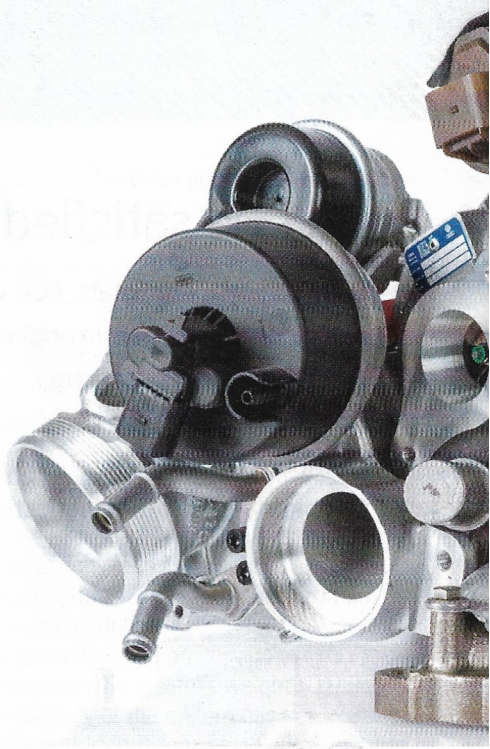
It's not just about the device itself, it's how it is treated. Proper maintenance and care will help a turbo go far, literally. Additives can provide some assistance here.

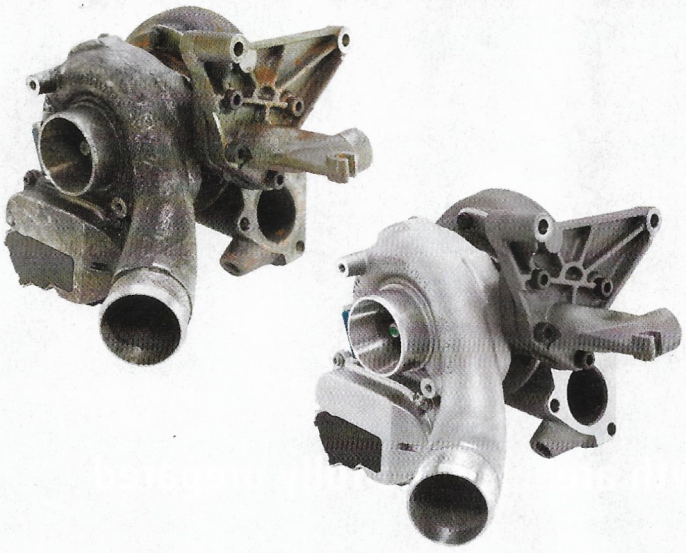
"Due to their extreme engine speeds, correct lubrication is crucial for turbochargers," says Harry Hartkorn, Head of Application Technology with LIQUI MOLY. This not only causes a massive increase in wear and tear, it can also result in preliminary damage that drastically shortens the service life of the turbocharger. This is precisely what is lacking when a turbocharger is replaced or re-installed after repair. Here, there is a particularly high risk of wear and tear as well as damage. But that's easy to prevent. The turbocharger additive made by LIQUI MOLY protects this sensitive piece of engineering when it is put into operation for the first time.

Harry explains how it works: "The LIQUI MOLY turbocharger additive reduces wear and tear when running in a turbocharger. When a new turbocharger is installed or the old one is repaired, the bearings are dry. If the engine is started in this state and the turbocharger runs for the first time, the engine oil has not yet lubricated all the bearings. Several 100,000 revolutions per minute without sufficient lubrication – that's bound to impact on the material. This not only causes a massive increase in wear and tear: it can also result in preliminary damage that drastically shortens the service life of the turbocharger.

"The LIQUI MOLY Turbocharger Additive is designed to prevent this. The combination of active agents in the tube includes a high proportion of the solid lubricant MoS2. This MoS2 sticks to the metal surfaces of the bearings, ensuring lubrication the first time the turbocharger runs. This prevents failure while at the same time increasing the turbocharger's lifetime. Using this additive is very straightforward but offers huge benefits – so it's recommended every time a turbocharger is exchanged or

Right: Turbo from BTN Turbo





BorgWarner's REMAN turbocharger

Remanufactured turbochargers play a key role in BorgWarner's aftermarket portfolio. Remanufactured during a complex process, they are a low-cost, environmentally friendly and high-quality repair alternative. With these turbochargers, BorgWarner offers its customers a fair value solution for vehicles at a later stage of life. The company currently offers approximately 800 different remanufactured turbochargers for more than 5,000 different applications worldwide. During remanufacturing, each product is analyzed, dismantled and cleaned to restore the parts to their original state of cleanliness. Reusable components are identified and all wearing parts are replaced. The entire manufacturing process is monitored to achieve maximum durability and quality.

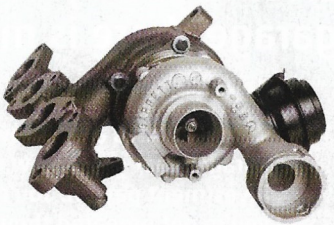
www.borgwarner.com

Turbo hoses

Although still sometimes thought of as a dealer-only product, First Line's range of turbo hoses now encompasses more than 700-part numbers, to provide the aftermarket an extensive coverage of the UK car parc. Popular applications include Ford Focus/C-Max 1.8 TDCi (First Line part number FTH1564), Ford Transit Connect 1.8 02> (FTH1291), Ford Mondeo 2.0TDCi 00-07 (FTH1292), GM Insignia 2.0D (FTH1394), Nissan Qashqai 1.5 DCi (FTH1709) and VAG A3, Leon, Golf V 1.9 TDI (FTH1078). First Line also offers slower-moving examples such as BMW E90/E90N/E91/E91N/E92/E92N (FTH1623), Ford Focus 2.5T 08-11 (FTH1592), Mercedes Sprinter 06> (FTH1363) an VAG A4/A6/Passat 1.9TDI 98-05 (FTH1097).

www.firstlineltd.com

Remanufactured turbos from Ivor Searle



Ivor Searle's all makes turbocharger programme covers diesel and petrol cars and LCVs with new applications constantly being added. The company provides free next day UK mainland delivery on stock items ordered before 3.30pm as well as a two-year unlimited mileage parts and labour warranty on all our turbochargers. Internal components are renewed as a matter of procedure and each turbo's rotating assembly is balanced on a computerised VSR machine to recalibrate the unit to OE specification before undergoing final quality inspection.

www.ivorsearle.co.uk

repaired."

Harry adds: "The little tube with the turbocharger additive belongs to LIQUI MOLY's Pro-Line. This is the product line for special chemical tools used by the professionals."