

BTN
TURBO

AUTUMN
2005

Revolution

The magazine for BTN Turbo customers and suppliers
including news, views and technical updates



MANUFACTURER PROFILE

BorgWarner Turbo Systems

tomorrow's turbo technology on today's cars



SPIN DOCTOR

How a turbocharger works

Le Mans 2005

A record-breaking victory for Audi and Garrett

WIN

A FANTASTIC DRIVING DAY AT SILVERSTONE!



Welcome to Revolution

2

When we launched Revolution magazine earlier this year we were pleasantly surprised by the positive feedback that we received from readers, in the form of calls, letters and emails. You seemed to like the mix of information and news and it's given us something to live up to with this, our second issue.

As the largest independent distributor of turbochargers in the world, we aim to support the factors and vehicle repairers who depend on us to supply replacement turbos quickly and efficiently, and to provide advice on all aspects of turbocharging. Some of the facts and figures that we quote in this issue illustrate just how many turbocharged vehicles there are on the road today. Sooner or later, they're all going to need some turbo attention!

Inside Revolution 2

In this issue, you'll find an article outlining the basic principle of turbocharging. It is surprisingly simple in its basic form, but technology is moving very fast, as you will see in our profile of BorgWarner Turbo Systems. We also look at the success of the Garrett®-boosted Audi R8 in June's Le Mans 24 hour race and, by way of contrast, we see how turbocharged diesel power is becoming popular in the marina (that's the harbour, not the seventies' Morris car!)

Win a Silverstone Track Day

BTN offers you the opportunity to spend a day driving at Silverstone! Enter our simple competition and you and a friend or colleague could be off to for an adrenalin-filled day behind the wheel, in everything from a Lotus Elise on the track to a 4x4 on the specially constructed off-road course.

More staff, more assistance

BTN Turbo is growing quickly, with eight new members of staff recently recruited and an extension to our warehouse. We'll profile the new people in a future issue and, in this edition, you can meet Peter Hesham and Peter Allpress. The two Peters are the faces you're most likely to see in your office or workshop. Those of you who deal with us by telephone will know the names of Derek O'Dea and Michelle Farmilo, who are also featured in this edition.

Web site update

If you missed the first issue of Revolution you can download it from our web site, www.btnturbo.com. It's worth checking out to see details of our 'New for old' policy on many replacement turbos and the 12 Month No Quibble Guarantee on all commercial vehicle turbochargers.

The web site, which is constantly updated, is also a useful source of reference for fault finding; helping to identify your turbo; build sheets; our catalogues; and news about BTN Turbo in general.

If you have any comments about Revolution or requests for topics to be included in future editions, please get in touch. It's your magazine and we want it to reflect the issues that affect your business.



Rachel Birch

Editor
RachelB@btnturbo.com





Bigger warehouse - better service

BTN Turbo has recently added 3,000 sq ft to its warehouse space in Uxbridge, which means it can stock more units and offer an even faster despatch service to help the customer who needs a replacement turbo in a hurry.

BTN moved into its Uxbridge base in January 1995 and, at the time, it seemed enormous. "We could have played five-a-side football in the space", recalls Mark Dickinson, Sales and Marketing Director. "1993/4 saw the business almost double in size and the last ten years has seen further rapid growth in the company. We are forecasting a 20-30% year-on-year increase in business in 2005." Turnover is expected to be around £8.5 million and the company holds at least £2.3 million worth of stock.

Despite the extra space, the current expansion is seen as a stopgap measure. Managing Director, John Brice, says, "As the use of turbochargers in all kinds of vehicle continues to grow, we anticipate more demand for our services and a move to new premises is part of our five year plan."

BTN COMPETITION...

...WIN a Silverstone Track and Rally Experience!

SEE BACK PAGE FOR DETAILS

Meeting industry leaders

Since the last issue of Revolution, BTN Turbo has joined two important trade associations – **SMMT** and **ADS**. In both cases it gives us access to the latest information about automotive developments and the chance to network with other members, share knowledge and identify market trends.



The Society of Motor Manufacturers and Traders is the voice of the automotive industry in the UK. It provides extensive data on both the UK and international markets – for example we can identify new vehicle registrations by type and even by postcode if we want to! Our membership of SMMT will help us to forecast demand for turbochargers based on European vehicle production figures, and so enhance our service to you.



The Association of Diesel Specialists is the worldwide diesel industry's leading trade association, dedicated to the highest level of service for diesel fuel injection and related systems. It provides an international forum for all segments of the diesel industry to communicate, interact, and share information and it works actively to educate legislators and regulators, the public and the ADS membership to understand and acknowledge the importance of the diesel industry to the well being of society.

Mark Dickinson, BTN's Sales and Marketing Director, recently attended the ADS International Convention and Tradeshow in Las Vegas, where topics for discussion included 'Weather Forecast for Diesel Technology: Cleaner Diesel on the Horizon, But Expect Partly Cloudy and Potentially Stormy Periods' along with manufacturer seminars from such leading companies as Delphi and Bosch; and meetings with other replacement parts suppliers.

"These seminars focus on the next ten years of diesel and turbocharging technology. They give us an insight into the changes coming and they allow us to position ourselves to be proactive in coping with the aftermarket demands of the future," he said.



Allan McNish slides through the Dunlop curve



Tom Kristensen, Marco Werner and JJ Lehto on the podium

Kristensen & Co drive Au



Tom Kristensen and JJ Lehto on the starting grid



Marco Werner practises in the wet

The 2005 Le Mans 24 Hour race was the final outing for the Garrett-boosted Audi R8 and it couldn't have been more impressive: Tom Kristensen (Denmark), JJ Lehto (Finland) and Marco Werner (Germany) took the Audi R8 to its fifth victory in the world-famous French endurance classic, in what will be remembered as one of the most fiercely contested races in the history of the event.

A record crowd of 230,000 spectators saw a stunning demonstration of Audi's corporate slogan 'Vorsprung durch Technik'. Whilst ambient temperatures of 35°C caused a large number of the 49 cars entered to drop out, the three Audi R8 sportscars of Audi's importer teams from the USA and France ran immaculately throughout the 24 hours and clinched first, third and fourth positions, thanks to their reliability.

Kristensen, Lehto and Werner didn't put a foot wrong during the 24 hours, taking Team ADT Champion Racing to its first victory at Le Mans – and the first win for an American team since 1967. In addition, Audi works driver Tom Kristensen opened a new chapter in Le Mans history: the Danish driver won arguably the toughest race in the world for a record seventh time, surpassing previous record holder Jacky Ickx. It was JJ Lehto's second victory after his inaugural win in 1995. For Marco Werner, a dream came true when he stood on the top step of the podium at only his fourth attempt.



Tom Kristensen on his way to his seventh win

Audi and Garrett® to record Le Mans win

The team, which won the Sebring 12 Hour race in the USA at the beginning of the season, led the race from the fourth hour to the finish. Tom Kristensen performed miracles: as the advantage over the second-placed Pescarolo-Judd had come down to less than one lap on Sunday at noon, Kristensen stayed in the cockpit for a stint of three and a half hours to avoid one more driver change and so save time.

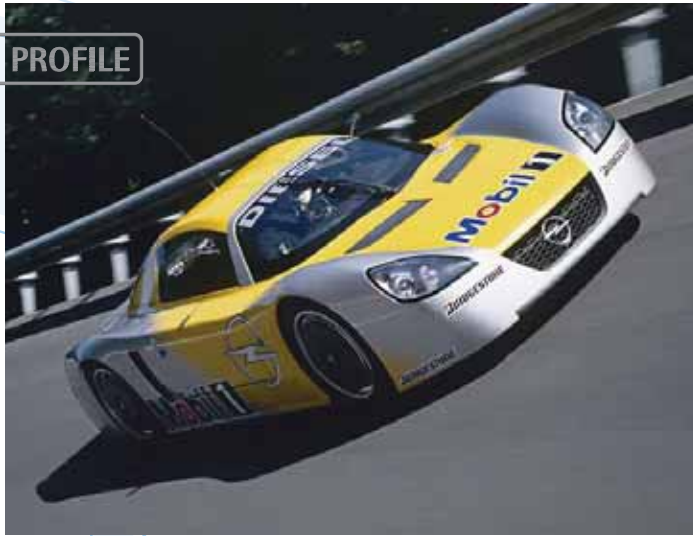
Frank Biela (Germany), Allan McNish (Scotland) and Emanuele Pirro (Italy) finished third in the 'American' Audi R8 sister car. Biela/McNish/Pirro lost their chance to fight for overall victory on Sunday morning due to a puncture, causing a run-off that necessitated a change of the front right suspension. The all-French Audi PlayStation Team ORECA, driven by Jean-Marc Gounon, Franck Montagny and Stéphane Ortelli, had to change the right front suspension twice and still came home fourth.

Out of a total of six starts since 2000, the Audi R8 has won the Le Mans 24 Hour race five times. "This is a fantastic result," said Dr Martin Winterkorn, Chairman of the Board of AUDI AG, who had green-flagged the race at 16.00 hours the previous day as Honorary Starter. "There is no way for a more impressive demonstration of the slogan 'Vorsprung durch Technik' in motorsport than at Le Mans. To clinch the fifth Le Mans victory in more difficult conditions than in

previous years is a remarkable feat. It was only possible thanks to the unique reliability of the Audi R8. We want to continue meeting this challenge in the future and it is no secret that a new sports prototype is under development at Audi Sport for the 2006 season."



MANUFACTURER PROFILE



The ECO-Speedster, 110mpg at 110 mph

BorgWarner Turbo Systems

Driven by technology

BTN Turbo is a leading European distributor for BorgWarner Turbo Systems, a division of the globally active automotive supplier BorgWarner, Inc. A foremost supplier of innovative turbocharging systems and a technology partner to the automotive industry worldwide, BorgWarner Turbo Systems offers a broad range of products for passenger cars and commercial vehicles in the engine output range of 20-1000 kW, as well as for industrial, locomotive and marine engines.

Future technology – on the road today

Whether for the Audi A2 or Bentley Continental, Opel Corsa or Porsche 911 Turbo, Mack truck or MAN Rallye-Truck, BorgWarner Turbo Systems develops tailor-made turbocharger systems for all types of application or performance. Recognised as a highly innovative company, the organisation has developed a wide range of advanced technologies.

BV-turbocharger helps the Opel ECO-Speedster to set 17 new world records

BV products, utilising the latest variable turbine geometry (VTG) technology, offer improved thermodynamics and an optimised control response with significantly greater reliability. In 2003, the 112 bhp, 1300cc Opel ECO-Speedster created 17 international records in a 24 hour test. The car, equipped with common rail multijet direct fuel injection, four valves per cylinder and a BV39 VTG turbocharger, competed against special vehicles with turbocharged diesel engines between 1.1 and 1.499 litres. Its victories included fastest average speed (at just under 140 mph, it beat the previous record by 61mph); fastest lap (average speed 159.37 mph); and greatest top speed over one kilometre with a flying start of 159.66 mph. An identical vehicle was made available to international journalists for testing on public roads, which returned an astounding 110mpg!

A version of the same ECOTEC engine and BV turbo combination is used in the Corsa and Agila. While they are not tuned to the same level, they are decidedly quick and environmentally friendly, and they meet the stipulations of the EURO 4 standard.

You can find more information on BorgWarner Turbo Systems at www.turbos-bwauto.de

Did you know ?

Britain's best selling cars

In the forty years from 1965 to 2004, only five models have topped the UK best sellers list. Can you name them?

[See following page for answer.](#)

The top ten best-selling new diesel cars in 2004

Source: SMMT

Ford Focus	(42,296)
Ford Mondeo	(38,562)
Volkswagen Golf	(38,245)
Renault Mégane	(36,305)
Volkswagen Passat	(27,972)
Peugeot 307	(26,155)
Vauxhall Vectra	(25,232)
Vauxhall Astra	(24,675)
BMW 3 Series	(21,864)
Citroën Xsara	(21,139)

BTN Turbo stocks turbochargers for all of them!

Diesel car registrations double in ten years

In 1995, a total of 405,079 new diesel cars were registered in the UK. This was less than 25% of all new car registrations.

By 2004, the figure had risen to 835,334 and diesel now accounts for almost 50% of all new car registrations.

That's a lot of turbos on the road!



The 2 stage R2S™ economically rockets the BMW 535d to 155 mph

BMW's world beater – a diesel saloon that does 0 – 60 in under 6.5 seconds and is limited to 155 mph!

How diesels have changed! BMW's new 535d is setting new standards in performance and economy (around 30 mpg) thanks to the R2S™ regulated 2-stage turbocharging system developed by BorgWarner Turbo Systems. Using a small KP39 high-pressure turbocharger combined with a larger K26 low-pressure unit, it ensures smooth and progressive acceleration throughout the rev range, eliminating turbo lag completely. At low engine speeds the smaller unit provides 95% of the torque and, as the revs increase, the larger turbocharger kicks in to compress the induction air and even out the power delivery, taking over completely above 2,500 rpm. This is a first for BorgWarner and further manufacturers are set to introduce engines with R2S™ systems in the near future – both in the passenger car and commercial vehicle fields.

eBooster – the innovative way to reduce fuel consumption and pollutant emissions

eBooster is an electrically assisted turbocharger system that is being developed for future generations of vehicles. Using a flow compressor driven by an electric motor placed as a component before or after the compressor it works in two stages, in much the same way as two turbo-machines connected in series. In doing so, the pressures of the two charging units are multiplied, permitting the development of small and efficient high-performance turbocharged engines whose dynamic response matches that of large non-supercharged engines of the same output class. Additionally, because the eBooster and exhaust turbocharger are separate units, the system has the advantage that thermomechanical stress on the electrical and electronic components is significantly less than with electrically assisted turbochargers.

BorgWarner Turbo Systems' technological edge gives automobile manufacturers important competitive advantages and it comes as no surprise that virtually every manufacturer in the world takes advantage of the know-how of this turbocharger specialist.



Did you know ?

From the Autoblog web site last year:

Mercedes dumps Kompressor engines

The Kompressor designation applied to the supercharged C, E and SLK-Class Mercs will soon disappear, as the automaker has decided to forge a future return to the turbocharger of old. Starting with the 2.0 litre turbo in the forthcoming A-Class, the other kind of forced induction will spread throughout the range.

Needless to say, BTN Turbo will keep pace with Mercedes-Benz, stocking a full range of replacement turbochargers available for this prestige marque.

Commercial vehicle registrations continue to rise

In the ten years since 1995 the total number of commercial vehicle (CV) registrations in the UK has risen by more than 50%, from 249,925 in 1995 to 389,923 in 2004.

4x4 registrations in 2004

They might be known as 'Chelsea Tractors' but, surprisingly, there are cities where 4x4s are more popular than in London. In Edinburgh, 7.82% of all new registrations were potential off-roaders. Sheffield came second with 7.02% and London was in third place with 6.98%.



1999-2004	Ford Focus
1990-91 and 1996-98	Ford Fiesta
1982-89 and 1992-95	Ford Escort
1967 and 1972-81	Ford Cortina
1965-66 and 1968-71	Austin 1100/1300

Britain's best-selling cars

Owning a power boat used to allow you the freedom to visit any marina in the U.K. or Europe – but that's not the case any more, if you have a petrol driven craft. It is becoming increasingly difficult to obtain petrol due to high maintenance costs and low demand. Boat owners face the aggravation of carrying fuel from the nearest car petrol station and then they have the potential safety hazard of on-board storage. Additionally, petrol engines are expensive to run compared to diesel or LPG, and petrol boats have a low resale value compared to diesel driven vessels.

That's why many owners are changing their power plant. They are usually happy with the layout and performance of their boats and simply want a different fuel. The options are generally diesel or gas.

Diesel - the seaw

The problems with gas are that they still have petrol onboard; gas stations are even scarcer than petrol depots; and they have to find more space for a new, heavy gas tank.

All of this means that diesel is a wise choice for today's boating fraternity. The advent of lightweight, high rpm, turbocharged diesel engines has opened up a market for removing the old petrol engines and bolting in a marine diesel, retaining the original stern drive.

In conjunction with BTN Turbo, Lancing Marine of Portslade, in Sussex, has developed a marine version of the four cylinder Ford 2.4 litre Puma turbo intercooled engine, as used in the

Putting a face to the name

In the last issue of Revolution we introduced you to the marketing team of Mark Dickinson and Rachel Birch. Now we'd like you to tell you more about the people you're most likely to meet face-to-face, and the voices you may know from the sales office.

Derek O'Dea is the Sales Office Supervisor. He joined BTN as a stopgap measure after leaving college and he must like it because, seven years later, he's still here. His outlook on BTN is that "We are the biggest; we are open earlier; we work later; we have more stock; and if we haven't got it, we can get it!" Derek likes to get home in time to play with his young son, a pastime that has taken over from his previous hobby, which he describes as 'alcoholic beverage appreciation'.



newest Transit, for just this purpose. Mark Dooley of Lancing Marine explains, "It has an aluminium head and a timing chain rather than a belt. A mechanical injection pump replaces the computer-controlled injection and the turbo, specified by BTN, allows the engine to achieve excellent torque at low revs as well as good acceleration when required."

Mark goes on to explain the engine replacement process: "Either the complete old engine is returned to our workshop, or the customer removes the interfacing housing, wiring harness and any other ancillaries. These are all adapted onto the Ford engine, which is already dyno tested to 145hp at 3900rpm. Being a package, we supply all the other coupling components, mounts, flex mounts, exhaust parts and extra instrumentation, ready to plug in and run."

orthy solution

On the boat, all the owner has to do is clean out the petrol tanks, modify the engine mount position and install the exhaust parts. He can then mount the engine, plug in the wiring harness and connect the fuel. A new prop maybe required, depending on the engine that has been replaced. Finally, a fuel return has to be added back to the tank and a turbo boost pressure gauge retro fitted to instrument panel.

Turbocharged diesel power is clearly the way forward for today's boat owners. It gives the performance they are used to at a lower cost, and the freedom to go wherever they want in Europe in the knowledge that fuel will be easily available.



Customer Service Representative

Michelle Farmilo has been with us for nearly four years, joining us after attending Thames Valley Chamber Training and securing an NVQ in business administration. During the day she's committed to customer service and her free time involves socialising, shopping and travelling the world.



Sales Manager **Peter Hesham** has been in automotive for 20 years (five years with BTN) and is proud of the fact that BTN is the only company to offer genuine product as a distributor for all major turbocharger manufacturers. He is passionate about sport, listing Manchester City, golf, cricket and

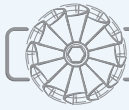


American football as his main interests. He was once asked if he could supply a turbo for a Reliant Robin – could it have been from Peckham?

Peter Allpress our Key Account Manager joined us over six years ago, having previously worked for one of our customers – he must have been impressed by BTN! His personal interests include turbos (yes, really), computers and his kids. Peter has also had the Reliant Robin enquiry and is convinced that there are lots of people who think you can just bolt a turbo onto any engine.



The most important thing that everyone comments on is the team spirit and 'can do' attitude that we all share. BTN Turbo still feels like a family business with a great atmosphere – we hope that shows when you're working with us.



SPIN DOCTOR

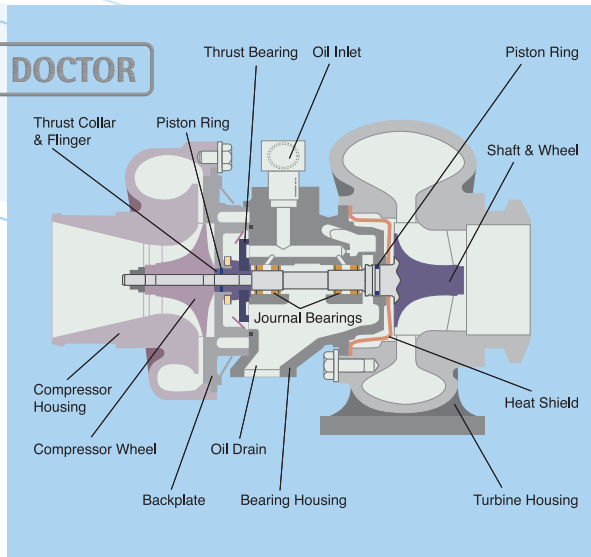


Figure 1

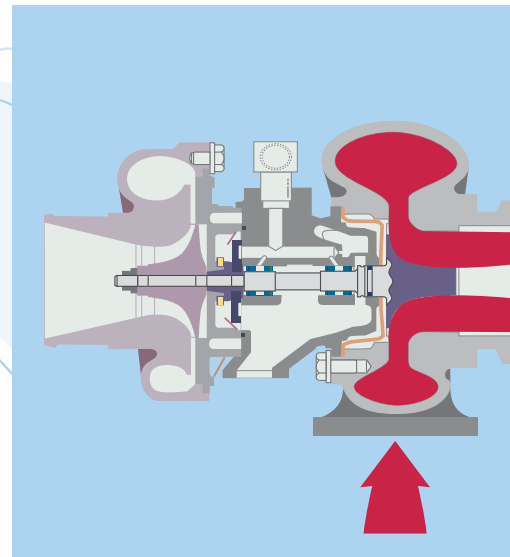


Figure 2

The principle of turb

The four-stroke piston engine, whether petrol or diesel powered, is by far the most common power unit in use for passenger cars, commercial vehicles and all kinds of vehicles and plant in the industrial, marine and agricultural sectors. In order to explain how a turbocharger works we must first look at the four-stroke cycle.

The four stages of the cycle – commonly known as Suck, Squeeze, Bang and Blow – are as follows:

Suction (charge exchange stroke)

In a diesel or petrol injection engine, the piston moves down and air is drawn through the intake valve. In a carburettor petrol engine, the air is mixed with petrol.

Compression (power stroke)

As the piston moves back up, the air or petrol/air mixture is compressed.

Expansion (power stroke)

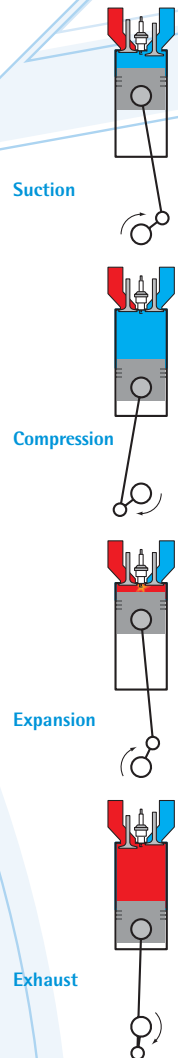
In all petrol engines, the fuel/air mixture is ignited by a spark plug; in the diesel engine, fuel is injected under high pressure and the mixture ignites spontaneously. In either case, the explosion drives the piston downwards.

Exhaust (charge exchange stroke)

The exhaust gas is expelled through the exhaust valve when the piston moves up.

In a turbocharged engine, the air is pre-compressed before being supplied to the cylinder during the suction stroke. Because it is at a higher pressure, a greater mass of air is held in the combustion chamber, which means that fuel is burned more efficiently. This increases the engine's power output, giving more torque and a higher top speed compared to a normally aspirated engine of the same swept volume, and reduces emissions.

Some diesel engines can also be set up to accept more air but the same amount of fuel, which does not increase the power but results in cleaner exhaust gases.



In the next
issue of
Revolution

Fitting a turbo
and bypass
housing

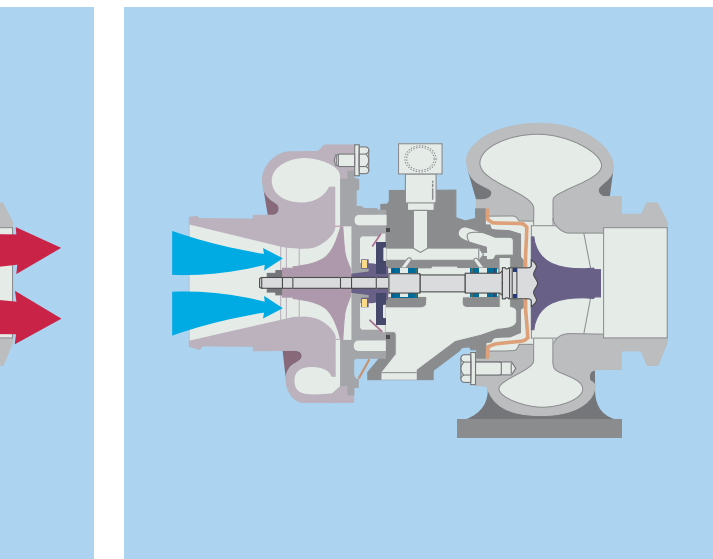


Figure 3

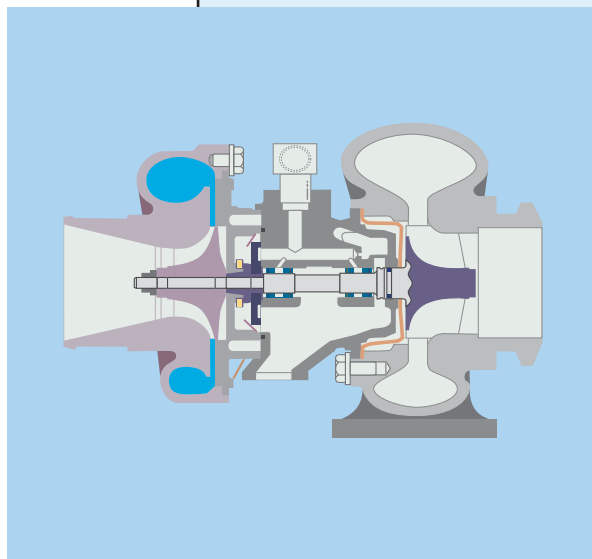


Figure 4

ocharging . . .

Supercharger or turbocharger?

There are two basic methods of pre-compressing the air before it enters the combustion chamber. Supercharging involves a compressor driven mechanically from the engine: this will improve performance but not to the full potential, as an element of the extra power is needed to drive the supercharger itself.

Turbocharging, on the other hand, uses the exhaust gases expelled during the exhaust stroke to drive a turbine connected to a compressor which supplies compressed air to the engine. There is no mechanical link to the engine and the exhaust gases would be expelled anyway – the turbo simply uses the 'free' power of the waste gases as they pass by.

How the turbocharger works

Figure 1 shows the main parts of a turbocharger.

Figure 2 shows how the exhaust gases (red) drive the turbine, which rotates at up to 230,000 rpm.

The turbine is connected by a centre shaft to the compressor, which draws in ambient air through an air filter. As the air passes over the compressor wheel it accelerates to a very high speed (Figure 3).

Once past the compressor wheel it passes through a diffuser, which is formed between the face of the backplate (or centre housing) and the machined face of the compressor housing (Figure 4).

Many systems incorporate a cooler between the compressor and the cylinder, as the compressed air, moving at high speed, can reach extremely high temperatures.

The idea of turbocharging is not new

As long ago as 1885 and 1896, Gottlieb Daimler and Rudolf Diesel respectively investigated ways of increasing the power output and reducing the fuel consumption of their engines by precompressing the combustion air. It wasn't until the 1950s and 1960s that the first turbochargers were fitted to commercial vehicles but, since that time, development has been continuous. Most manufacturers now produce turbos with variable turbine geometry (i.e. moveable vanes on the turbine for greater flexibility) and, as you will see elsewhere in this magazine, we are seeing the development of two-stage turbo-charging systems (BorgWarner's R2S™) and electrically assisted charging systems. This level of complexity means that fewer turbos are suitable for repair or remanufacture; however, BTN Turbo holds large stocks for immediate delivery and can give you any advice that you require on this now essential part of the drive train in so many vehicles on the road today.

If you would like to know more BTN have published a CD demonstration of the basic principles of turbocharging – for your free copy contact Rachel Birch at:

BTN Turbo
BTN House, Arundel Road
Uxbridge Trading Estate
Uxbridge
Middlesex UB8 2RP
Tel 01895 466 666



Entry form

1. Who were the three drivers of the winning Audi R8 at Le Mans this year?

.....
.....
.....

2. What is the name of BorgWarner's two-stage turbocharging system, used in the BMW 535d?

.....

3. How many square feet has BTN Turbo recently added to its warehouse?

.....

4. How many commercial vehicles were registered in the UK in 2004?

.....

Name

Position

Company

Address

.....

Postcode

Daytime tel. no.

Email address

Send your completed entry to Revolution competition, BTN Turbo Ltd, BTN House, Arundel road, Uxbridge Trading Estate, Uxbridge, Middlesex UB8 2RP, to arrive no later than 30th November 2005.

Photocopies of the entry form are acceptable if you don't want to cut up your copy of Revolution!



GOOD LUCK!



WIN...



...a Silverstone Track and Rally Experience!

We've got a pair of tickets to The Silverstone Track and Rally Experience to be won in a simple-to-enter free draw. The winner and a colleague or friend will spend a day at the world-famous circuit, which is the home of the British Grand Prix, driving a host of fabulous vehicles both on the track and on specially-prepared courses.

The Experience combines the speed and agility of cars like the Lotus Elise with the rough and tumble of 4x4 off-roaders. Highly experienced instructors share their knowledge of driving and racing skills to guide you round the track and courses by the quickest and safest means. You will learn new driving techniques and you will leave Silverstone after this fabulous day with some great memories and a higher level of driver confidence.

You'll drive vehicles such as the Audi TT, Lotus Elise and Single Seater on track and the Peugeot Gti Rally, Land Rover Defender, Skid Car, Caterham Autotest and Quad Bikes on specially prepared courses. A high-speed ride with a race instructor and a pit stop challenge add to this high-energy day.

To be entered into the draw to win this fabulous prize, correctly answer the questions, complete your personal details and send the entry form to the address shown.

Conditions

1. The free draw is open to all employees of motor factors and vehicle repairers who answer all four questions correctly.
2. Entries must be received at Revolution competition, BTN Turbo Ltd, BTN House, Arundel road, Uxbridge Trading Estate, Uxbridge, Middlesex UB8 2RP, no later than 30/11/05.
3. No purchase necessary.
4. The prize comprises two tickets for the Silverstone Track and Rally Experience, to be used on the same day (a list of available dates will be made available to the winner). There is no cash alternative.
5. The winner will have to make his/her own way to Silverstone: travel is not included. The event starts at 8am and ends at approximately 5.30pm.
6. All timings and events may be subject to change due to weather and track availability.
7. The winner (and companion) must weigh no more than 16 stone, be between 5'2" - 6'2" tall and have held a full driving licence for at least a year, which will need to be presented on the day.
8. The name and employer of the winner will be announced in the next issue of Revolution. Entrants agree to the use of their names, and pictures, in this publicity.
9. The judge's decision is final and no correspondence will be entered into.