

TurboNews

1/08 Issue

The Info Magazine of BorgWarner Turbo & Emissions Systems

The comeback of the bubble car

CINQUECENTO CELEBRATES REVIVAL
WITH TURBO DIESEL



Vorsprung durch Turbo

Audi peeps up the TT with two powerful turbocharged engines

Setting new trends

Nissan Qashqai impresses with its innovative concept

Double victory

BorgWarner once again receives PACE Award

A company in motion

Dear Readers,

BorgWarner Turbo & Emissions Systems is set to invest around \$125 million in the expansion of its worldwide capacities over the course of the next few years. This investment is necessary to keep up with demand, as the turbocharger specialist has enjoyed unparalleled success as a development partner to auto manufacturers. Technological leadership, not just thanks to the first VTG for gasoline engines or regulated two-stage turbocharging systems for passenger vehicle diesel engines, but also the leading VTG and R2S technology for commercial vehicles are important cornerstones for the continued success of BorgWarner.

From sports coupés to small cars, from SUVs to family sedans, from trucks to tractors, the range of vehicles that now run more economically and environmentally friendly thanks to BorgWarner products is greater than ever. You can find some examples of this in the articles on the Audi TT, Fiat 500, Nissan Qashqai, Renault Laguna and Deutz TCD 2013 in this edition of TurboNews.

BorgWarner is currently working intensively on setting the necessary conditions for its planned growth. Reports detailing activities at the turbocharger manufacturer's various sites therefore form the second key focus in this edition of TurboNews.

We hope you have fun reading!

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BORGWARNER EXPANDS ITS GLOBAL PRODUCTION CAPACITIES

Creating new capacities

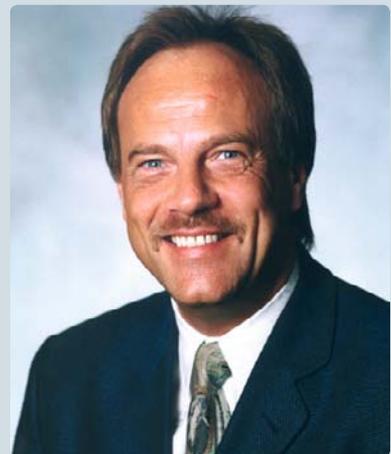
The ever greater global success being enjoyed by exhaust gas turbocharging in both passenger vehicles and commercial vehicles represents great challenges for turbocharger manufacturers. Production capacities have to be extended, organized and integrated into the supply chain above and beyond typical industrial growth. Supply bottlenecks and capacity limitations also represent a daily challenge for BorgWarner Turbo & Emissions Systems. Having set ourselves the goal as technological leader to always meet customer requirements promptly and to their complete satisfaction, we are working intensively on expanding our production sites.

In Europe, North America and Asia we are investing significant sums in the rapid expansion of our production capacities. In 2007 we opened a new facility in Korea and also developed our facility in Bradford (Northern England) into a high-tech production site. In Hungary we have more than doubled our production areas, while in Poland we are currently constructing a new production site. And in Campinas (Brazil) we have created space for extending our production capacity with the opening of a new aftermarket warehouse. Further BorgWarner facilities are currently under construction in Mexico and Thailand. We will be sending out more information on these shortly.

However, the expansion of our own capacities is only half the challenge that we must face. To facilitate our growth targets, our suppliers must also significantly expand their capacities. Opti-

mization of the entire supply chain and simultaneous expansion of both internal and external capacities are therefore decisive factors for our future success. Our supply chain team is therefore working intensively worldwide on optimizing the process chain and integrating suppliers closely in processes of change and growth. One example of this is the Supplier Day we organized in April for around 30 key supply partners.

Being successful in such a dynamic market also requires companies to continually set themselves new challenges, to explore new avenues and make new commitments. The staff members at BorgWarner Turbo & Emissions Systems show great commitment every day in working to meet the expectations of auto manufacturers. We are keen to prove to our customers that our success is justified. As a leader in innovation, we want to demonstrate how hard we are working to remain the reliable first choice partner in future.



Ulli Fröhn, Vice President Sales & Marketing at BorgWarner Turbo & Emissions Systems.



THE NEW CINQUECENTO WITH TURBO DIESEL IS LIVELIER AND MORE ECONOMICAL THAN EVER BEFORE

The comeback of

The auto manufacturer Fiat is currently being showered with awards: Car of the year 2008, Top Auto 2008, Auto Bild Design Award 2008... and these coveted awards are not being presented for a luxury saloon or a sports car, but for the retro model of the Fiat 500. With a design and innovative technology, this vehicle, previously also called the „bubble car“, is making the kind of comeback that famous film stars can only dream of.

The old Fiat Nuova had a two cylinder, four stroke inline engine, which sat in the rear and provided just 13.5 bhp. No comparison to the current Cinquecento, which has inherited only its model name and design elements from its ancestor. In total, three modern engine variants are available: Two petrol engines with 69 and 100 bhp and a diesel engine with 75 bhp. All engines already meet the requirements of the Euro5 standards.

Small diesel, lots of fun

The diesel engine is a technical masterpiece in miniature format, weighing just 130 kg when completely equipped: The 1.3 Multijet 16V is currently the smallest and most modern second generation common rail diesel engine with direct injection. Over two million of these units have already been produced. The four cylinder inline engine with a cylinder capacity of 1,248 cm³ has four valves per cylinder, which are directly controlled by the two overhead camshafts with hydraulic valve tappets. It is fitted with a particularly compact BorgWarner KP35 turbocharger with a fixed turbine geometry and charge cooler and has a maximum output of 75 bhp at 4,000 rpm. The engine reaches its maximum torque of 145 Nm at the low engine speed of 1,500 rpm. The turbo diesel gives the new Cinquecento excellent

driving performance: The top speed is 102 mph, and the dinky Italian car can accelerate from 0 to 60 mph in just 12.5 seconds.

Less consumption, lower emissions

The mini-diesel also impresses due to its environmental compatibility: With fuel consumption of around 50 mpg in urban traffic, 65 mpg over land and 56 mpg with a combined driving style, the engine is extremely economical. The low CO₂ emission value of just 179 grams per mile is just as pleasing. What's more, Fiat fits all Cinquecento models with a particle filter as standard, which completely regenerates and cleans itself – and thus has the same life expectancy as the vehicle itself. With the 75 bhp 1.3 Multijet 16V, Fiat has taken a real technological and innovative leap which offers the customer clear advantages: A reduction in fuel consumption and exhaust gas emissions without compromising the driving performance.

Externally retro, internally comfortable

The design of the Fiat 500 isn't only appealing to retro fans. Stylistic parallels to its historical predecessor are found above all in the lines of the bodywork, the round headlights and the trim, which



all draw on the former design elements. The new 500 is even available in the original colors of its predecessor. But that's where the similarities end. For the new Cinquecento is presented as a modern compact car with ample space and good driving comfort, and all models,

the bubble car



A classic reinterpreted: The Fiat 500 with attractive design and innovative engine technology.

including the basic version, are equipped with ABS, airbags, power steering, central locking and more.

All in all, Fiat has succeeded in developing a retro vehicle that achieved instant cult status on its release, while at the

same time meeting all the requirements of a modern automobile. The modern engines have certainly contributed to this – in this case in particular the small turbo diesel, which combines excellent driving performance with low fuel consumption.

NISSAN QASHQAI IMPRESSES THROUGH ITS INNOVATIVE CONCEPT AND ECONOMICAL TURBO DIESEL

Setting new trends

SUV in compact class format

The Qashqai is the first European compact class car to result from the Renault-Nissan alliance. Although it has the features of a thoroughbred SUV, it is designed more for the urban jungle than for all-terrain use – a concept underlined by Nissan with its „urban proofed“ advertising slogan.

The Qashqai basically has the body of a compact class vehicle. But with its high chassis, large bumpers and lateral impact bars, it gives a real feeling of adventure. The unique front and rear lights are also make it stand out. With its extraordinary front design, Nissan has implemented the latest pedestrian protection guidelines, which have been difficult for SUVs to achieve in the last few years. In terms of safety, the manufacturer has hit the mark. The Qashqai obtained 37 out of 37 possible points in the Euro-NCAP crash test and is therefore the current record holder.

Powerful and economical

Despite its chunky appearance, high ground clearance and 4x4 capabilities, the Qashqai drives like an exemplary compact class passenger vehicle in terms of fuel consumption. This is particularly true when it has the modern 1.5 dCi turbo diesel engine under the hood. For – unlike most all-terrain vehicles – the Qashqai's four cylinder common rail turbo diesel with second generation direct injection impresses due to its extraordinarily efficient fuel

consumption of 49 mpg of diesel. And this in no way impairs the driving performance, as shown by its acceleration from 0 to 60 mph in 12.8 seconds and a top speed of 110 mph.

More efficiency thanks to VTG

The million-selling 1.5 dCi was designed by Renault and is already used in many of the Group's vehicles. The engine, which is famous for its low fuel consumption and low noise emission, adheres to the Euro4 emissions standards, compresses at a ratio of 15:3 and has the benefit of a high-performance turbocharger in the lower speed range. The BV39 turbocharger is supplied by Borg Warner Turbo & Emissions Systems and has a variable turbine geometry, which guarantees optimal adjustment of the turbine vanes to the corresponding engine operation point. Thus, the turbocharger helps the small turbo diesel to achieve a performance of 106 bhp and a maximum torque of a considerable 240 Nm.

The small common rail turbo diesel is not only the most economical engine available for the Qashqai. Even in comparison with all other SUV models of the same size, the Nissan Qashqai fleet with the 1.5 dCi is the clear winner in terms of consumption. Here, it is obvious that even small engines – such as Renault's 1.5 liter K9K engine – can offer good driving performance in large vehicles and can also excel with low fuel consumption. This is more in step with our environmentally-conscious times now than ever before.



Nissan has launched a really unusual car on the market in the shape of the Qashqai. It is a model belonging to the practical compact class but with the prestigious appearance of an SUV – it is manageable and comfortable, with modern technology, but not over the top: This is the successor to the Nissan Almera. The Japanese auto manufacturer is setting a new trend, and the sales figures prove that it is on the right track. The new member of the compact class is a successful rival to the established competition.



The Nissan Qashqai: An SUV for the metropolitan jungle.

BORGWARNER WINS PACE AWARD FOR
TWO-STAGE REGULATED BOOSTING

Double victory

On 14 April 2008, the 14th PACE Awards ceremony took place at the Max M. Fisher Music Center in Detroit (USA). The „Premier Automotive Supplier's Contribution to Excellence Awards“ were presented by Automotive News, Microsoft, SAP and Transportation Research Center Inc. (TRC Inc.). Having already won in 2005 and 2007, BorgWarner was delighted to accept its third PACE Award. The automotive supplier with global operations received an award for its R2S technology.

The PACE Award ranks among the most renowned prizes in the automotive industry. It recognizes the success of automotive suppliers in the development of advanced products and processes. BorgWarner has already received the highly coveted award twice in the last four years. In 2005 the company won an award for its pioneering DualTronic technology, which is today used in almost all double-clutch transmissions. In 2007 the award went to BorgWarner Turbo & Emissions Systems – in recognition of its variable turbine geometry (VTG) system for gasoline engines. The jury paid tribute here to the successful cooperation between BorgWarner and Porsche on the 911 Turbo.

The most powerful turbocharging technology

This year, one of the most powerful turbocharger concepts that the automotive industry has ever seen was honored in the “European products” category – the regulated two-stage boosting system (R2S) – also from BorgWarner Turbo & Emissions Systems. “We are extremely proud to have won this award. It represents another great achievement and underlines the success story of our company”, explains Tim Manganello, CEO at BorgWarner. “The development trends throughout the world in the field of drive systems are clearly moving toward greater eco-

nomy and lower emissions while simultaneously offering improved performance. BorgWarner is the leader among automotive suppliers here. We already offer the drive technologies today to meet precisely these requirements.”

Best of both worlds

With the regulated two-stage turbocharging system, two turbochargers are arranged in series – one large low-pressure turbo and one small high-pressure turbo. At low revs, the smaller, high-pressure turbocharger provides spontaneous engine response and eliminates the turbo-lag. As the revs increase, the



With the prize for R2S technology BorgWarner received its third PACE Award.

BORGWARNER TURBO & EMISSIONS SYSTEMS EXPANDS PLANT IN OROSZLÁNY

Capacity expansion in Hungary

Exhaust gas turbocharging is increasingly becoming the norm in combustion engines. The growth in demand from the automotive industry for high-tech turbochargers – particularly in Europe – is just as strong. To further improve the availability of the desired turbocharging systems, BorgWarner Turbo & Emissions Systems has significantly expanded its production site in Oroszlány, Hungary.



The R2S system combines cost-effectiveness with top performance.

large low pressure unit is then engaged. This larger unit ensures a continuous increase in power output and then takes over the entire boosting function above a certain speed. With this turbocharging technology, engines are able to meet the toughest requirements in terms of torque, response and power output – all while remaining extremely economical.

Premiere in BMW

The two-stage booster system, which celebrated its world premiere in 2004 in the BMW 535d, has since been incorporated in more and more vehicle classes. And from late 2008, another German OEM is set to use the award-winning turbocharging technology from BorgWarner in its engines.

Equipped for the future

The official opening ceremony of a modern production hall was held at the end of last year, marking the expansion of the production area of the Oroszlány plant by nearly 5,000 square meters to 13,500 square meters. The opening ceremony in Oroszlány, which is around 50 miles west of Budapest, was attended by Roger Wood, President and General Manager of BorgWarner Turbo & Emissions Systems, the American Ambassador April Foley, the Hungarian State Secretary of the Ministry for the Economy Géza Egyed, Plant Manager Kornél Schmidt and other representatives from the field of politics and economics. *“Reducing fuel consumption and improving driving dynamics and environmental friendliness are the three driving forces behind engine development,”* emphasized Roger Wood at the opening ceremony. *“Thanks to our increased capacity we can introduce innovative technologies and products and are well equipped for the increasing demand in Europe.”*

Tailor-made manufacturing

The success of BorgWarner’s Hungarian plant is not only based on the rapid growth of the turbocharger business, but can also be attributed to the many years of successful cooperation with a large number of customers. In addition to innovative production technologies, the site also offers the possibility of individually adapting the assembly lines to the customer’s requirements.

Rising demand in Europe and Asia

In Hungary, BorgWarner produces turbocharging systems for around 50 different passenger vehicle models. The production volume rose in several steps from around 50,000 turbochargers in 2001 to the current 1.5 million turbochargers. There are now over 600 employees at the plant. Due to the rising order figures, several new buildings were added to the Oroszlány plant in 2004. Production of impellers and part of the manufacturing of shafts and wheels have now been relocated to the new halls. The well-designed infrastructure on site means the turbocharger manufacturer can supply leading car manufacturers in Europe, China and Mexico.



RENAULT LAGUNA'S EFFICIENT TURBO DIESEL IS CONVINCING

Vive l'efficience!

With the third generation of its medium class model, Laguna, Renault is starting a quality offensive that is to move the French brand into the top three in the quality ranking again. In addition to its elegant design (the Laguna Grandtour was nominated the most beautiful series-produced car of the year at the 23rd Festival Automobile International in Paris at the start of 2008), the significantly more economical turbo diesel engine is also a winning point for Renault customers.

Renault has fitted the new Laguna with the 1.5 liter common rail K9K diesel engine, which has already proven successful in other models. In addition to being particularly quiet, this compact engine offers the very good driving comfort expected by medium class car buyers. With a performance of 110 bhp (81 kW), the Laguna 1.5 dCi accelerates from 0 to 60 mph in just 12.1 seconds. On average, its fuel consumption is approximately 53 mpg. Renault is therefore setting new efficiency benchmarks by using such a small diesel engine in a medium class model for the first time.

VTG turbocharger vouches for quality

The Renault Laguna is fitted with the powerful turbocharger model produced by BorgWarner for the K9K engine. This is a third generation BV39 exhaust gas turbocharger with variable turbine geometry (VTG), a vacuum dashpot and bearing housings in air-cooled designs. These tried and tested technologies are not only the basis for the extraordinary engine efficiency, but also for the high quality standards aspired to by Renault.

A success story

The use of the K9K diesel engine in the Laguna, on which Renault's hopes are pinned, marks a further milestone in its success story so far. It is also further proof that turbocharger specialist BorgWarner is continuing to meet its customers' high quality performance and technology leadership requirements – also and in particular for small diesel engines.

BorgWarner is sole supplier since 2000

The dynamics and efficiency of the 1.5 dCi are due in particular to an advanced exhaust gas turbocharger by BorgWarner Turbo & Emissions Systems. BorgWarner has been the sole supplier since 2000 when Renault started using what was the smallest diesel engine on the market – then as the EU3 version in various applications. With the current EU4 and future EU5 variants, which are to be rolled out from the middle of the year, BorgWarner will remain the sole supplier in future too – not least of all due to the constantly high level of quality it provides.



With the new Laguna, Renault wants to return to the top of the quality ranking.

DIXON IS MAIN SITE FOR EMISSIONS PRODUCTS

BorgWarner goes green

If you leave the congested and busy streets of Chicago and head west for approximately one hundred miles you will stumble into Dixon, Illinois. Although the town has just 15,000 or so inhabitants and appears more idyllic than industrial, this is where BorgWarner produces important technology for the automotive industry.

Dixon is a small town which has more parks per capita than any other city in Illinois. President Ronald Reagan lived here in his youth – and probably enjoyed it very much. Rock River runs through the heart of the town and its banks are the source of many recreational activities the town has to offer. With this much natural green acreage maybe it's no coincidence that Dixon is also the most important site for BorgWarner's environmentally friendly emissions systems product line.



Quality since 1962

The Dixon production facility opened in 1962 and has undergone five expansion projects since. Amid a total of 155,000 sq. ft. (130,000 sq. ft. manufacturing and 25,000 sq. ft. office space), the site runs a three-shift workforce consisting of 250 employees. For many years, Dixon has been applying lean manufacturing concepts and is currently in year four of deploying Six Sigma methods and tools for problem solving. In addition to being an OSHA VPP (Occupational Safety & Health Administration Voluntary Protection Program) site, the facility is TS 16949 and ISO 14001 certified. The permanent desire to improve is clearly reflected in the quality: last year, the team in Dixon achieved an excellent error rate of 10 ppm (Parts per Million).

The leader in emissions

The Dixon plant generates approximately 75 percent of BorgWarner's emissions systems sales. Its main customers are Toyota, Chrysler, Ford, General Motors, Volkswagen, BMW and Porsche. The company supplies these and other auto manufacturers with exhaust gas recirculation (EGR) systems, secondary air pumps and actuators, which guarantee improved engine performance, greater fuel economy and reduced exhaust emissions. As emissions and fuel economy regulations become increasingly stringent, the Dixon facility continues to be the leading provider in this market segment. To ensure that this site adapts optimally to the requirements of this market, it has an engineering site, in which the functionality and durability of new products are tested.

Equipped for the future

With a product portfolio that includes innovative emissions technologies for light and heavy commercial vehicles, and with a wide customer base, BorgWarner's Dixon site is in an optimal position to achieve long-term success. The site is working intensively on being the ideal partner in future too, supplying the automotive industry with „green products“.



DEUTZ DEVELOPS TURBO DIESEL FOR ON-HIGHWAY APPLICATIONS

On the road

For a long time, the well-established commercial vehicle engine manufacturer Deutz was best known as a supplier of engines for the off-highway segment. But a few years ago, Deutz managers decided to change this and tie in with the successes of earlier days in the on-highway segment. In spring 2006, the company was able to celebrate a successful comeback with the supply of engines for medium-weight commercial vehicles and busses.



The Deutz TCD 2013 makes the Fendt 936 Vario one of the world's most powerful series-produced tractors.



again



Turbocharging in different versions

The advanced TCD 2013 engine for commercial vehicles played a major role in this successful comeback. During the development process, engineers focused primarily on achieving an intelligent combination of combustion optimization and exhaust gas after-treatment. The unit is a liquid-cooled, inline engine with either four cylinders and a 4.8 liter displacement or six cylinders and 7.2 liter displacement. The two units allow for engine performance of 214 to 365 bhp. They are turbocharged by different versions of the powerful S200 turbocharger, which is supplied by BorgWarner Turbo & Emissions Systems and is produced at the Bradford plant in England. The turbocharging system, which has been ideally matched to the different TCD 2013 models, allows for a maximum torque of 800 to 1,200 Nm in both engine versions, even at low speeds of 1,200 rpm.

Fit for Euro5

The TCD 2013 complies with the European emissions standard Euro4. With some minor changes, it can be modified to comply with the Euro5 standard, which officially comes into force on September 1, 2009. This can be done by simply adapting the injection strategy

and increasing the SCR efficiency. Deutz is therefore already in a position to offer its customers a Euro5 incentive engine. The main attraction for commercial vehicle manufacturers is that they are now already able to offer their customers Euro5-compliant commercial vehicles, for which a lower toll is charged for long-distance journeys.

An engine for all applications

The main purchasers of the Deutz TCD 2013 in the truck sector are Volvo Truck and Renault VI. For its part, Volvo Global Truck is taking advantage of its close links with Deutz: The Swedish manufacturer has a stake in Deutz.

In the off-highway segment, Deutz supplies the TCD 2013 engines to Fendt Tractors. Since 1997, the company has been part of the American AGCO Corporation which combines globally successful agricultural machines and tractor manufacturers under one roof. Fendt uses the Deutz TCD 2013 in its largest tractor series in particular. The 936 Vario tractor is the famous manufacturer's flagship model and, with the 365 bhp output produced by the Deutz turbo diesel engine, it is top of the performance scale. In the total

market too, the Fendt 936 Vario is one of the fastest and most powerful series-produced tractors in the world – built to work reliably and efficiently under the toughest operating conditions over a long period of time.

Overview of the Deutz TCD 2013 models

TCD 2013 L06 4V Truck

- Controlled S200 turbocharger for outputs of 279 to 323 bhp
- Uncontrolled S200 turbocharger for an output of 240 bhp

TCD 2013 L04 4V Truck

- Controlled S200 turbocharger with new N-compressor from the B series with milled aluminum wheel for an output of 214 bhp
- Controlled S200 turbocharger with new N compressor from the B series with cast aluminum wheel for outputs of 160 to 190 bhp

TCD 2013 L06 4V

- Controlled S200 turbocharger with new N compressor from the B series

AUDI PEPS UP THE TT WITH TWO POWERFUL TURBOCHARGED ENGINES

Vorsprung durch

Audi is one of the most successful companies in the international automotive business, as is demonstrated impressively by the vehicle manufacturer's record balance sheet with an operational profit of € 2.7 billion. Compared with the previous year alone, this represents an increase of 34 percent. Audi's success is not least of all due to the popularity of the TT, which was exhibited with two pioneering engines at the Geneva Motor Show in March.



The new Audi TT 2.0 TDI: One of the first sports cars with a diesel engine.

Sports coupé with turbo diesel

With the TT 2.0 TDI, Audi is setting new trends in the sports car sector. The dynamic coupé is one of the first sports cars to have a diesel engine and, according to Audi, it combines pure sportiness and high performance with sensational efficiency. The two liter, four cylinder turbo diesel engine has a performance of 170 bhp, allowing acceleration from 0 to 60 mph in 7.7 seconds and a top speed of 140 mph. The new TT also

excels with extremely low fuel consumption of 50 mpg of diesel fuel and low CO₂ emissions, clearly fulfilling the strict Euro5 standards.

Special features of the engine include advanced technologies such as common rail direct injection and a turbocharger ideally matched to the engine. BorgWarner Turbo & Emissions Systems contributed a BV43 exhaust gas turbocharger with third generation variable turbine geometry to the turbo diesel

engine. With its optimal thermodynamic design – together with the excellent performance parameters of the BV43 – and a vacuum actuator with position sensors, it was also possible to significantly improve the torque development. The BV43 is also equipped with a milled impeller as well as an integrated pulsation silencer.

Economical sports car

The top model of the TT series is the new Audi TTS, which was also exhibited in Geneva by the premium car manufacturer. It is equipped with a revised two-liter TFSI engine and the all-wheel drive Quattro. With 272 bhp and acceleration from 0 to 60 mph in just 5.2 seconds, the TTS guarantees pure driving pleasure – without any negative impact on fuel consumption. The sports coupé runs on super unleaded at an impressive 35 mpg.

The new TFSI unit offers around 30 percent higher performance than the existing 2.0 TFSI engine. As with the TT TDI, an advanced BorgWarner turbocharging system can take the credit for this. The K04 exhaust gas turbocharger with waste gate, which has an integrated electrical recirculation valve, a milled impeller and a pulsation silencer, is already being used successfully by Audi in other high performance models such as the S3.

Turbo

BORGWARNER LAYS THE FOUNDATION
FOR ITS 25TH PRODUCTION SITE IN EUROPE

New plant in Poland

On March 18, BorgWarner celebrated the groundbreaking ceremony for a new turbocharger plant in Poland with representatives from the world of economics and politics. The laying of the foundation stone will mark the start of construction of a production plant at the new Rzeszów site, where around 500,000 turbochargers are to be produced per year for European auto manufacturers from as early as 2009.

Innovative together

The Audi TT's two new turbocharged engines are an impressive demonstration of the many years of successful cooperation between Audi and BorgWarner Turbo & Emissions Systems. With the TT TDI and the TTS, the auto manufacturer is once again setting new milestones in engine technology – particularly in using diesel engines in a sports car. This ability to forge new trends, guarantee the innovative advantage and tap market potential is ultimately the driving force behind Audi's great success. In BorgWarner, Audi has found a partner that fully meets its high demands for expertise and innovative flair.



High performance at 50 mpg:
The BV43 turbocharger makes it possible.



Commitment to Europe

The official groundbreaking ceremony was attended not only by regional politicians, but also by investors in the industrial park. In his address, Tim Manganello, Chairman and CEO of BorgWarner, said: *"This new plant will allow us to establish the necessary capacities required to meet the increasing demand by auto manufacturers for advanced turbocharging systems over the coming years. The expansion of our production network is a clear commitment to Europe"*.

The turbocharger specialist's new plant will be constructed to the south-east of Krakow in the Podkarpackie Science and Technology Park over an area of 5,000 square meters. There, after completion, around 200 employees are to be taken on in the ultra-modern production site. Rzeszów, in the south-east of Poland, not only offers excellent economical advantages, but is also in a very favorable location in terms of transport. Nearby Jasionka

airport provides the 400 hectare industrial park with excellent logistical connections to Western and Eastern Europe.

Designed for further growth

Construction of the new plant is expected to be complete by the end of 2008 so that around 500,000 turbochargers can be produced per year for passenger vehicles from as early as 2009. A further increase in the production volume is anticipated in the following years. With its new plant in Poland, BorgWarner is not only pursuing its global growth strategy, but is also reinforcing its commitment to Europe. The European market is already an important market for turbochargers due to the high proportion of diesel engines. And this will be further reinforced in the coming years by the rising number of turbocharged gasoline engines. BorgWarner Turbo & Emissions Systems is therefore building additional production capacities specifically in order to be able to meet the rising demand for innovative drive technologies in Europe. By constructing new plants, the company is preparing itself for the demands of tomorrow.



From 2009 BorgWarner aims to produce 500,000 turbochargers per year in the new plant in Rzeszów.

BORGWARNER IS PREPARING FOR INCREASING REQUIREMENTS IN ITS COMMERCIAL DIESEL BUSINESS

Fit for future

For a long time it has been hard to imagine commercial vehicle engines without turbochargers. Exhaust gas turbocharging is the key technology with which commercial vehicle manufacturers reduce fuel consumption in their vehicles, comply with increasingly stringent emissions standards – and ensure that even the heaviest transport tasks and jobs can be completed easily and reliably. In the last few years, BorgWarner Turbo & Emissions Systems has consistently supported the commercial vehicle industry in this area with its future-oriented solutions.

BorgWarner produces over 1.5 million commercial vehicle turbochargers for more than 30 customers. The production facilities for the commercial vehicle segment are strategically distributed across the globe and therefore guarantee that the company remains close to its customers. To meet rising demands in terms of production and technology, in existing and future markets alike, the commercial vehicle department is continuously working on optimizing its operating processes and further expanding its technological leadership.

High investment in the state-of-the-art manufacturing

In the last few years, the company has invested large sums of money in expanding its worldwide turbocharger pro-

duction and now has state-of-the-art production sites in North and South America, Europe and Asia. In addition to creating the necessary production capacities, the commercial vehicle operations also takes the necessary steps to standardize processes worldwide and to offer customers everywhere the same high quality standards.

"We have made significant strides in driving synergy throughout the commercial vehicles operations and leveraging our strengths across the globe," said Pete Kohler, Vice-President and General Manager of the commercial diesel operations of BorgWarner Turbo & Emissions Systems. This will benefit our customers through our ability to produce the same products with the same processes and the same quality at world class level – be it in Asheville

(USA), Bradford (England), Kirchheimbolanden (Germany), Campinas (Brazil) or Ningbo (China).

Driven by Innovation

But BorgWarner has achieved a lot in terms of product technologies too, said Pete Kohler: *"Our engineers have developed advanced balancing techniques that have allowed us to exceed the most stringent NVH (Noise, Vibration, Harshness) targets in the world for commercial vehicles. We have also developed the most robust machining and assembly processes for variable turbine geometry (VTG) turbochargers. As in 2007, in 2008 we will produce several hundreds of thousands of VTG turbochargers specifically for the commercial vehicles market for both on and off highway applications."* This level of experience with the VTG in commercial vehicle products gives BorgWarner an excellent starting position to support the growing demand for VTG products to meet Euro6 and Tier IV requirements.

In 2006, BorgWarner released the new second generation VTG design on the market, along with its very own electric actuator. The new VTG turbochargers were a culmination of combined efforts by the development departments of the various BorgWarner plants to achieve



VTG turbocharger for commercial diesel application.



Regulated 2-stage turbocharging (R2S).



Annually BorgWarner Turbo & Emissions Systems produces over 1.5 million turbocharging systems worldwide for more than 30 customers.

technological progress. But as with any new product, also the newly developed VTG generation first had to prove its performance and durability in the strictest of tests. Due to the robust development and validation process of the Global Product Engineering team, the new product generation is meeting all performance requirements as well as exceeding expectations regarding its reliability.

R2S as alternative solution

In addition to the second generation VTG, BorgWarner engineers also continued to develop its world-leading regulated 2-stage boosting technology (R2S). With this technology, two turbochargers are used in series with regulating valves between the stages, so that the boosting system can be matched flexibly to the corresponding engine operating point. BorgWarner thereby provides engine manufacturers with an alternative option in complying with

the increasingly strict emission requirements, while continuing to improve fuel economy and drivability. The R2S system has now been applied to on and off highway applications. And, just like the new VTG generation, the R2S technology also meets all performance and durability requirements.

Excellent market position

"Now that our products have celebrated market launches across multiple customers and applications globally, we have gained extensive data about their road capability. So, we have seen that our products have adopted an excellent market position in terms of their performance and reliability," explained Pete Kohler. *"With our innovative but tried and tested products, we are in the best position to develop engines together with the manufacturers of commercial vehicles, in order to meet the highest requirements concerning exhaust emissions, drivability and cost-effectiveness."*

Kohler continued by emphasizing the importance for BorgWarner in taking a global approach to managing Warranty. The company has learnt a lot on this in the past – and these experiences as a whole were incorporated into these new designs.

On course for growth

The turbocharger specialist can certainly attribute its great success in the commercial vehicles market to its product leadership strategy, which applies in particular for the commercial vehicles sector, and the significant global efforts to meet its customers' high demands. With a series of leading technologies and production capacities round the globe, BorgWarner Turbo & Emissions Systems is in a prime position to satisfy the growing demand for advanced turbocharging technologies in commercial vehicles throughout the world.

BORGWARNER HOSTS A SUPPLIER DAY
AS THE BASIS FOR POWERFUL GROWTH

Growing together

The experts at BorgWarner Turbo & Emissions Systems expect the demand for turbochargers to rise significantly in the course of the next few years, both for passenger and commercial vehicles. The company is currently preparing for a significant increase in production capacity in Europe. In achieving this; BorgWarner is also relying on significantly increasing the capacity of its suppliers. In April, the turbocharger specialist therefore invited its main suppliers to a Supplier Day.



With the Supplier Day BorgWarner wants to prepare itself and its suppliers for successful growth.

Platform for optimum cooperation

The 30 most important supply partners took up BorgWarner's invitation to come to Germany. They met with experts from the turbocharger manufacturer on 14 April 2008 at Hotel Wartenberger Mühle – some 30 kilometers from the Turbo & Emissions Systems facility in Kirchheimbolanden. Brett Gilman, Director Supply Base, opened the event by greeting everyone and then spoke about why BorgWarner had decided to hold the Supplier Day and what topics would be covered: *"With the Supplier Day we hope to create a platform for even better communication and closer cooperation with our suppliers. We have also developed various concepts and programs to offer our suppliers the best possible support in expanding their capacities and optimizing their process chains."*

Wilhelm Baum, managing director of the Kibo facility, then gave an overview of the company and its market. BorgWarner's focus is on engine and drive components. Almost 50% of revenue comes from Europe. Turbo & Emissions Systems is now represented with its products at all important OEMs. *"Driven by strong growth in the market for turbochargers, all our company's European sites have experienced rapid development with regular capacity increases. Yet today, BorgWarner Turbo & Emissions Systems faces its greatest challenge in this regard: We want to significantly expand our production capacities in Europe within one year",* explained Wilhelm Baum.

Technological leadership claim

The reasons behind the growing demand for turbochargers include stricter emissions standards and the use of turbocharging to reduce fuel consumption and CO₂ emissions, while at the same time improving performance. These factors also represent the most important technological drivers of exhaust gas turbocharging. BorgWarner has developed and launched a whole range of innovations, thereby maintaining its claim of many years to be technological leader. A good example of this is the new VTG generation for diesel engines. Or the R2S system, which significantly improved the performance-consumption ratio. Indeed, diesel engines with the regulated two-stage turbocharging system from BorgWarner consume around 20% less fuel with comparable performance figures. For gasoline engines, the turbocharger specialist developed and launched a pioneering VTG turbocharger: the BV50, which has enabled the Porsche 911 Turbo to become a low-consumption vehicle despite its amazing performance.

As the technological leader, BorgWarner is the leading partner to auto manufacturers and is now setting the conditions to be able to reliably meet the anticipated growth in demand. During the Supplier Day, experts from various disciplines spoke about the strategies with which BorgWarner will master the growth that is to come.



Hotel Wartenberger Mühle near Kirchheimbolanden makes a pleasant environment for seminars and business meetings.

Suppliers play a key role

The turbocharger manufacturer has already been working intensively for some time on making its internal processes more efficient and powerful. A significant milestone of further development is the „Accelerate Kibo“ program, which is being supported both by management and staff members and is enjoying great success. It has been possible to reduce the open production part acceptance procedure by over 60% within just eight months. Yet to cope with the planned growth, BorgWarner is relying heavily on a high degree of flexibility within the added value chain. And the company's suppliers have a key role to play here.

One important step is the transparent depiction of requirements and supplier capacities. A business warehouse has therefore been developed as a communication platform, via which the BorgWarner sites and their respective suppliers can communicate in future about requirements and capacities.

However, to achieve improved productivity, a high degree of reliability and fast delivery times are absolutely vital within the delivery chain. BorgWarner is therefore keen to implement new logistics concepts, such as „Vendor Managed Inventory“ or the reduction of repackaging costs on the production line. Workshops are to be held with suppliers and these should help contribute to increasing their productivity.

Growing with quality

Under no circumstances should growth be made at the expense of quality. There are therefore also many quality assurance measures to be implemented. To this end, BorgWarner Turbo & Emissions Systems has extended its team for supplier management by adding Supplier Quality Engineers, who hold regular quality reviews with the suppliers. With these measures it was, for example, possible to reduce the number of complaints in 2007 by approximately 12%, while the number of parts with errors (ppm) dropped a massive 40%. The next step was to launch the Supplier Development Initiative. This includes documentation of processes and increased use of local audits.

Progress through success

Following the series of speeches, Roger Wood, President & CEO of BorgWarner Turbo & Emissions Systems, joined the group via video conference. He highlighted the company's particular strengths – such as technological leadership, global presence and successful focusing on the needs of its customers. As an example of the company's technological leadership, he spoke of the PACE Award, which was awarded to Turbo & Emissions Systems again in 2008, having already won in 2007, and went on to say: *“People often ask me what I make of all the new competitors that*

are entering into the turbocharger business. Well, these are certainly respectable companies. However, particularly in the field of exhaust gas turbocharging, experience is a vital success factor. BorgWarner has been active in this field for over 60 years and has developed skills that offer an extremely solid foundation for the future. As our long-standing supply partners, this offers you excellent prospects to grow with us. The Supplier Day is the ideal platform to take our already great cooperation and make it even better.”

Increasing capacities systematically

Together with 15 selected suppliers, BorgWarner held a kickoff meeting on its Supplier Capacity Boost Program directly after the event. The goal of the program is to set up the processes at suppliers in such a way that the necessary supply capacities can be reliably built up to meet the anticipated growth. Initially, existing capacities are to be recorded and then compared with the requirements for 2009. Following this, an analysis of the most important supplier processes (production, logistics, quality, etc.) will be made. This will then form the basis for identifying necessary measures. The corresponding measures and agreements are then to be agreed upon and signed off together by the end of June, allowing BorgWarner and its suppliers to optimize the entire added value chain to meet the planned growth targets.

CAMPINAS WINS SAFETY AWARD AGAIN

Seventh Safety Award

Nowhere in the world is safer than Brazil. Or at least you could come to this conclusion if you look at the accident statistics of the BorgWarner production facilities in Campinas. The plant, which produces Turbo & Emissions Systems and Thermal Systems products, has accomplished another year without a serious accident at work – and was therefore presented with its seventh Safety Award since 2002. This was an important event for the employees and was celebrated on February 23 at a large party, which was also attended by Ingrid Mangold and Rick Woodcock from BorgWarner.

The Safety Award is presented by the BorgWarner Group with a charitable donation of five thousand dollars. On behalf of the employees in Campinas, this money was donated to the Ingo Hoffmann Institute, an organization founded by Ingo Hoffmann, one



of the most famous racing drivers in Brazil. He started his career in Formula 3, then moved to Formula 2 and Formula 1, Stock Car racing and Rallies. His institute supports families whose children have to be treated in the Boldrini Center, a philanthropic hospital which specializes in cancer and blood disease treatment.



Racing driver Ingo Hoffmann (displayed right in picture) was delighted to receive five thousand dollars for his nonprofit organization.

CAMPINAS PURCHASES NEW AFTERMARKET WAREHOUSE

Room for growth

Creating room for further growth is currently an important issue for many BorgWarner sites. The Campinas plant in Brazil, which manufactures products for Turbo & Emissions Systems as well as for Thermal Systems, recently relocated the Aftermarket sales department and IDS warehouse (Independent Distributor Service). Since February, the products have been distributed from a logistics center located approximately 15 minutes by car from the production facilities. The plant is therefore increasing its focus on the Aftermarket business while at the same time creating space for the urgently needed expansion of production capacities.



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