

# TurboNews

Magazine for Friends and Customers of BorgWarner Turbo Systems 1/02

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# A Myth Meets the Modern Age

NEW MAYBACH WITH V12  
TURBOCHARGED ENGINE

## Editorial

TURBONEWS REPORTS ON THE CURRENT STATUS OF IMPROVEMENT PROCESSES AT BW TS

# Improvement

Dear Reader,

Since 1999, TurboNews has been keeping you informed on developments and the current situation at BorgWarner Turbo Systems. We hope we've been able to stimulate your interest and supply the information you wish for over the past three years. Of course, at TurboNews we're dependent on getting your feedback so we can improve our publication and provide you with just the right mix of information and entertainment.

There is therefore a short questionnaire at the back of this issue. We'd be very pleased if you could take a moment of your time to complete it and return it to us. And as a special enticement, we'll reward you with a chance to win an attractive prize!

Now a word about the contents of this issue of TurboNews: once again, it contains interesting reports on a variety of topics and places. This time our interview is with Wolfgang Schneider, Director of Quality Management, and deals with merging standards at BorgWarner Turbo Systems and introducing the Six Sigma initiative, the point of which is to enable additional significant progress in improving quality. We also acquaint you with three exceptional applications for BW TS turbochargers; we're supplying state-of-the-art turbocharging technology for three outstanding stars of engine development: the V8 of the Audi RS6, the V-12 of the new Maybach and the V-12 marine motor from MAN.

We hope you enjoy reading this issue. And if you have any ideas, praise or criticism – don't hesitate to use the questionnaire at the back to let us know!

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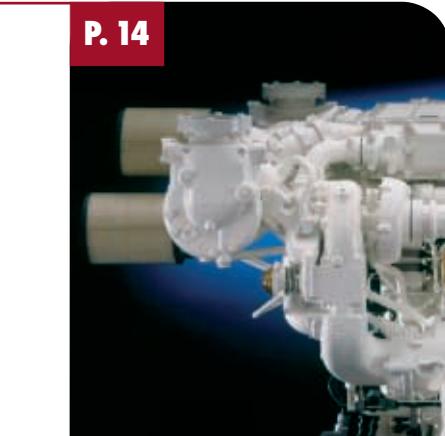
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## Commentary

BW TS WILL BE INTENSIFYING IMPROVEMENT PROCESSES WITH SIX SIGMA

# Systematic Improvement

Continual improvement of products and processes has been everyday practice at BorgWarner Turbo Systems for decades. So in this sense at least, Six Sigma is nothing new at all for the company. Six Sigma does, however, involve an approach that will allow us to work more systematically toward our goals, and to measure our success more accurately.

This issue of TurboNews also contains an interview with Wolfgang Schneider, who is responsible for the global Six Sigma activities of BorgWarner Turbo Systems. Our commitment to meeting Six Sigma quality requirements is essential for our future growth. In order to fully satisfy our customers' needs, we must step up our efforts to improve our products and processes.

Many of you are already familiar with the Six Sigma concept, but it's worthwhile to explain it again. In a normal distribution of data, Sigma – the Greek letter corresponding to our "s" – is used to describe the "standard" deviation between a data point and the average in a population of data. Without getting into a course of statistics, suffice to say that 6 sigmas (or six "standard" deviations) represents 99.9997% of any typical population. The goal of our Six Sigma initiative is to reduce the variations in our processes such that 99.9997% of the products produced by those processes are within the set control limits. Said another way, at a Six Sigma level, a process will yield a maximum of only 3.4 parts per million rejects. Although our process quality continues to improve, we still have some way to go to achieve a 6 Sigma level. We also need to keep in mind that as we get closer to 6 Sigma levels, each incremental step becomes

increasingly difficult. Both special techniques and a great deal of discipline are required to maintain the momentum.

We are going to be applying Six Sigma methods at all Turbo Systems sites worldwide – under the supervision of specially trained experts (also called "BlackBelts") who will be assigned full time to this very important task. These individuals have been picked from among the best qualified workers at each facility and will be completing their training within the next six months. Each Six Sigma specialist will be assigned to certain projects for improving processes, and will provide support and instruct others in applying Six Sigma methods.

I'm positive that we will achieve major improvements in quality with our Six Sigma program. And I strongly recommend that everyone learn as much as they possibly can about Six Sigma principles and methods.



**BW TS President Lee Wilson expects Six Sigma to yield additional improvements in processes and quality.**

DAIMLERCHRYSLER DEVELOPS MAYBACH WITH  
TURBOCHARGED V12 ENGINE

## Myth Meets the Modern Age

**A**fter some 60 years, a legend is awakening to new life: the Maybach, a name that automobile lovers associate with exclusivity, luxury, and exceptional performance. The DaimlerChrysler group, which now owns this tradition-steeped brand, will be marketing absolutely top-of-the-line luxury cars under the Maybach name starting this year.

The new Maybach will be a technological marvel, meticulously assembled by hand for a select clientele. Finding the right engine for such a vehicle, which has to live up to the highest expectations in every respect, was an exceedingly engrossing and demanding challenge. And this didn't just apply to the technologies used; it also had to be developed quickly.

After thoroughly analyzing the target group for the new car and examining various possible technical solutions, DaimlerChrysler rapidly concluded that a twin-turbocharged, 5.5-liter V12 engine would be the best answer. The company's engineers then rolled up their sleeves and took only 35 months to come up with the goods – in close collaboration with BorgWarner Turbo Systems, because the turbochargers used in an engine of this breed crucially impact its power rating. Putting out 405 kW (550 HP), the Maybach engine also

features breathtaking peak torque of 900 Nm (664 lbs.-ft.). This meets all of the prerequisites for outstanding performance in tandem with maximum comfort.

The size K24 turbochargers that BW TS developed – with water cooled bearing housings and waste gates – also boast special features. For example, the turbine housings are integrated into the exhaust gas manifold and made of high-temperature-resistant cast steel. The exhaust ducts for cylinders 1, 5 and 6 are directly connected to the turbine housing via exhaust expansion bellows. In addition, the BW TS engineers integrated the air circulation valves right into the compressor housing. This has yielded a very compact design. And the resulting short paths between the valve outlets and the turbine gives the turbochargers hair-trigger response – providing the Maybach engine with excellent performance.

The new Maybach, its engine, and the turbocharging technology it incorporates together mark a new milestone in automotive history. DaimlerChrysler's decision to team up with BorgWarner Turbo Systems on this development project was simply the logical consequence of the technology leadership that BW TS has in turbocharging for spark-ignition engines.



The new Maybach combines exclusivity with outstanding power and elegance.



405 kW and peak torque of 900 Nm, attractively packaged.



The turbocharging system from BW TS is no less than a technological masterpiece.



INTERVIEW WITH WOLFGANG SCHNEIDER,  
DIRECTOR OF QUALITY MANAGEMENT AT BW TS

## Continual Improvement the Top Priority

TurboNews talked with Wolfgang Schneider about the quality strategies of BorgWarner Turbo Systems. This "quality team leader" is also responsible for launching the Six Sigma program company-wide.

**TN:** Quality is a fundamental prerequisite for any company's success. What does quality management mean for you, Mr. Schneider?

**Schneider:** Quality management involves much more than just product quality. In recent years, more and more aspects of process and corporate management have also been becoming essential parts of quality management. Models like the European striving for "business excellence", EFQM, and the Malcom Baldridge Award in the U.S. clearly demonstrate this. Like us, many other successful companies have already begun basing their businesses around them.

**TN:** What does this mean for BorgWarner Turbo Systems?

**Schneider:** Our quality strategy exactly defines how we support the company's business activities and add value to the enterprise. Our goal is to offer the same high level of quality to customers at all Turbo Systems sites around the world. Above and beyond this, we make sure that all employees are kept informed about our goals. We want them to see how their own work contributes to the company's success and our efforts to continually improve quality. Which is also where our important Six Sigma project comes in.

**TN:** What does your role as "quality team leader" at BorgWarner Turbo Systems involve?



**Wolfgang Schneider wants to use Six Sigma to improve products and, especially, processes.**

This saves time and resources. Quality, the ability to supply, technical support, and competitive pricing are all evaluated applying consistent criteria in consultation with everyone concerned. The next big joint project will be to introduce consistent management of improvements with Six Sigma.

**TN:** What are your goals and expectations, and how will Six Sigma fit into the existing programs?

**Schneider:** Well ... let me answer your last question first. Six Sigma excellently rounds out the systems we already have in place today. As I said at the outset, we now have a consistent system for defining goals. To achieve these goals, it's necessary to define improvement projects, which we will be addressing with Six Sigma. Plus, Six Sigma dovetails perfectly with the kaizen approach we've already been practicing. The point of this program has been to establish a common basis for conducting improvement projects. Kaizen is also intended to get our people to learn new ways of thinking. To ensure our future success as well, we need to be in a position to put changes into practice fast. Our vision calls for us to set up an internal pool of experienced specialists within two or three years; they can then be assigned to improvement projects as needed to address complex problems and implement the solutions.

**Schneider:** The merger of two former competitors (I'm referring to 3K and Schwitzer) and the associated global expansion of our activities naturally brought together two different systems and organizations. One of my jobs is to work with the global quality management team to derive "best practices" from these differing approaches. The best way for us to boost our competitiveness is to develop synergies and standards that we can apply at all of our sites. That's why we've defined which processes must take place globally, and which ones must be performed locally but in the same way everywhere. It's definitely a great help to us that all of our sites have been certified under QS9000/VDA 6.1. But in the future, we're going to take our orientation from the new TS 16949 standard instead.

**TN:** Could you give us an example of these common standards?

**Schneider:** I can cite several examples. We have, for instance, a common quality strategy and quality policy, an enterprise-wide FMEA system based on the same platform, and a consistent reporting system. But we're particularly proud of the fact that we have succeeded in introducing a uniform supplier management system everywhere.

Approvals, agreements on goals and assessments of goal achievement can now be straightforwardly taken and used by any site.

BORGWARNER TURBO SYSTEMS BEGINS SIX SIGMA TRAINING IN KIRCHHEIMBOLANDEN

## Fit for the Future



The participants in the Six Sigma training in Kirchheimbolanden with Wolfgang Schneider

### THE SIX SIGMA VISION OF BW TS

- 1** In two to three years we will have project leaders who have a firm command of all important techniques and methods for improving processes and quality.
- 2** The implemented Six Sigma projects will permit us to achieve our goals and noticeably improve the already high level of satisfaction of our customers.
- 3** There will also be projects involving multiple BW TS sites or customers and suppliers – and everyone will profit from them.

### TRAINING PARTICIPANTS:

- One employee from the Asheville plant of BorgWarner Turbo Systems
- Two employees from the Bradford plant of BorgWarner Turbo Systems
- One employee from the Campinas plant of BorgWarner Turbo Systems
- Four employees from the Kirchheimbolanden plant of BorgWarner Turbo Systems
- One employee from the Ketsch plant of BorgWarner Transmission
- One employee from the Heidelberg plant of BorgWarner Transmission
- One employee from each of two different suppliers

Constantly improving processes has top priority at BorgWarner Turbo Systems. It is integral to the philosophy of this specialist in innovative turbocharging systems, and essential for continuing to strengthen and extend its worldwide industry leadership. In mid-2001 Lee Wilson, the President of BorgWarner Turbo Systems, therefore requested Wolfgang Schneider, in charge of quality management, to implement an enterprise-wide Six Sigma improvement management approach. Wolfgang Schneider, who has intensively concerned himself with improvement methods in recent years in connection with his responsibility for quality management, assumed the role of "champion". Ever since, he has been coordinating all required activities for realizing this ambitious project.

In order to introduce improvement management across all sites, it was first necessary to designate project leaders. Training of these "BlackBelts" began in Kirchheimbolanden in January 2002. Appropriate training of the managers of all Turbo Systems sites began at the same time.

The idea behind this coordinated training of components suppliers, employees of the BorgWarner Transmission sites in Heidelberg and Ketsch, Germany, and the workers of all Turbo Systems plants is not only to convey knowledge, but also to set a dynamic group process in motion. The declared goals of the project are to achieve a new way of thinking, install a company-wide network, and develop and implement best practice processes. This will, it is expected, improve both processes and the quality of BW TS products to benefit customers.

During training, each "BlackBelt" is expected to successfully complete an improvement project. The actual training sessions add up to a total of five weeks, with three to four weeks of project work in between the modules. The current training program will be finished in July 2002. But official "BlackBelt" status is not awarded until a candidate has successfully completed two projects.

SIX SIGMA EXPERTS RECEIVE SUPPORT FROM "GREENBELTS"

## Fit for the Future II

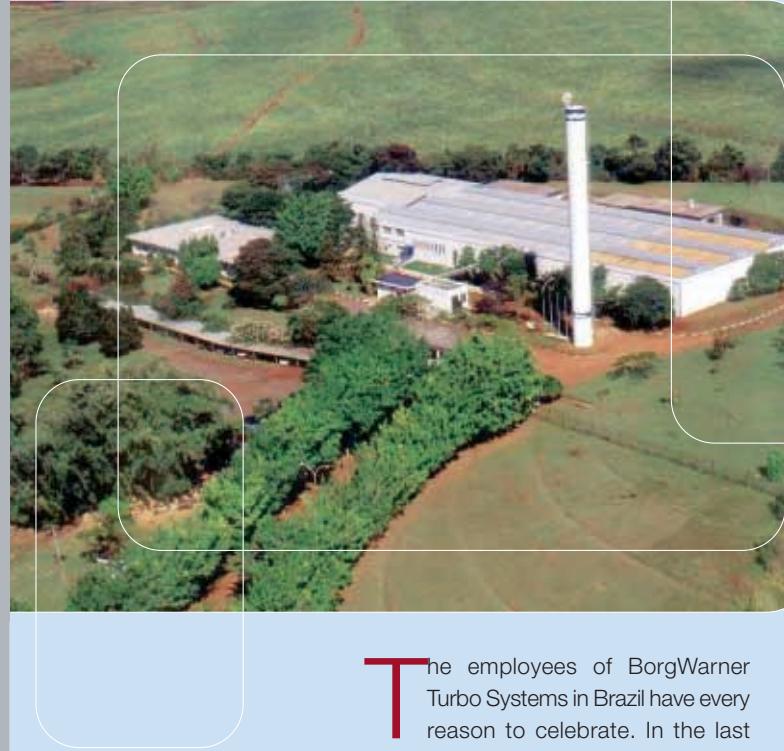
**O**n June 12, representatives of Caterpillar met with employees of the Asheville plant of BorgWarner Turbo Systems to present them with certificates for their successful completion of Six Sigma DMIAC GreenBelt Training. This course taught the participants the basics of the Six Sigma method, covering definitions, measures, analyses, improvement, and monitoring. Now the job of the new GreenBelts is to support the BlackBelts in projects for reducing quality fluctuations and the associated costs.

The Asheville group attended the three-day training course at the headquarters of Caterpillar in Peoria, Illinois. They were: Geoff Bruce (head of turbocharger assembly), Neal Narron (now a Six Sigma BlackBelt), quality control technicians Steve Lewis and Tim Montgomery, and Steve Webb and David Franklin (both from Remanufacturing in Cane Creek).

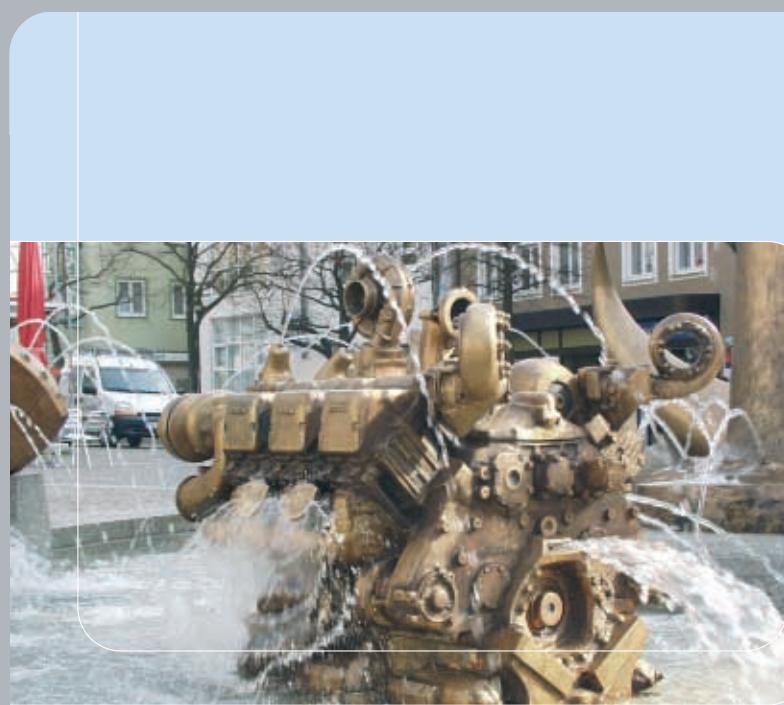
The certificates were presented to them by Frank Sullivan, a BlackBelt at Caterpillar who is working with BorgWarner employees in Cane Creek on a project for reconditioning turbochargers.



The participants, from left to right:  
Steve Lewis, Tim Montgomery, Geoff Bruce,  
David Franklin, Steve Webb and trainer Frank Sullivan.  
Neal Narron had already departed for Kirchheimbolanden to undergo BlackBelt training.



**T**he employees of BorgWarner Turbo Systems in Brazil have every reason to celebrate. In the last week of February, the Campinas facility successfully passed the QS-9000 surveillance audit, which was performed by DNV Register. The plant was first certi-



The Buchholz fountain erected in 2001 in Friedrichshafen at Lake Constance.

BW TS COMPLIES WITH STRICT QUALITY STANDARDS IN CAMPINAS

## Rapid Progress in Brazil

fied in December 2000, and was able to maintain and improve the quality system already in place with everyone's support and participation. During the course of 2002 the site will be working hard to implement the ISO 14001 standard. This comprises a whole series of tools and systems for managing day-to-day operations as they impact the environment.

The next step in Campinas will be to implement ISO/TS 16949. This quality standard was developed by the International Automotive Task Force, a group of automotive manufacturers and trade associations formed to improve product quality for automotive customers worldwide. Although car makers do not yet require suppliers to obtain certification under ISO/TS 16949, there is good reason to expect that it will become the definitive standard in the global automotive industry.



BW TS TURBOCHARGER ADORNS THE 'BUCHHOLZ' FOUNTAIN AT LAKE CONSTANCE

## Power Source

**S**ince September 2001, the competence of BorgWarner Turbo Systems in the field of powerful charging systems can also be admired in public. The renowned sculptors, Mr. and Mrs. Barbara and Gernot Rumpf, created a fountain for the city of Friedrichshafen at Lake Constance with a turbocharger by BorgWarner on top.

A total of seven tons of bronze were required to create the extraordinary piece of art with exciting water-works in front of the town hall. The fountain with its artistic elements from different fields displays an exciting combination of fauna, flora and technology. A stylised beech tree in the centre of the fountain is, for example, accompanied by a 600 HP engine of the BW TS customer mtu Friedrichshafen at which the BorgWarner turbocharger is mounted.

BorgWarner Turbo Systems is glad about the prominent placement in the heart of the city of Friedrichshafen which belongs to the most innovative and dynamic economic regions of Germany with companies such as mtu, FZ, Dornier, and above all the former Zeppelin group.



# Packs a Wallop: The New Audi RS 6

**A**udi has just launched its most powerful model to date. This ultimate top-of-the-range version in the A6 model line was created by quattro GmbH and developed in conjunction with Audi AG. The new car's V8 twin-turbocharged engine is the outcome of an intensive joint effort by Audi and BorgWarner Turbo Systems, and delivers the performance of a thoroughbred sports car. The exterior design of this exclusive model is deliberately restrained.

The Audi RS 6 incorporates a uniquely high-tech package. Even in the class of high-performance vehicles, it sets new standards with its immense power characteristic, quattro permanent four-wheel drive, innovative Dynamic Ride Control (DRC) suspension system, and high-performance braking.

The 4.2-liter V8 engine that powers the Audi RS 6 delivers a permanent output of 331 kW (450 HP) at speeds between 5700 and 6400 rpm. The fact

that its peak torque of 560 Nm (413 lbs.-ft.) is available across an extremely wide speed range, from 1950 to 5600 rpm, is exceptional. The Audi RS 6 also complies with the EU3 exhaust gas standard.

## From 0 to 62 in 4.7 Seconds.

The tractive capability of the quattro permanent four-wheel drive converts the V-8 biturbo's high torque into propulsive power with impressive efficiency and directional stability. The Audi RS 6 sprints from 0 to 62 mph (100 km/h) in 4.7 seconds, and hits the 124 mph (200 km/h) mark after 17.6 seconds. The top speed is electronically limited to 155 mph (250 km/h).

The engine in the Audi RS 6 has an aluminum block and five valves per cylinder with three inlet and two exhaust valves per cylinder unit. To increase power output, the admission and exhaust ports have been modified in the cylinder head,

based on the well-known K0 series with water-cooled bearing housing, which has demonstrated its reliability millions of times over in practice. The ambitious technical goals of this project necessitated various adaptations and improvements, however. Like in the biturbo V6 engine of the RS4, the turbine housings are made of high-temperature-resistant cast steel. The compressors have been adapted to the greater air requirements and fitted with specially designed housings to optimize installation.

## From Square One to Series Production in 18 Months.

When BorgWarner Turbo Systems was awarded the contract, it had about 18 months to develop and begin series production of the required turbochargers. To meet this ambitious target, it took close collaboration with Audi, tightly organized project management, and the use of cutting-edge development and rapid prototyping techniques.



BORGWARNER TURBOCHARGERS GREATLY BOOST POWER



With the V8 biturbo engine, the Audi RS6 offers the power of a thoroughbred sports car.

and the air ducts on both the intake and thrust sides redesigned for the twin-turbocharged engine.

Most of the power gain is due to the two fast-acting turbochargers, whose efficiency is enhanced by two pressure-loss-optimized intercoolers. There is one turbocharger for each bank of cylinders.

The K04 turbochargers from BorgWarner Turbo Systems used are

But the effort has paid off. An extraordinary vehicle has been created that sets new standards in advanced engine technology.

The Audi RS 6 demonstrates once again – like the exceedingly successful RS 4 before it – the uniquely outstanding capabilities of BorgWarner Turbo Systems as a partner for developing spark-ignition turbocharging solutions.

## BW TS DISPATCHES SECOND RESIDENT ENGINEER TO VOLKSWAGEN

### A Case for Two

These days, the challenges that the automotive industry and its suppliers must overcome to develop new engines are looming ever larger. Not only are time and cost pressures mounting, but modern technologies are becoming more complex and a growing number of projects need to be managed simultaneously. So it's indispensable for a first-class, forward-looking development partner to offer its customers intensive on-site support. BorgWarner Turbo Systems began responding to this need as long ago as 1999 – by installing its first resident engineer at Volkswagen in Wolfsburg, Germany.

This approach has proven its value many times over. In order to cope with the increasing number of projects while still providing very intensive support and assistance, now a second resident engineer is being dispatched to reinforce the presence of BW TS in Wolfsburg. Since June 1, 2002 there has been a capable team in place consisting of Jens Grabow and Dirk Schnelle. This means that Volkswagen can now rely on not one but two specialists in turbocharging and engine development.

During the course of his career Mr. Grabow also worked as a test engineer at Audi, where he acquired extensive knowledge of engine technology and turbocharging. He joined BW TS at the start of 2002, immediately embarking on an intensive five-month familiarization program in Kirchheimbolanden.

The Wolfsburg team will be collaborating closely with the project group in Kirchheimbolanden to support Volkswagen's development projects. BW TS regards its firm commitment to continually improving its cooperation with motor vehicle manufacturers as a vital prerequisite for the successful development of future engine generations.



**From Audi to BW TS, then as resident engineer to Volkswagen – Jens Grabow's know-how is still benefiting the Volkswagen Group.**

In June 2002 the state of the art in manufacturing technology reached BorgWarner Turbo Systems in England. That was when the Bradford plant received its first German-built Millturn Center – a latest-generation combined milling and turning machine that is expected to improve both the efficiency of production and the manufacturing quality of the site.

The machine is designed to produce small lots of bearing housings in a large variety of versions and sizes. It can be fitted with close to 100 different tools, which can be used in any desired combination and even simultaneously. The machine is also equipped with advanced probing technology that permits absolutely precise positioning of the work before cutting begins.

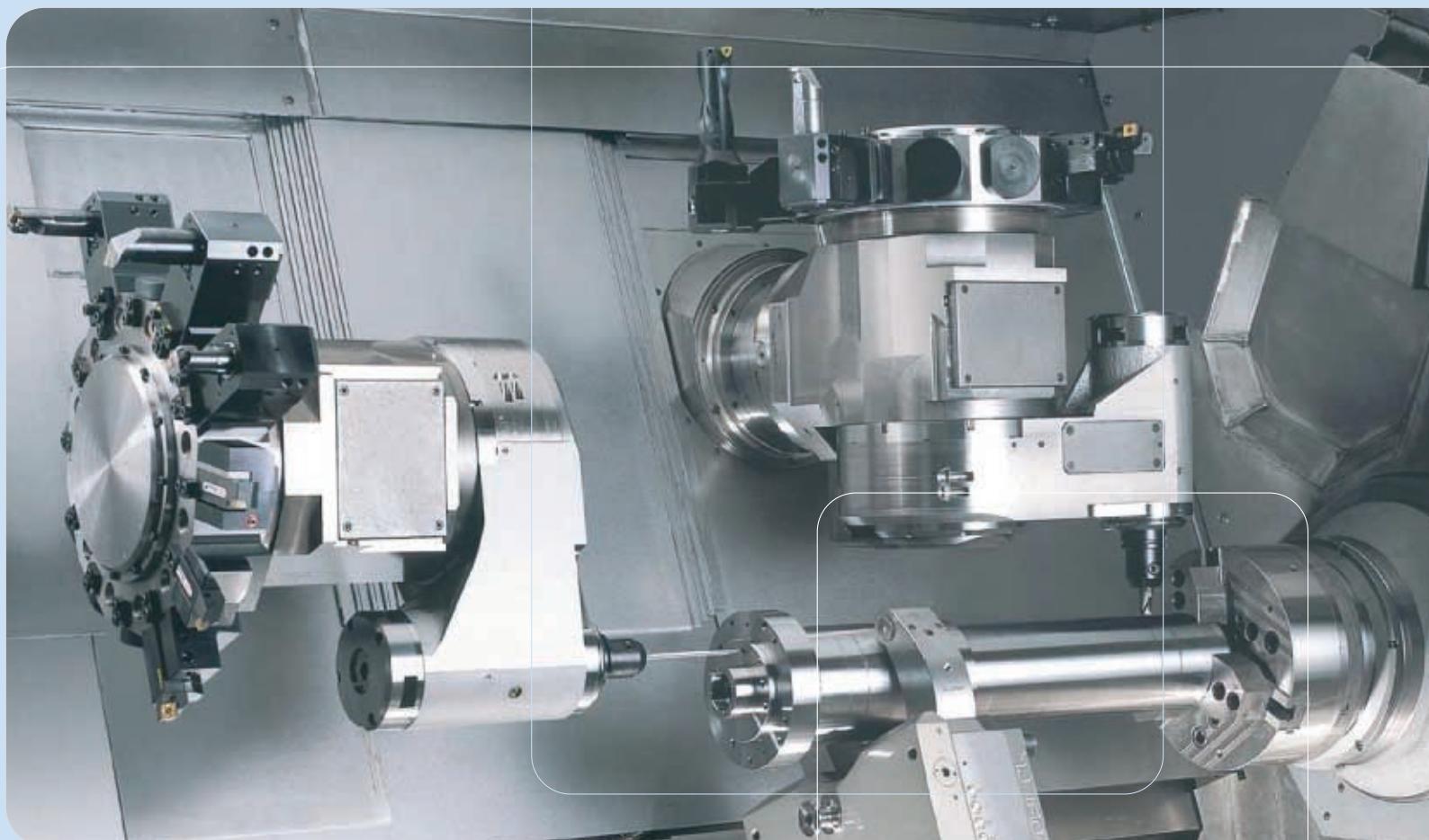
The machining center has five axes of movement, which ensures an extraordinary degree of flexibility. This enables highly cost-effective, precise production of modern bearing housings. It also has two spindles that automatically transfer the part being machined, reducing manual handling by about 50 percent.

By combining both rotational and prismatic machining operations, a bearing housing can be produced in two successive stages. This lets the milling, turning and honing operations be grouped in one production cell with single-piece flow. In other words, each part traverses the entire process without stopping until it is finished.

The project to optimize processes in Bradford with this advanced machine tool is part of the ongoing efforts of BorgWarner Turbo Systems to improve routines and quality throughout the enterprise. It adds to the capabilities of this turbocharging systems specialist and helps ensure a high level of customer satisfaction.

## BRADFORD PLANT GETS LATEST-GENERATION MILLING AND TURNING MACHINE

### Dream Machine



**The new machining center improves productivity and quality further with shorter lead times and much greater cutting precision.**



#### PRINCIPAL BENEFITS AT A GLANCE:

- Shorter lead times
- Less work in progress
- Reduced tooling costs and lead times for new product launches
- More precisely manufactured parts, which raises product quality further



## R2S™ System Makes Waves

From luxury yachts to speed boats – the new MAN V-12 with R2S™ delivers plenty of power.



With 1,103 kW and excellent torque at lowest speeds, the new engine excels in new applications calling for a great deal of power.



**A**t Boot 2002 – the world's largest trade show for boats and water sports, held in Düsseldorf, Germany – a technological masterpiece celebrated its world premiere in January: MAN Nutzfahrzeuge AG's most powerful marine engine, which boasts 1,103 kW (1,500 HP).

This engine combines cutting-edge four-valve technology with the innovative regulated, two-stage turbocharging system R2S™ from BorgWarner Turbo Systems. The V-12 engine achieves its impressive performance with a displacement volume of 22 liters. In addition to high maximum output, the engine also boasts high torque at the lowest engine speeds. This was enabled by taking advantage of R2S™ technology, providing impressive proof of the performance of this BW TS turbocharging system.

The first basic studies on two-stage, regulated turbocharging were carried out back in late 1992. In close cooperation between MAN and BorgWarner Turbo Systems, the groundwork was then laid for their large-volume production and use today. The decision to utilize the

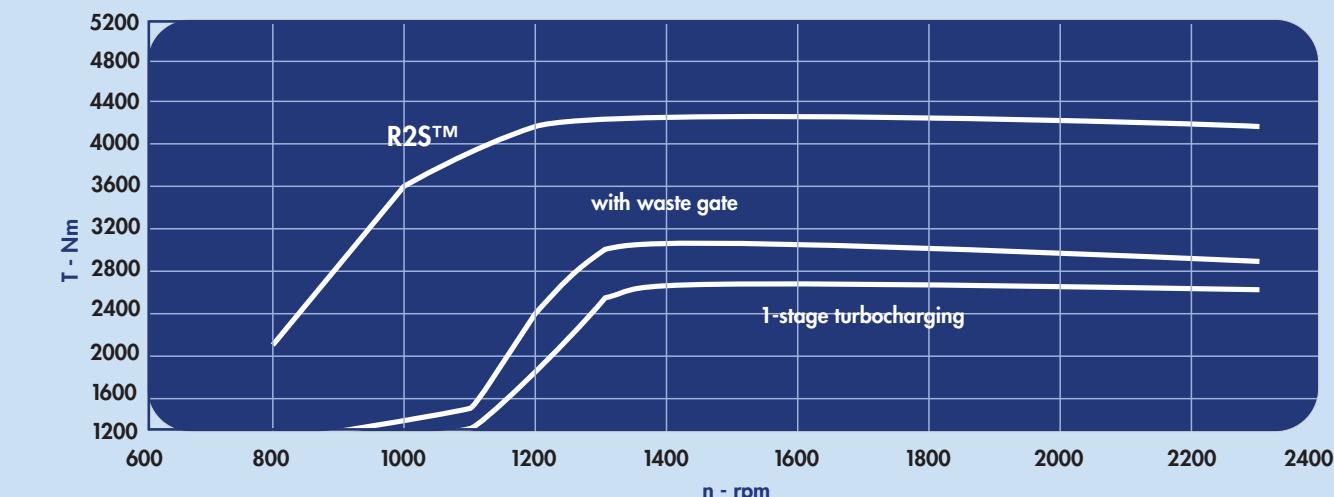
### MOST POWERFUL MAN MARINE ENGINE WITH R2S™ CELEBRATES WORLD PREMIERE AT BOOT 2002

R2S™ system was made in 1999. The marine engine market was calling for further increases in power and torque – and also even faster development of torque at the lowest engine speeds while simultaneously reducing the amount of smoke produced under transient conditions.

The R2S™ system of the MAN D2842LE409 consists of two high-pressure stages with K31 turbochargers

and two low-pressure stages with K36.5 turbochargers. The two R2S™ systems are regulated by separate boost pressure control valves that optimally distribute loads between the two stages depending on the operating points. To deal with even the most demanding operating conditions, the turbocharging systems were equipped with water-cooled turbine housings. The high-pressure stages also have turbine housings made of cast steel.

Thanks to close cooperation between MAN and BorgWarner Turbo Systems, this high-tech engine was brought to market maturity in a minimum of time. The premiere of the regulated, two-stage turbocharging system R2S™ from BW TS marks the start of a new era in supercharging technology in marine engines. In the near future we will be witnessing additional examples of the outstanding performance of R2S™ technology – and not just in the marine sector.



A comparison with conventional turbocharging technologies reveals the true potential of R2S™ technology.

BW TS OPENS NORTH AMERICAN TECHNICAL CENTER IN ASHEVILLE

## Concentrated Competence

The first Indianapolis facility of turbocharger specialist BorgWarner Turbo Systems was built back in the early 1920s in the Brookside district. The second plant was built in the northwest of Indianapolis in 1989, and opened in 1990 to house four product families: turbochargers, dampers, fans, and fan drives. During the 11 years since then, this second facility (first as Schwitzer, then part of Kuhlman, and finally as a division of BorgWarner) took care of product sales, design, testing and validation.

### Short paths, innovative products

The rationale behind moving the Indianapolis operations to Asheville was to promote the development and market launch of new, innovative products by enabling the various departments involved to work together more closely. To accomplish this, it was necessary for the product development and applications engineers to work shoulder to shoulder with the manufacturing engineers. It was also clear to BorgWarner Turbo Systems that the

global Development Center in Kirchheimbolanden would have to be joined by a modern Technical Center for supporting North American customers. The final decision to shift the development department to Asheville was made in May 2000. BorgWarner Turbo Systems formed a team to design an additional Technology Center on the Asheville campus. Karl Walther headed the group, and Brian Hogan, the former laboratory supervisor, was given the job of assisting him in this task. The other members of the team were Joe Gainey, Steve Roby, Chuck Wicker, and James Verrier.

On September 13, 2000, BW TS chose Herman Thun of LTZA, who had done preliminary studies for the existing Asheville plant, to be the architect for the new project. Design work began on October 24, 2000 – following exhaustive analysis of the existing testing equipment and local conditions in Asheville. The goal was to build a state-of-the-art technical center without exceeding budget constraints.

The plan was to move the gas stands, their compressors, the dynos, and the

entire rubber factory for damper development to Asheville. At that time the gas stands were only eleven years old, because when the Westside Indianapolis facility was built in 1989, the old, manually controlled, diesel-fired gas stands from the former Brookside plant were scrapped in favor of natural-gas-fired, automatic gas stands. The dynos from Brookside were rebuilt and also installed in the new Technical Center in Asheville.

### Much space for new ideas

The new Asheville building was designed to permit later expansion of both the existing manufacturing building and the laboratory to the north to accommodate the dynos and gas stands. The building now has 23,225 square feet ( $2,158 \text{ m}^2$ ) on the ground floor, with another 8276 square feet ( $769 \text{ m}^2$ ) in a mezzanine containing control equipment for the stands. The engineering offices cover 12,586 square feet ( $1169 \text{ m}^2$ ), of which 9,096 square feet ( $845 \text{ m}^2$ ) were formerly utilized for manufacturing.

Because the facility is located in a rural zone and adjacent to a public school, noise levels had to be kept as low as possible. To achieve this, special low- and high-frequency mufflers were specially designed for all test cells. The maximum noise level at the perimeter of the new facility is now only 50 dB – nearly 40 percent less than that of a car driving past.

The configuration of the test labs was changed from that in Indianapolis so that each of the test cells could be accessed from the back instead of the front, in order to keep forklift trucks out of the control aisle.

The design of the new dyno rooms was also changed from that in Indianapolis to enable forklift access from the side of the cell, so the motor could be placed on the bedplate in one motion. At the new facility, the engines rest on weldments similar to those used in Kirchheimbolanden, which facilitated rebuilding the stands. There are four rooms for housing the various dynos: five eddy current dynos, which can be exchanged as required, and one 600 HP motoring dyno. These

rooms are equipped with their own air-handling units to provide air at up to a  $25^\circ\text{F}$  ( $14^\circ\text{C}$ ) temperature increase.

The Technical Center holds four natural-gas-fired gas stands. The new configuration of these was modified slightly from that in Indianapolis, where the burner and oil system were separated from the test area of the cell by a wall. In the new design, the technicians decided that the cells would be a single, contiguous space, thus eliminating the wall. In addition, the new facility has areas for engine preparation, turbocharger assembly, a small fabrication and welding shop, some machinery, parts inventory, and offices.

The first members of the new Asheville team moved into the existing office space in October 2000, and ground was broken for the new facility at 11:45 a.m. on March 23, 2001. The office portion of the new facility was completed in August 2001, permitting the team to move to its permanent spaces. The sales, applications, and product development engineers then joined the manufacturing engineers in an area designed to

streamline the NPI processes and easily permit impromptu meetings for discussing new product releases. The laboratory and the engineering office have together been dubbed the BorgWarner Turbo Systems North American Technical Center.

### Ready, Steady, Go!

On November 15, 2001, as part of the Worldwide Leadership Council proceedings, John Fiedler (the CEO of BorgWarner) pressed a red start button that brought a Caterpillar 3126 engine to life. This marked the opening of the new Technical Center – a proud moment for the entire team, which had worked on the project under great pressure for so long. But it was not until December 6, 2001 that Ulli Froehn (VP Product Development) and Richard Lutovsky officially cut the ribbon to celebrate the grand opening of the facility. Present at the ceremony were customers, local officials, and employees.



#### The participants of the official opening

John Deere: **Phil Mulvey**

International: **Chuck Mitlovic,**  
**Mack Sherman**

Caterpillar:  
**Don Heston**  
Mack:  
**Rich Brager,**  
**Glenn Lauver**

From North Carolina: **Ray Denny**,  
Business and Industry Division of the  
N.C. Department of Commerce

From Buncombe County:

**Nathan Ramsey**, Chairman

Buncombe County Commissioners  
**David Young**, Buncombe County  
Commissioner

From Asheville: **Richard Lutovsky**,  
President and CEO of the Asheville Area  
Chamber of Commerce

**Jack Cecil**, Chairman of the Asheville  
Area Chamber of Commerce  
**Ray Bailey**, President of Asheville  
Buncombe Technical College

### BORGWARNER TURBO SYSTEMS HAS REACHED ITS GOALS:

- A state-of-the-art Technical Center was completed on time and within budget.
- Employees and equipment were smoothly transitioned to Asheville.
- With Asheville, BorgWarner Turbo Systems now also has a world-class development center in the United States to help ensure its product leadership.

## BORGWARNER TURBO SYSTEMS OPENS NEW PRODUCTION FACILITY IN HUNGARY

### Let's Go East



The Oroszlány plant inaugurated in 2001 in Hungary is the latest to join the family of turbocharger specialist BorgWarner Turbo Systems, which now operates six state-of-the-art production facilities around the world.

The new BW TS site is conveniently located in the immediate vicinity of the motorway connecting Vienna and Budapest. It was built there in consultation with Audi, which has a highly modern engine plant in Györ just 75 kilometers (45 miles) away. Set up along the lines of a satellite plant, the new facility supplies turbochargers to the Audi factory.

Oroszlány assembles compressor and turbine housings for turbocharger series K03 and K04, which Audi uses in its well-known 1.8- and 2.7 turbocharged spark-ignition engines. The plant in Kirchheimbolanden forms a production network with Hungary, supplying it with components. Oroszlány is equipped with an innovative IT system that directly links it to BorgWarner Turbo Systems in Kirchheim-



bolanden via a leased line to ensure smooth communication throughout the supply chain.

**Already 8 months after start of construction, the plant was opened in autumn 2001.**



**Already 8 months after start of construction, the plant was opened in autumn 2001.**

### FAST FACTS

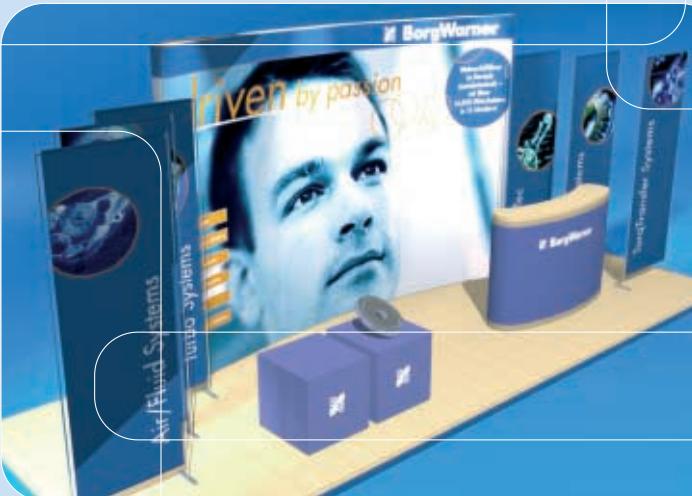
#### The Oroszlány plant in figures:

Total area: 28,500 m<sup>2</sup> (307,000 sq ft)  
Floor space: 1,800 m<sup>2</sup> (19,400 sq ft)  
Employees: 24

## BORGWARNER TURBO SYSTEMS PRESENTS INNOVATIVE IDEAS

### Know-How and Showing How

Developing new products and concepts and presenting them to an interested trade public is an important part of product leadership. BorgWarner Turbo Systems therefore makes sure to be seen and heard at the most important events devoted to turbocharging. The aim is to stimulate discussion of innovative ideas and the latest advances and findings, in addition to demonstrating its own innovative capabilities.



#### Vienna: International Vienna Motor Symposium, April 2002

At the 23rd International Vienna Motor Symposium in April 2002, a BW TS representative held a presentation on the topic of „New Investigations of Variable Turbine and Compressor Geometry for Passenger Car Turbocharger Applications“. It was the first time that all divisions of the BorgWarner Group were present at the Vienna Motor Symposium. At a joint booth, BorgWarner acquainted visitors with its broad portfolio of innovative products for drive trains and engines.



#### London: ImechE Conference on "Turbocharger and Turbocharging", May 2002

„Lifetime Predictions for Turbocharger Compressor Wheels – Why Use Titanium?“ This was the title of a presentation that visitors to the ImechE Conference „Turbochargers and Turbocharging“ in London in May 2002 could attend. BorgWarner Turbo Systems also showcased leading product technologies at a booth of its own at this conference, which focussed on supercharging.

#### Dresden: Supercharging Conference, October 2002

At the „Supercharging Conference“ in Dresden, Germany, BW TS will hold no fewer than two interesting presentations: „Turbochargers with Variable Turbine Geometry for Heavy Commercial Vehicle Applications with High Braking Power“ and a joint contribution by BW TS and ebm: „The eBooster – Concept and Performance of an Advanced Electrically Supported Supercharging System“.

WE'D LIKE TO GET YOUR OPINION!

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**First name** \_\_\_\_\_

**Last name:** \_\_\_\_\_

**Position:** \_\_\_\_\_

**Country:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

## HOW DO YOU JUDGE

**The information content of the articles?**

|                  |                          |             |                          |                     |                          |                    |                          |
|------------------|--------------------------|-------------|--------------------------|---------------------|--------------------------|--------------------|--------------------------|
| <i>Very good</i> | <input type="checkbox"/> | <i>Good</i> | <input type="checkbox"/> | <i>Can't decide</i> | <input type="checkbox"/> | <i>Not so good</i> | <input type="checkbox"/> |
|------------------|--------------------------|-------------|--------------------------|---------------------|--------------------------|--------------------|--------------------------|

**How about the relevance of the topics?**

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**The design of TurboNews?**

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**Organization of TurboNews?**

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| <i>Too many</i> | <input type="checkbox"/> | <i>Just right</i> | <input type="checkbox"/> | <i>Not enough</i> | <input type="checkbox"/> |
|-----------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|

**Number of issues?**

**Do you have any other suggestions, wishes or criticisms?**

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