

# EXPLOITING POTENTIAL, SPEEDING INTO THE FUTURE



Impetus for tomorrow – “They’re here. Ideas for the future. Interlocking. One spark is all you need. And energy becomes movement. Each one is an engine of progress.”



## PERFORMANCE – THE DRIVING FORCE FOR SUCCESS

Driven by performance: more power, more torque, higher peak cylinder pressure, higher temperatures. Less weight, lower emissions, less consumption. With higher cost pressure and shorter development cycles. As we look toward the future, the increasing requirements of the automotive industry call for partners who, with greater performance, are a true driving force.

MAHLE – with outstanding passion for performance, precision, perfection and unique systems competence in all aspects of the combustion engine, we promote innovations for progress dynamically and powerfully, and have been doing so for over 80 years. Our aim is clear: to decisively shape the development of automobile and engine technology and set new standards time and again. With growing success. Because our components, systems, services and global presence with networked development resources give our customers the decisive edge on the market – both now and in the future. Performance that pays off.

### The members of the Management Committee



*Prof. Dr. Heinz K. Junker*



*Dr. Hans Peter Coenen*



*Dr. Hans-Josef Enning*



*Michael Glowatzki*



*Peter Grunow*



*Dr. Bernhard Volkmann*

### MAHLE – GLOBAL LEADER IN TECHNOLOGY

MAHLE components and systems developments are used in every second automobile produced worldwide. MAHLE has an on-site presence in all important automotive markets worldwide. Approximately 37,500 employees work at 80 production plants and seven R&D centers. Through our global positioning, and by concentrating on our core business, the combustion engine and engine peripherals, we advanced our position as technological leaders and were also able to win new market shares in many segments last year. Today, we develop and produce a wider range of engine components and systems than any other renowned engine manufacturer. Our customers include all the well-known manufacturers of combustion engines worldwide.

**MAHLE Group organization**

Product lines			Profit centers		
Piston Systems			Aftermarket		
Cylinder Components			Small Engine Components		
Valve Train Systems			Large Engine Components		
Air Management Systems			Motorsports		
Liquid Management Systems			Industrial Filtration		
Advanced development	Sales	Procurement			



*Dr. Thomas Buchholz*



*Hans Gebert*



*Claus Hoppen*



*Dr. Bernd Mahr*



*Dr. Rudolf Paulik*

**GROUP ORGANIZATION – GLOBAL AND CUSTOMER-ORIENTED**

We have arranged our Group organization to be consistently customer-oriented. Key account management simplifies communication with the customer by representing all products and services. Five globally arranged OEM product lines and MAHLE Powertrain, as an engineering services provider, cover original equipment for the automotive industry.

Organizational structures functioning in parallel serve the automotive aftermarket, as well as the market for small engine and large engine components, motorsports and industrial filtration.

## PRODUCT LINES

### **Piston Systems**

Aluminum pistons for gasoline and diesel engines, articulated and steel pistons for commercial vehicle engines, piston assemblies and modules.

### **Cylinder Components**

Piston rings, piston pins, connecting rods, cylinder liners, bearings and bushings for combustion engines and other automotive applications, piston inserts.

### **Valve Train Systems**

Complete valve train systems and their components: cast and composite camshafts, rocker arms, cam followers and lever modules, rocker arm shafts and rocker modules, valves, valve tappets (sliding and rolling actuation), valve seat inserts and guides, machined cylinder heads and engine blocks as well as cylinder head and engine assemblies, precision sintered parts, turbocharger parts.

### **Air Management Systems**

Complete air intake systems, air filters, crankcase ventilation vents (with oil mist separation and pressure regulation), cylinder head and engine covers, cabin air filters, actuators, blow-by heating.

### **Liquid Management Systems**

Oil filter modules, oil and fuel spin-on filters, fuel filter modules, fuel pressure regulators, inline fuel filters, carbon canister modules, heat exchangers for engines and transmissions, hydraulic oil filters, air driers.

## PROFIT CENTERS

### **Aftermarket**

The MAHLE product line for engine maintenance and repairs.

### **Small Engine Components**

Pistons, cylinder assemblies and filters for small engines, handheld professional lawn and garden equipment, motorcycles and leisure vehicles.

### **Large Engine Components**

Pistons with diameters from 150 to 580 or 650 mm for gas, diesel, heavy oil and multi-fuel engines.

### **Motorsports**

Development and production of high-quality engine components for motorsports.

### **Industrial Filtration**

Industrial filters and filter systems, devices and accessories for fluid technology, de-dusting devices and systems as well as automatic filter systems.

## DEVELOPMENT PARTNER WITH GROWING SYSTEMS COMPETENCE

To be the first to achieve new goals, you need adequate power reserves. For this reason, we have expanded our technological base in a targeted way so that we can respond flexibly to growing challenges. This means that we can now think beyond the existing system boundaries.

We are systematically expanding our competence in our core business, the combustion engine and engine peripherals. This means that our customers look to us as a global development partner for new, integrated solutions. Networked, inter-departmental knowledge management ensures that our product and process know-how is transferred to every region and every location where MAHLE is represented.

MAHLE now has R&D centers in Stuttgart, Northampton, Detroit (Farmington Hills and Novi), São Paulo, Tokyo and, very soon, in Shanghai. Approximately 2,000 development engineers and technicians worldwide are involved in fundamental research and ongoing development of the combustion engine. They work specifically on forward-looking new concepts, products and systems, which eventually go into mass production at customer sites as ecologically and economically sound solutions.

## MAKING GOOD THINGS BETTER, SETTING STANDARDS

If you rest on your laurels, it is impossible to make progress. At MAHLE, we make optimizations down to the last detail, ensure consistent quality worldwide and promote innovations at a fast rate. With the right know-how in our heads. With fuel in our blood. With passion for engines in our hearts. And with modern tools in our hands, so that every day we can achieve technological excellence for our customers.

Impressive proof of our technological leadership can be seen, for example, in the successes achieved in international motorsport: vehicles with MAHLE engine components hit the top spots time and again – in Formula 1, in the 24 Hours of Le Mans, in the Rally World Championships, in touring cars, motorbikes and truck racing. And it is often the leading-edge technology used in today's motorsport products that ends up in tomorrow's series-produced automobiles.

With our comprehensive systems competence, we contribute to making engines even more efficient: optimized for more performance, longer service life, and reduced fuel consumption and emissions. Each time the emissions limits are tightened, we will offer new solutions and further expand our position as technological leaders. This is the driving force for international growth.

### MAHLE Powertrain – Integrated powertrain technology

- Engineering services
- Development, production and assembly of roadworthy, high-performance engines
- From individual components and sub-systems to complete powertrain assemblies for both prototypes and series production
- Electronic control units, electronic diagnostics



**GERMANY**

Albershausen  
 MAHLE Motorkomponenten GmbH  
 Alzenau  
 MAHLE GmbH  
 Eislingen/Fils  
 MAHLE Motorkomponenten GmbH  
 Fellbach  
 MAHLE GmbH  
 Gaildorf  
 MAHLE Ventiltrieb GmbH  
 Leibertingen  
 MAHLE Motorteile GmbH  
 Lorch  
 MAHLE Filtersysteme GmbH  
 Markgröningen  
 MAHLE GmbH  
 Öhringen  
 MAHLE Filtersysteme GmbH  
 Plettenberg  
 MAHLE Brockhaus GmbH

Roßwein  
 MAHLE Brockhaus GmbH  
 Rottweil  
 MAHLE GmbH  
 Schorndorf  
 MAHLE Aftermarket GmbH  
 Stuttgart  
 MAHLE Aftermarket GmbH  
 MAHLE Filtersysteme GmbH  
 MAHLE GmbH  
 MAHLE International GmbH  
 MAHLE Motorkomponenten GmbH  
 MAHLE Motorteile GmbH  
 MAHLE Ventiltrieb GmbH  
 Wölfersheim  
 MAHLE Ventiltrieb GmbH  
 Wustermark  
 MAHLE Ventiltrieb Brandenburg GmbH  
 Zell im Wiesental  
 MAHLE Ventiltrieb GmbH

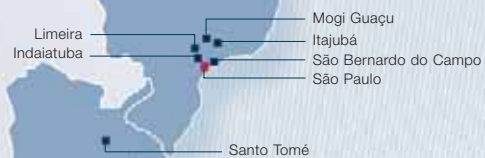


**NORTH AMERICA**

Puebla, MX  
 MAHLE Sistemas de Filtración de México S.A. de C.V.  
 Ramos Arizpe Coahuila, MX  
 MAHLE Componentes de Motor de México, S. de R.L. de C.V.  
 MAHLE de México S. de R.L. de C.V.  
 Farmington Hills (MI), US  
 MAHLE, Inc.  
 MAHLE Technology, Inc.  
 Fletcher (NC), US  
 MAHLE Motorsports, Inc.  
 Holland (MI), US  
 MAHLE, Inc.  
 Morristown (TN), US  
 MAHLE, Inc.  
 MAHLE Industries, Incorporated  
 Murfreesboro (TN), US  
 MAHLE Filter Systems North America, Inc.  
 Novi (MI), US  
 MAHLE Powertrain, LLC  
 Trumbull (CT), US  
 MAHLE, Inc.  
 Winterset (IA), US  
 MAHLE Filter Systems North America, Inc.

**SOUTH AMERICA**

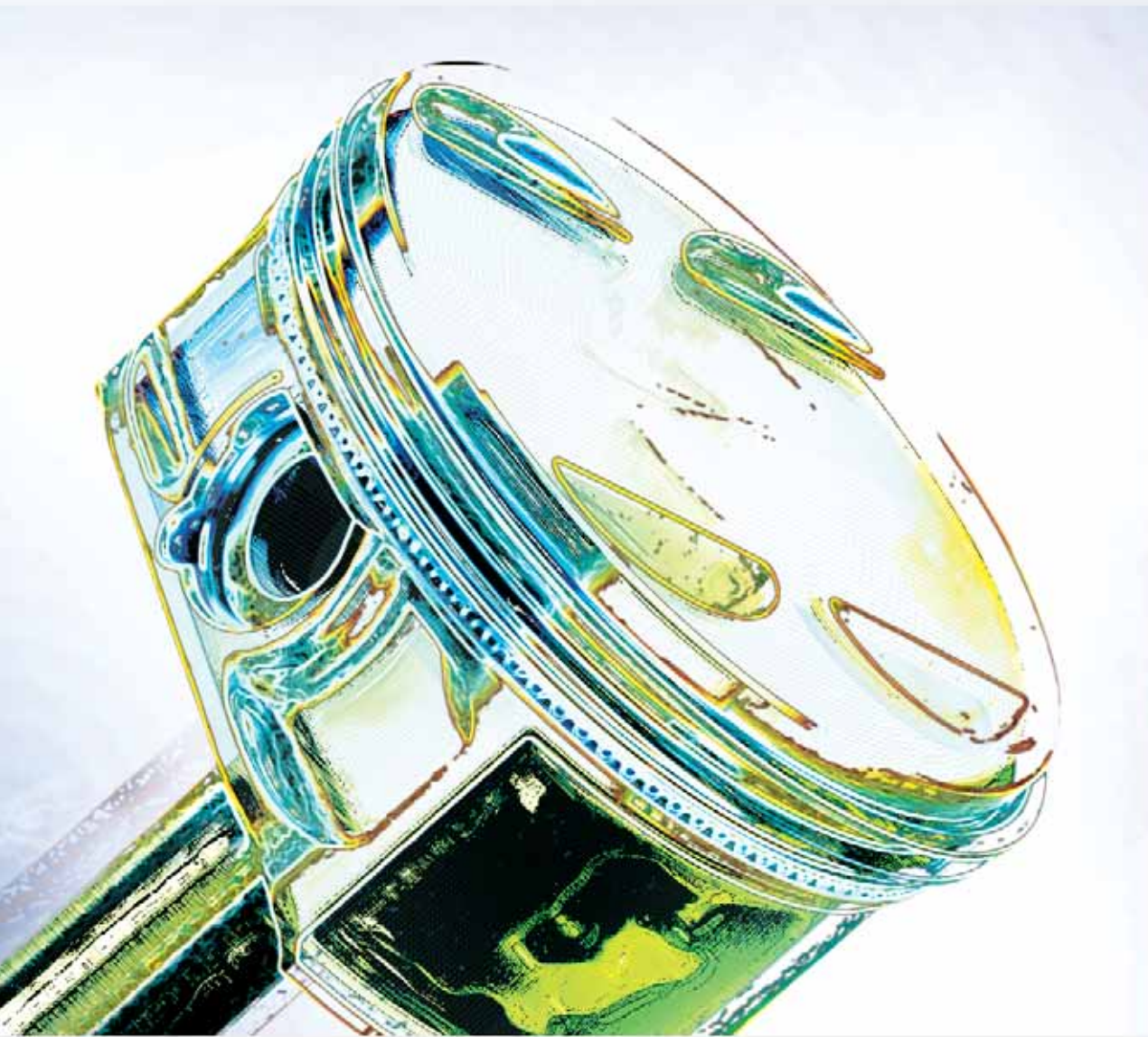
Santo Tomé, AR  
 MAHLE S.A. de Argentina  
 Indaiatuba, BR  
 MAHLE Metal Leve Miba Sinterizados Ltda.  
 Itajubá, BR  
 MAHLE Componentes de Motores do Brasil Ltda.  
 MAHLE Metal Leve S.A.  
 Limeira, BR  
 MAHLE Metal Leve S.A.  
 Mogi Guaçu, BR  
 MAHLE Metal Leve S.A.  
 São Bernardo do Campo, BR  
 MAHLE Metal Leve S.A.  
 São Paulo, BR  
 MAHLE Componentes de Motores do Brasil Ltda.  
 MAHLE Metal Leve S.A.







# ASSUMING



# RESPONSIBILITY

FOR THE WHOLE



Making a bigger impact – “Understanding relationships.  
And taking every opportunity to improve on the details, through commitment,  
for the benefit of the whole.”

## OPERATING SUSTAINABLY – ACCEPTING OUR RESPONSIBILITY TO THE COMMUNITY

As a global player, MAHLE is active throughout the world. We are responsible not only for our products and direct employees, but also to the environment in which our company operates. We take this role seriously. Only through responsible cooperation, the balance between economy and ecology, and being a “good neighbor” in the regions can we create long-term values, which bring more than just economic benefits. Responsibility to the community is rooted in our tradition and is one of the fundamental values of our Group.

### THE MAHLE FOUNDATION


As early as 1964, the company founders Hermann and Ernst Mahle transferred their ownership of the company to the MAHLE Foundation for public benefit, with the consent of their heirs. Since then, the MAHLE Foundation has held almost all the company’s shares. The Foundation’s property is held in trust. In establishing the MAHLE Foundation, the company founders put public welfare before personal gain.

### THE OBJECTIVES AND ACTIVITIES OF THE MAHLE FOUNDATION

The dividend of MAHLE GmbH to be paid from the annual Group profit has been available exclusively to the MAHLE Foundation since that time. The Foundation’s task has always been to pursue charitable goals – by promoting health care, youth development and welfare, schooling, general adult education and vocational education, as well as science and research. One of the key projects sponsored by the MAHLE Foundation is the anthroposophically oriented Filderklinik in Filderstadt-

*As part of its activities,  
the MAHLE Foundation  
promotes health care*





Bonlanden near Stuttgart. The Filderklinik uses acute and holistic methods in its practice of anthroposophically extended medicine, all under one roof. The construction, modernization and annual costs of running the clinic have been supported substantially by the MAHLE Foundation since its opening in 1975. The Foundation has donated EUR 6.5 million to date to support the clinic extension that has become necessary since 2004, with the construction of an outpatient, diagnosis and reception center.

## RESPONSIBILITY THAT GOES THE EXTRA MILE

Besides the financial strength of the MAHLE Foundation, we also strive – throughout the company – for a responsible, hands-on role in the community. We see our locations as part of the basic social order and values. Only in this way can we reconcile economic interests with social and ecological aspects throughout the world. We are, therefore, committed to improving the quality of life and the environment in the geographical and social surroundings in which we operate.

One example is the collaboration in the Stuttgart area in the renaturation of the Neckar River landscape – an initiative by our group of international trainees as part of a larger regional action alliance.

Naturally, we run the gamut from continual improvement of safety at work and environmental protection standards in our plants, and comprehensive integration of disabled people, to topics that stretch far beyond the boundaries of our company. We are committed to numerous social and cultural projects worldwide.

At our location in Poland, we started initiatives for the town and region – to provide assistance to families with a large number of children, to sponsor cultural and sporting events or to organize days out for children.

In Brazil, we were able to continue sponsoring socially underprivileged and educationally disadvantaged young people in 2005. The independent commitment of our employees at all Brazilian locations contributed substantially to this project. Our employees have supported 150 young people with medical care and after-school classes. This project also aimed to secure young people a place in society for the future. In 2005, we also sponsored over 350 children from socially disadvantaged families with dancing and foreign language classes, with the objective of stimulating talent and providing them with a meaningful activity. In many cities in Brazil, MAHLE employees visited hospitals as story-tellers to help raise the spirits of younger patients.

Both now and in the future, our company's links with the individual regional locations and the acceptance of responsibility for public welfare represent an important, active part of our corporate culture. We will make an even greater commitment than before to those countries and regions that are underprivileged on a global scale and rely on the support of global Group structures.







# INNOVATION

UNLEASHES POWER



Accepting challenges – “Contemplating visions.  
And realizing them with enthusiasm.”



## RESEARCH AND DEVELOPMENT – SYSTEMS COMPETENCE AND INNOVATIVE STRENGTH ENHANCED

For decades, MAHLE has been a pioneer for technological innovations in the ongoing development of the combustion engine, and its systems know-how, extending to the complete engine, is constantly growing. Using innovative strength, we expand our position as technological leaders through systematic, internationally networked research and development activities. Our engineers throughout the world work together on new objectives in order to offer our customers efficient, innovative approaches to meet the increasingly complex requirements for the combustion engine of the future.

### PREPARED FOR THE DEMANDS OF THE FUTURE

The current demands on modern engines are: to reduce emissions, improve fuel economy, downsize, and increase power density, reliability and durability even further. The main, prerequisite for developing innovative concepts is an in-depth fundamental understanding of the relationships and interdependencies between the individual components throughout the entire engine. Only by means of comprehensive engineering competence can cost-saving potential be fully exploited – whether through detailed optimization of all components or through intelligent integration of functions within a complete system. The trend toward completely pre-built assemblies, made available as modules or sub-systems, also requires the systems suppliers involved in the first supply stage to have an infrastructure that reliably ensures high quality from assembly to logistics.



*Simulation tools shorten development times*

### MAIN FOCUS AREAS OF RESEARCH ESTABLISHED

These demands raise issues for research and development at MAHLE, which are addressed with a high level of commitment. In order to optimize our products, we regularly evaluate current and future technologies relevant to these products and systems.



*Engine test bench*

Another area of focus is the consistent consideration of all components in their respective environments. We use the knowledge gained from this approach to further improve our simulation tools. This helps us to better analyze component behavior in terms of strength, service life, wear, noise and numerous other aspects. The simulation tools are realistically formulated in detail using physically-based models and thus constantly refined.

In order to achieve a reliable projection, it is vital that the simulation tools are compared with the reality. For example, we use efficient telemetry technology to measure piston temperatures in the complete engine via thermocouples – as a function of the operating point and other parameters.



*Fundamental research for new materials*

MAHLE has an innovative frictional loss test bench for performing tests on the complete engine. In laboratory tests, we check the fatigue resistance of bearings under realistic conditions, with a dynamic load comparable to that of an engine.

MAHLE intensively promotes the development of materials and, in particular, the definition of the properties of materials. Our objective is to extend the boundaries of the materials' applications to allow weight-optimized designs and provide accurate material data – strength, thermal characteristics, etc. – for design and component simulation. An important role is played by the creation of material models, which allow for an improved evaluation of the service life, especially taking into account thermal fatigue.

With the ongoing development and testing of innovative coatings and the modification of machining processes, we put forth considerable efforts to improve product characteristics in a targeted manner. Optimizing the functionality of surfaces, particularly with respect to wear, friction and susceptibility to seizure, offers considerable development potential for improving fuel efficiency even further.

In a joint project with the Massachusetts Institute of Technology in Boston, we are developing a comprehensive simulation tool. This tool will be used to analyze the effects of various parameters in the total power cell – taking a decisive step forward in the wider issue of reducing oil consumption.

## **R&D CENTERS FOR PROGRESS**

Today, approximately 2,000 development engineers and technicians are involved in fundamental research and the ongoing development of the combustion engine at the seven R&D centers in Stuttgart, Northampton, Detroit (Farmington Hills and Novi), São Paulo, Tokyo and Shanghai. This allows MAHLE to take on specific development tasks, carry out component optimization and tuning, and perform complex vehicle and engine tests on-site in close cooperation with all our customers worldwide.

Our R&D centers are networked globally and continuously exchange knowledge with each other constantly. This ensures that information is passed on quickly, response times to the customer are reduced and all available resources can be used to optimum effect.



## **MAHLE POWERTRAIN: ENHANCED ENGINEERING COMPETENCE**

On January 1, 2005, MAHLE acquired the Cosworth Technology Group, with the competence it has built up since 1958 in developing and producing high-performance engines. Its integration into the MAHLE Group and the change of name to MAHLE Powertrain on July 1, 2005 opens up unique prospects for the long term. These prospects include engineering services, integrated prototype hardware and software for the whole powertrain, and the development and manufacturing of complete engines.

The targeted expansion of our engine know-how represents an important step in decisively shaping and promoting the developments of the future. MAHLE is thus playing an active role in a trend that will see systems suppliers assuming more responsibility in future engine and powertrain projects.

As an integral part of the MAHLE Group, MAHLE Powertrain has complete expertise in all aspects of engine development – from the initial concept to the new design of a complete engine. The company's skills and experience go far beyond its roots in the development of high-performance engines. Today, it covers all engineering tasks related to exhaust gas optimization, drivability, improved fuel economy and electronics applications.



Computer-aided development and analysis processes generate fast, cost-effective design layouts, which can later be verified on the basis of components or the entire engine using various test equipment. For this purpose, MAHLE Powertrain has 18 live engine test benches and four chassis dynamometers. In addition to the power output and torque characteristics, the entire emissions spectrum can also be recorded and certified. This is particularly relevant in relation to future exhaust gas specifications, which will be even stricter.

MAHLE Powertrain is also able to manufacture both components and complete engines at its own facilities. This includes the casting and machining of engine blocks and cylinder heads in series of 120,000 units per year. Our extensive experience ensures that each solution we develop is also designed for optimum production. In addition, we offer our customers a complete engine assembly that is tested and delivered ready-to-install.

As a result of this broad range and the combination of engineering and production know-how, MAHLE Powertrain has been involved in more than 30 major new engine programs in recent years. These include automotive, marine, aeronautical, racing and industrial applications.



*Engine assembly at  
MAHLE Powertrain*



*Consistent product and process development*

## PROJECT WORK: RELIABLE PROCESSES

In order to solve the complex problems raised by our customers' diverse development projects, while ensuring the highest quality, we use modern project management methods. These methods lead to systematic and efficient processing from the initial concept study to the successful startup of series production.

A standardized product development process, which can be applied flexibly to a simple component development as well as to highly complex system environments, forms the basic structure of the development work. It describes the business process of product and process development from the customer enquiry to delivery of the series product and is subdivided into five project phases. The individual phases are completed by means of "quality gates," in which the status of the project progress is checked and approval is granted for the following phase. All tasks, interfaces and responsibilities are described in detail in the product development process.

The standardized documentation and the project plan – coordinated with the product development process – are available for all process partners, regardless of their location, in MAHLE's internal worldwide information system. This ensures that, in the future, all development is carried out worldwide in accordance with a uniform, clearly structured procedure. Consequently, development and production risks are detected at an early stage and any necessary remedial measures can be implemented at the appropriate time.

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*Camshaft as basic component for fully variable valve lift and duration*

## ADVANCED DEVELOPMENT PROJECTS: POTENTIAL FOR TOMORROW

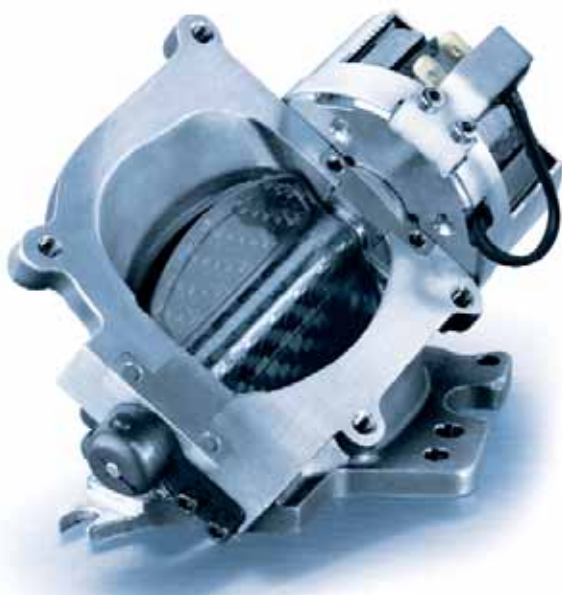
We are continuing to strengthen our predevelopment activities in order to develop innovative products for series production. The focal points of development work are defined within agreed product and technology fields. The extensive advanced development projects deal primarily with the following topics: variable valve lift and timing, dethrottling, reduction of emissions, downsizing and reduction of frictional loss.

Variable valve timing can be achieved to optimum effect with the new SCP (Single Cam Phaser) camshaft with integrated phase adjustment. On the basis of this system, a fully variable valve train can also be developed to control the valve lift and valve opening. This allows throttle-free load control, which can deliver potential fuel savings of approximately ten percent – depending on the size of the vehicle and engine. As a result of optimized combustion, the raw emissions are also reduced.

Another technology that enables dethrottling results from using a fast-switching valve in the intake system of gasoline engines. This produces potential fuel savings of approximately seven percent. Advantages can also be created in terms of cold start characteristics, internal exhaust gas recirculation and charging.

The emission reductions that will be required for diesel vehicles in the future can be achieved by means of selective catalyst technology and exhaust gas recirculation. MAHLE is working on EGR with the aim of avoiding additional fuel consumption that might result from adverse pressure characteristics.

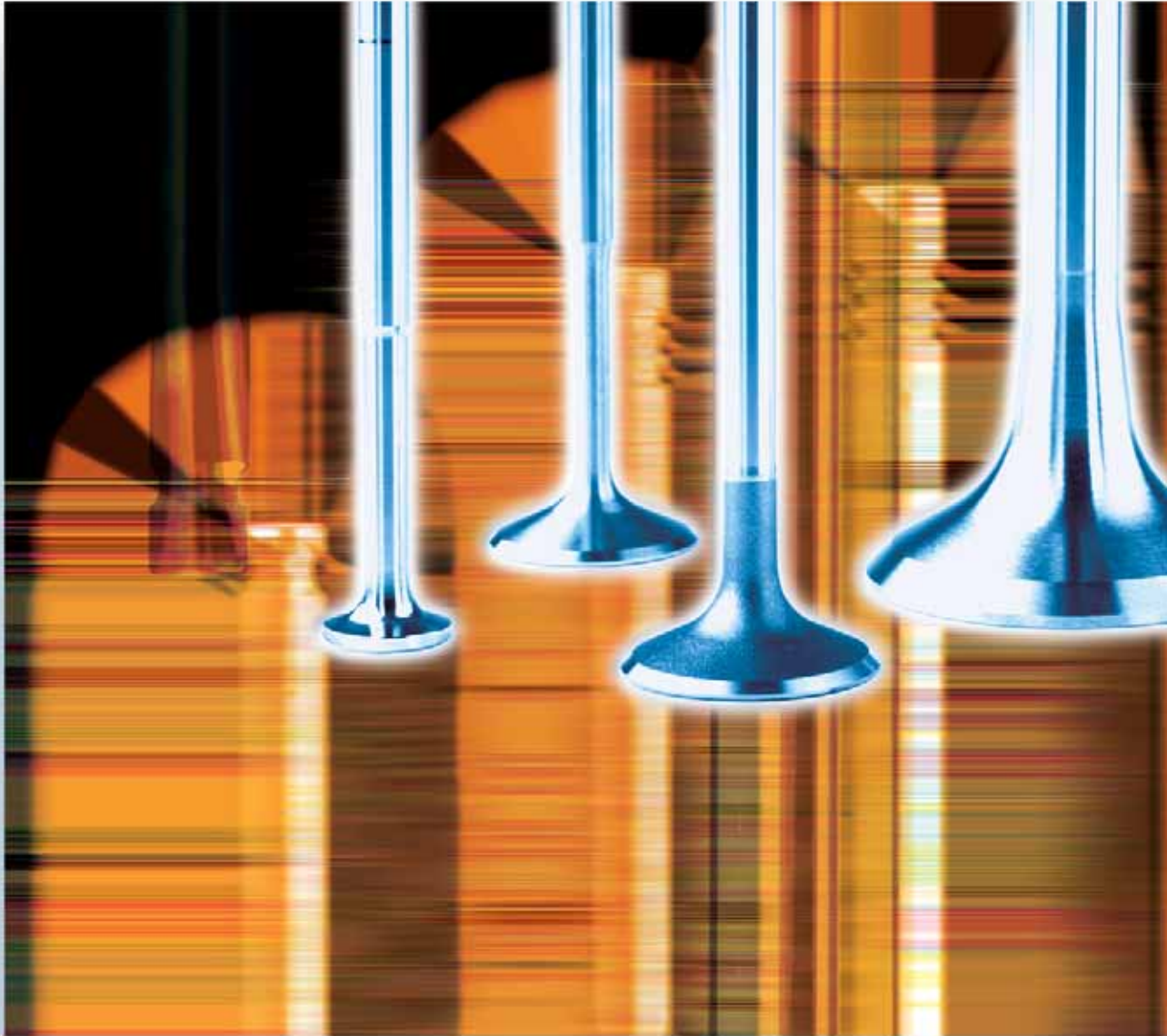
Just as turbochargers are already used in almost all passenger car diesel engines to increase power output, a similar trend can also be observed in the development of the new generation of gasoline engines. Downsizing involves using the additional power output achieved by charging to reduce engine displacement, thereby reducing fuel consumption. Various charging systems can be used in the process. The future potential of the various charging technologies is currently being investigated in a systematic analysis.



*Air pulse valve*



*Venturi nozzle with ring-shaped EGR inlet and poppet valve*



# PROMOTING SUCCESS TOGETHER





Team player – “The fascination of interplay. Everything in action. Everyone plays an important role. The detail affects the whole, and the whole each detail.”

## COOPERATION – GLOBAL, HUMAN, COMMUNICATIVE

MAHLE owes its success to the commitment of its employees throughout the world. Every day, global cooperation and internationalization – practiced internally and toward customers and suppliers – represent a fresh and exciting challenge for everyone, and the executives make an important contribution to the implementation of the corporate strategy and the accomplishment of the necessary development and adjustment measures. Committed specialists from all functional divisions contribute to further strengthening our outstanding market position and technological leadership, both now and for the future.



*Committed cooperation for shared success*

In order to accomplish the tasks that will arise in the future, our Group organization is networked through cross-disciplinary processes and equipped with modern means of control.

In recent years, the technical foundation has been laid for a Group organization with distinct global activities. We have made great efforts in this area and also in employee orientation, in order to boost the motivation of our employees and the dynamics of the entire organization. This is not least expressed in the new corporate slogan – MAHLE “Driven by performance”. This is accompanied by an employee- and goal-oriented leadership style, incentive-based remuneration and flexible working hours systems, teamwork and a high level of decision-making autonomy. These increase our employees’ motivation to give their best:

positive thinking, personal initiative and the extra commitment that customers expect from us.

After all, it is always the people that allow MAHLE’s international spirit to grow. Our biggest potential lies in highly trained employees. Their above-average motivation, their technical ability and their communication skills for committed cooperation in projects and partnerships that span countries are the driving forces for our worldwide successes.

This is why we offer our employees opportunities to become qualified for cooperation at all levels. This can be achieved, for example, by means of intensified training measures that convey intercultural understanding. Our language courses use new, innovative learning methods such as “blended learning”, which combines different styles of learning such as virtual or online learning with face-to-face training in a particularly effective and varied way. This means that every employee can expand his knowledge according to his own level and time constraints. We ensure that advanced training in technical and management topics is organized in a targeted way by holding annual employee dialogs and systematically raising the qualification requirements.



*Securing jobs*

## SECURING OUR GERMAN LOCATIONS

We are committed to supporting our German location on a sustainable economic basis. In order to secure international competitiveness and the future of the MAHLE locations in Germany, we concluded an agreement in spring 2005 after intensive negotiations with the employee representation, trade unions and employers' associations. The agreement will lead to a cost reduction in the medium term

through the solidarity contributions of all employee groups. This will also help to preserve jobs in Germany in the longer term. However, our global presence and our strengthened commitment in the growth markets outside Europe remain a prerequisite for further balanced and profitable growth. This will inevitably be combined with an increase in headcount abroad.

## COMMUNICATION AND COOPERATION WORLDWIDE

Our global structure requires global information networks, from sales control and worldwide cooperation in the product development process to an active communications policy through our employee magazine "MAHLE global". It allows people who work for MAHLE, scattered throughout the globe, to come closer together. The editorial teams of the regional editions for North and South America and the national editions in France, Spain, Poland, Japan and China contribute voluntarily and enthusiastically. Today, through the worldwide exchange of information, our employees are better informed about Group events than ever before.

Knowledge and knowledge management are increasingly becoming the key factor for success. All our employees are linked by an Intranet, which is accessible worldwide and is used as a tool for international project work. This is where our information and work platform "Expert" is set up, allowing employees to access expert knowledge within the Group and to network with each other.

Contact that spans countries and intensive cooperation between our employees are taking on increasing significance for our international competitiveness. This is why, in 2005, we passed a Group-wide guideline for organizing international assignments, in close cooperation with the regional human resources managers. The successful expansion of our activities in Asia has shown how important presence, personal relationships and the exchange of experience within the special economic and cultural conditions of these countries are. For example, we specifically selected the Chinese engineers for our R&D center in Shanghai – currently under construction – according to certain criteria and, as part of an international collaboration lasting several months, trained them intensively and prepared them for their future tasks, primarily in Germany but also in Japan.



*Worldwide networking  
of experts and know-how*

We consciously promote employee exchanges and cooperation across national borders in Europe as well as the Far East (e.g., in the integration of our new Group subsidiary, MAHLE Powertrain Ltd. in Great Britain, formerly Cosworth Technology). This is another example of the cooperation that takes place within the Group, fully in line with our management model.



*Expanding knowledge, challenging and encouraging employees*

### **VOCATIONAL TRAINING, QUALIFICATION AND PROMOTION OF TALENT**

In Germany, we are able to fill the majority of the junior specialist positions through our own training scheme. As a forward-looking company, we are particularly interested in vocational training and ongoing qualification for young people. Therefore, the initial vocational training remains the basis for talent promotion in specialist areas; this applies to both industrial and commercial apprenticeships and company-related courses of study at the University of Cooperative Education (Berufsakademie).

In addition to this, we provide attractive opportunities for internships both in Germany and abroad. The number of apprentices that we train often exceeds far beyond our company needs; this represents an important part of our responsibility to society and the community. Initial vocational training is now also becoming increasingly important at many foreign locations.

### **MANAGEMENT DEVELOPMENT WORLDWIDE**

Our management trainees are systematically selected from our employee base in all regions of the world. On the basis of cooperative leadership, which is laid down in the MAHLE leadership model, we regularly ascertain the skills and potential of our employees. Successors for managerial positions are identified and their potential is systematically developed in all corporate divisions. This enables us to fill more and more managerial positions from within our own ranks and increase our appeal as an employer.

In order to fill the top management positions, we are also intensively promoting the organization of a Group-wide program for ongoing development of our existing middle management. The Group's executives have discussed this topic, and many others, at the international executive meetings, in addition to dealing with the ongoing development of our corporate values and identity. The worldwide coalescence of our Group organization is showing clear signs of success, although we are determined not to rest on our laurels.

## CONSTRUCTIVE COOPERATION WITH THE EMPLOYEE REPRESENTATION

The cooperation with the employee representatives at all locations and in all countries has shown that, even when it comes to difficult topics, it is possible to successfully find common solutions meeting the needs of all parties involved. Adverse economic conditions necessitated cost savings in many cases, which placed high demands on the good and efficient cooperation we have with our internal partners. A sense of responsibility for this issue secures the Group's long-term future and preserves jobs, even in countries with high labor costs and salaries.

The Management Board would like to express its thanks to all employees for their commitment, proven team spirit and the successes they have achieved – driven by the willingness to perform that carries us and our customers worldwide forward.



*Technically advanced  
production processes –  
controlled by flexible,  
qualified employees*



NEVER EASING OFF,  
**BECOMING BETTER AND**





BETTER

No pause for breath – “Charging. Driving. Breathing.  
Is it better, faster, cleaner? We’re sure to find a way.”

## QUALITY MANAGEMENT – FROM INSPECTION TO PREVENTION

After the successful restructuring of the Group organization, one of our priorities in 2005 was to extend the Group-wide standards in quality management. In order to further improve the overall quality we provide to our customers over the whole process chain and be able to respond efficiently to problems at an early stage, new areas of focus were established – from prevention in product and process development to systematic analysis of causes.

### QUALITY MANAGEMENT SYSTEM IMPROVED

In 2005, we were able to refine the model of the MAHLE business processes even further and gradually optimize the Group-wide standards it defines. Four TOP quality processes have been defined to control the quality management system:

- Defect prevention to avoid potential risks
- Inspection and testing to avoid defects and eliminate defective parts
- Problem solving in case of defective parts
- Continuous improvements to increase the quality of all products and services



*Leading-edge testing technologies ensure high-quality standards*

### EARLY PLANNING AND PREVENTION IN PRODUCT AND PROCESS DEVELOPMENT

In our development projects, we clarify at an early stage – by means of an extensive feasibility study – whether process risks may arise in the production cycle and initiate effective corrective measures in order to eliminate the risks immediately. In addition, experience from completed projects is incorporated into production planning. We analyze and evaluate the product concept and the planned production process using standardized methods of analysis. This allows us to objectively determine possible risks and eliminate them effectively. The structured procedure reduces both development and process times in production. At the same time, potential defects in the product are avoided, costs are reduced and warranty costs minimized – in this way, we can deliver sophisticated, reliable products to our customers right from the start.

By creating uniform risk analysis tools, we are able to achieve additional improvements. Standardized software, coordinated evaluation guidelines, reduced administrative processes and multilingual databases help to structure development processes more effectively and actively support our global production strategies.

## ONGOING DEVELOPMENT OF QUALITY MANAGEMENT IN PRODUCTION

We have developed classic quality management – 100 percent inspection before creation of value, process control with statistical methods and 100 percent inspection after creation of value – even further, with new areas of focus. We systematically examine production processes and incorporate failure prevention measures at critical points. In complex handling and assembly processes, highly effective safeguarding effects can usually be produced with small but crucial improvements. Automatic inspections, performed as part of the process step control, indicate defects as soon as they occur, enable immediate correction and increase the overall reliability of the process considerably. As a result of ongoing development of the test method for pistons, the inspections that take place during production are now integrated into an automatic measuring machine, instead of the several items of test equipment required previously. This means that the necessary process control can be performed to the desired degree of accuracy considerably more quickly on one piece of equipment. This reduces response times to a quarter of their previous level. Other advantages, besides better production control, include simplified data collection and the possibility of trend analysis.

## ANALYZING CAUSES OF QUALITY PROBLEMS WITH AND PROBLEM SOLVING

Should defects occur in the product despite the extensive safeguarding measures in our production processes, we respond with a quick analysis of the causes of the defect and corrective measures derived from this. As a result of ongoing development of our quality management, we have an efficient problem analysis tool at our disposal – root cause analysis: a method of analysis that uncovers the root of the problem. The employees perform the analysis themselves at their workstation and obtain the best possible results. Finally, the effectiveness of the improvement is checked in order to ensure the improvement process. The experience gained from solving problems is automatically incorporated into the development of new products and processes.

## QUALITY IMPROVEMENT TEAMS

Quality needs people who are able to think and act responsibly. The strategic objective we have set ourselves is to improve constantly in order to optimize quality and processes. The growing number of our quality improvement teams worldwide shows that our highly trained employees are strongly committed to producing the highest level of quality. Their experience is incorporated into the process documentation and further standardization of our processes.



*Continuous improvement of processes within the team*

## INTEGRATED PROTECTION FOR THE ENVIRONMENT AND EMPLOYEES

Environmental awareness is anchored permanently in the principles at MAHLE, just like safety at work and health care. By incorporating safety at work into our environmental management, we have consistently created an integrated structure. As a result, our environmental protection and safety at work strategy is oriented globally at all locations. It comprises the involvement of all employees, the saving of resources and consistent optimization of the products and production processes in order to protect the environment and our employees.

### UNIFORM STANDARDS IN ENVIRONMENTAL PROTECTION AND SAFETY AT WORK

In 2005, the newly created central division for environmental protection and safety at work established a Group-wide process structure for auditable environmental management and introduced it in phases. At the same time, the effectiveness of the new structure was verified – it brought significant success for the individual locations. The standards created in this way ensure that procedures from planning to development can be implemented uniformly and promptly within a modern framework for environmental protection and safety at work.



*High standards in safety at work and environmental protection*

### SAFETY AT WORK: ALWAYS A STEP AHEAD

As a result of constantly checking the effectiveness of our safety at work measures by means of internal and external audits, MAHLE has now achieved a maximum degree of safety. The consistent involvement of employees is a decisive factor in attaining this high standard. After all, the only way to reduce accidents and health hazards even further is to practice and apply safe behavior. Therefore, in a pilot project, we tested an interactive instruction module, which conveys important knowledge about safety at work to employees individually through self-training. The results of this project were extremely satisfactory for all participants; as a result, we will take the initial step of introducing this instruction module at all German-speaking MAHLE locations.

### CHLORINE GAS REDUCED BY A FURTHER 20 PERCENT WORLDWIDE

Because of the high oxidation potential and hydrogen solubility of aluminum melts, a melt cleansing process needs to be performed before casting. In order to achieve the required material quality in piston alloys, various “disruptive” elements such as calcium and sodium must also be removed. The use of chlorine is vital for this. In the conventional process used previously, chlorine gas was blown into the melt. Not only did this result in a high level of consumption, but the process was also dangerous for people and the environment. The search for alternative processes was imperative and led to some convincing solutions.

Today, all MAHLE foundry locations have melts that are cleansed using state-of-the-art technology in Foundry Degassing Units (FDU). In this process, the chlorine is steadily introduced into the melting bath via a rotor, the gases are extracted during the treatment and the solid foreign substances



*Environmental awareness on the basis of a worldwide environmental management system*

are transported to the surface of the bath. There they can finally be removed safely by the employees. In addition, the process avoids damage to buildings and equipment as a result of corrosion.

At one of our locations in the USA alone, this resulted in savings of 19 tons less chlorine per year in comparison with the average consumption using conventional technology – clearly easing the burden on the environment.

#### **ENVIRONMENTAL CERTIFICATION FOR CHINESE AND JAPANESE LOCATIONS**

In 2005, the MAHLE locations MAHLE Engine Components Japan Corporation, Nishimurayama and Tsuruoka; MAHLE Engine Components (Yingkou) Co., Ltd.; MAHLE Engine Components (Nanjing) Co., Ltd. and MAHLE Shanghai Filter Systems Co., Ltd. were checked for certifiability in an internal audit. The auditing procedures were prepared using established MAHLE standards. The result was positive in all cases and there were no reservations with regard to certification in compliance with ISO 14001, which is planned for 2006.

#### **HEAT RECOVERY CONSERVES RESOURCES**

Our newly constructed plant in Grenchen/Switzerland, and the new German locations in Wölfersheim and Wustermark use energy resources particularly efficiently by means of heat recovery from production facilities. The environmentally friendly technology was a requirement even in the planning stage. The waste heat from cooling plants, sintering furnaces and compressor plants is mainly used directly for heating and producing hot water. In view of the dramatic rise in crude oil prices, these investments will be quickly amortized. The decrease in investments for the smaller-scale heating installation leads to further savings and shortens the amortization period.

#### **AWARD FOR WATER CONSERVATION**

Water is a valuable commodity. For this reason, MAHLE Pistoni Italia S.p.A. in La Loggia initiated a project that aimed to exploit all the possibilities of saving water. All production processes were consistently examined and optimized with regard to their water consumption. The pleasing result was water savings of 40 percent. This success was rewarded by the company Acque Porino. The knowledge gained in Italy can be transferred to other locations – environmental protection that pays off.