MAHLE

Driven by performance

CHANGE BORN FROM RESPONSIBILITY

Annual Report 2016

MAHLE GROUP FIGURES

in EUR million	2016	2015	2014	2013	2012
Sales	12,322	11,486	9,942	6,941	6,159
EBITDA	1,079	1,093	1,022	771	725
EBIT	473	511	514	422	401
Result from business activities	228	309	401	307	267
Net income	63	122	279	236	149
Tangible fixed assets	3,029	2,888	2,446	2,167	1,561
Capital expenditure on tangible fixed assets (without first consolidation)	563	564	488	397	324
Equity	2,722	2,667	2,555	2,207	1,775
Dividend paid by MAHLE GmbH	6.0	6.0	8.5	7.1	5.0
Headcount (as at Dec. 31)	76,632	75,635	66,234	64,345	47,662

THE MAHLE PRODUCT PORTFOLIO

ENGINE SYSTEMS AND COMPONENTS

As a global market leader in our key market segments, we have decades of systems and development expertise and extensive production experience to build on. Since our company's early days, the development of piston systems and cylinder components has been a core competence of MAHLE. Because we understand the interaction of all engine components, we can deliver optimal solutions to our customers. Products such as pistons, piston rings, cylinder liners, bearings, as well as valve train systems and components are used around the globe in two-wheeled vehicles, passenger cars, commercial vehicles, and large engines. And the range is continuously being expanded, so that emissions and fuel consumption in combustion engines can be further reduced in the future.

FILTRATION AND ENGINE PERIPHERALS

MAHLE manufacture filters, pump systems, and oil coolers for engine and transmission applications—all of which are designed to increase the engine's efficiency and service life and reduce emissions. We are thus contributing to clean air and preventing engine damage resulting from oil and fuel contamination. Engine peripherals often vary due to different regional emissions regulations, individual car body shapes, and various power classes—even for identical basic engines. To address this diversity, we have partnered with our customers in recent years to develop modular systems for every major product group. Here again, we are one of the global market leaders.

THERMAL MANAGEMENT

An increasing electrification of the powertrain calls for superior innovative capacity in thermal management—for batteries and the entire electric powertrain alike. As engines are downsized for the purpose of lowering emissions, thermal management plays an even greater role in improving the combustion engine's performance. What's more, air conditioning is expected to provide comfort inside the cabin while keeping energy consumption low. When it comes to the thermal management of batteries, MAHLE is a technological pioneer. Our solutions ensure constant temperature levels and an even distribution of temperature between battery cells, producing long-lasting storage systems that deliver high performance.

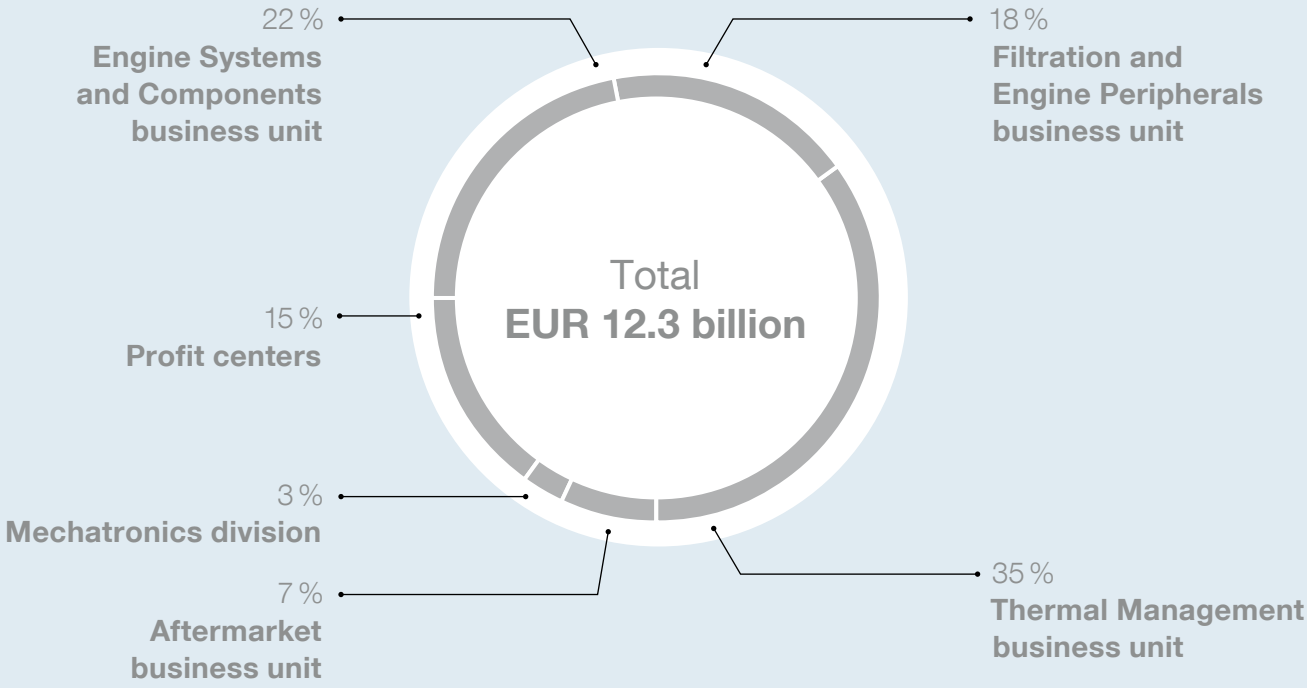
MECHATRONICS

Mechatronic components are playing an increasingly crucial role in enhancing the efficiency of the powertrain and advancing e-mobility. That is why, in early 2016, MAHLE merged the group's mechatronics expertise in a new division, along with the product groups of electric drives and auxiliaries as well as actuators. This division is infused with our R&D and manufacturing expertise in electric motors and electronics. Although these are used in a wide variety of applications, their technology is closely related, which affords synergies and economies of scale—two highly relevant factors in the automotive industry.

MAHLE AT A GLANCE

As one of the world's 20 largest suppliers and a development partner to the automotive industry, MAHLE offers innovative mobility solutions that stand for clean air, fuel efficiency, and driving pleasure. Our product portfolio for passenger cars and commercial vehicles demonstrates our unique systems competence, as it addresses all crucial issues related to the powertrain and air conditioning technology—from engine systems, filtration, and electrics/mechatronics through to thermal management. The group supports manufacturers as early as in the development of new vehicle generations, not to mention the continuous improvement of series production applications. Proof of our technological leadership is not least to be seen in our successes in motorsport—be it in Formula 1 or in Le Mans. Moreover, our innovative products are used in stationary applications, mobile machinery, as well as in railroad, marine, and aerospace applications. And of course, we also supply workshops and engine repair workshops with MAHLE products in original equipment quality.

SALES BY SEGMENT



For details on the organizational structure,
see page 85

OUR SELF-PERCEPTION

The MAHLE Group is a leading global development partner to the automotive industry and offers its customers complete systems from a product range that is unrivaled in breadth and depth. Our new developments are geared toward the further optimization of combustion engines and thermal management solutions as well as the expansion of e-mobility. We also want to set new future standards with our innovative solutions by consistently using and expanding our knowledge and innovative strength.

With our strategic orientation, we are addressing megatrends such as population growth, urbanization, globalization, connectivity, or limiting emissions to promote climate protection. We not only see these as an opportunity for further growth, but as an obligation to design our technologies so that mobility on our planet is as environmentally friendly as possible.

The Mahle brothers have bequeathed us a company structure that secures our independence and the long-term orientation of the group. In accordance with their specifications, we want to continue to successfully develop MAHLE as a leading company and attractive employer.

“Change born from responsibility” summarizes the course we are on. We are thus explicitly committed to fairness, legality, cultural diversity, and equal opportunities. Our relationship with our employees, customers, and suppliers is based on these values. Assuming social responsibility is a corporate objective set by our founders. It is always incorporated into all of our decisions—now and in the future.

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You will find the report online on:
www.annualreport.mahle.com

Whenever you see this QR code in the report, there is a video with further information on that topic.

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Download a QR code scanner. This is available free of charge from the appropriate iOS and Android app stores.

Step 2 › Open
Open the app and scan the QR code.

Step 3 › Scan
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EDITORIAL

Ladies and Gentlemen,

Over the past few years, the MAHLE Group has been decisively shaped by far-reaching change like never before. The company has become considerably bigger and, above all, notably more diverse. Technological developments and, above all, changes in the automotive industry are the main driving forces behind this all. Our sector is undergoing a fundamental transformation that will last for many years to come. This is attributable to the use of new drive concepts, connected mobility and networked production technologies, and the growth in other emerging markets. From both an economic and technical standpoint, these factors call for widespread presence, great flexibility, and above all: continuous change.

A few years ago, we therefore started to broaden our company's position in terms of portfolio and regional presence. We pursue a dual strategy: On the one hand, we are convinced that the combustion engine will remain an important drive for a long time to come. This is why we are continuing to work intensively on new solutions to raise the efficiency of these engines while lowering their emissions. At the same time, we want to be a driver of e-mobility, just as we already are in the conventional market today.

In order to carry out the next step of this ongoing development, we need to assert our economic success and further enhance profitability, in particular. Because only by consistently expanding our financial strength are we able to invest in research and development, establish new business areas, make strategic acquisitions, and position ourselves as a resilient company.

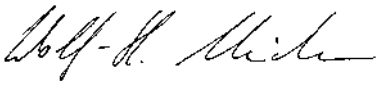
In the magazine section of this Annual Report, we provide you with a few examples of how we are managing change in our day-to-day activities and which technical solutions we are offering our customers. You will discover how broadly positioned MAHLE is and how special people stand behind our company's products and services. Because they are the real drivers of change with their enthusiasm for new solutions, contagious vigor, deep knowledge, and team spirit.

Many of the changes in our company are aligned with our strategic reorientation. We have divested some of our previous activities, and added new ones, such as vehicle electronics, for example. Such a process always involves changes for our employees and their environment. We are only too well aware of this and accept this responsibility. Firstly, because our founders, the Mahle brothers, bequeathed us with the task of always keeping people first and foremost in mind besides economic success. And secondly, out of conviction: because MAHLE would not be so successful today without our dedicated employees.

“Change born from responsibility” is therefore our guiding principle for this year’s Annual Report because it is pivotal to all our decisions, and will continue to be so in the future. Together with my colleagues on the Management Board, I would like to thank the Supervisory Board, the members of MABEG—Verein zur Förderung und Beratung der MAHLE Gruppe e. V.—, and the employee representatives for their strong cooperation during the 2016 business year. But most importantly, our special thanks goes to our close to 77,000 employees around the world. Their daily commitment ensures that MAHLE worldwide stands for innovative spirit, high product quality, and a particular proximity to customers.

Wolf-Henning Scheider

Chairman of the Management Board and CEO of the MAHLE Group



Wolf-Henning Scheider

Chairman of the Management Board
and CEO of the MAHLE Group

MANAGEMENT BOARD

As at March 31, 2017

Bernd Eckl

January 1, 2017: joining

effective April 1, 2017: Engine Systems and Components business unit, Corporate Quality Management, Large and Small Engine Components profit center

Arnd Franz

Automotive Sales and Application Engineering, Aftermarket business unit

Wilhelm Emperhoff

Filtration and Engine Peripherals business unit, Mechatronics division; until October 31, 2016: Industrial Filtration profit center

Dr. Rudolf Paulik

until March 31, 2017: Engine Systems and Components business unit, Corporate Quality Management, Large and Small Engine Components profit center

Dr. Jörg Stratmann

Thermal Management business unit, Industrial Thermal Management, Compressors, Control Units, Front-end Modules profit centers

Wolf-Henning Scheider

Chairman

Research and Advanced Engineering, Corporate Planning, Corporate Communications, External Affairs; Engineering Services, Motorsports, and Special Applications profit centers

Michael Glowatzki

Director of Personnel, Human Resources, Legal

Michael Frick

Finance, Corporate Controlling, Taxes, IT Services, Corporate Insurances, Corporate Internal Audit

REPORT OF THE SUPERVISORY BOARD

For the MAHLE Group, the 2016 business year was influenced by disparate conditions. While group sales grew by 7.3 percent to EUR 12,322 million due to the positive global market development, first consolidation effects, and exchange rate effects of important national currencies, the development of the financial result and net income was disappointing. This was partly due to individual effects, but also the operating performance in some business areas was inadequate.

In particular asset adjustments and impairments in connection with planned restructuring measures had a negative impact on profit.

The Supervisory Board has actively discussed and advised on all decisions pertaining to the long-term strategic development of the group. These include the disposal of the industrial filter activities, the sale of parts of our raw forging production, as well as the acquisition of the Spanish company Nagares to strengthen our mechatronic and electronic activities. The changes in future individual mobility triggered by various effects over the past few years will require considerable efforts on MAHLE's part—particularly in the area of portfolio management and product development. The importance of the internal combustion engine for passenger cars in the MAHLE Group's overall product portfolio will decrease over the years. A concerted decision-making process between the Management Board, the Supervisory Board, and the shareholders need to ensure that this development is managed within a sustainable business policy.

In the 2016 business year, the Supervisory Board met all of its obligatory responsibilities in accordance with the law, Articles of Association, and Rules of Procedure. It held a total of five meetings in the business year.

During the year under review, the Supervisory Board was informed regularly, promptly, and comprehensively through verbal communication and written documentation from the Management Board and during meetings about the business development of the company, the group, its business segments as well as its participations. Along with the operational and strategic issues, the implementation of the new law for the equal participation of women and men in managerial positions was also discussed in these meetings.

Mr. Uwe Schwarte and Mr. Michael Kocken, the latter as the successor to Mr. Patryk Krause, were appointed to the Supervisory Board by supplementary resolution of the district court, with effect from January 19 and March 19, 2016 respectively. Professor Dr. Gisela Lanza, holder of the professorship "Production Systems and Quality Management" at the Karlsruhe Institute of Technology (KIT) and Head of the Institute for Production Technology (wbk) was appointed a member of the Supervisory Board on July 1, 2016.

The Supervisory Board would like to extend its thanks to long-serving member Professor Dr. Hans-Joachim Schöpf, who retired on June 30, 2016, for his constructive and trustworthy cooperation.

The Supervisory Board appointed Mr. Bernd Eckl as a member of the Management Board of MAHLE GmbH on January 1, 2017, where he will be responsible for the Engine Systems and Components business unit as well as the Large and Small Engine Components profit center with effect from April 1, 2017. He is also responsible for central quality management at corporate level. In taking over these duties, Mr. Eckl succeeds Dr. Rudolf Paulik, who will go into retirement on the same date.

The Supervisory Board expresses its thanks to Dr. Paulik for his almost 25 years of successful work in various positions in the group.

The appointed auditors PricewaterhouseCoopers AG audited the annual financial statements and management reports of the MAHLE Group and of MAHLE GmbH for the 2016 business year, rendering an unqualified audit opinion. The Supervisory Board agreed with the results of the audit following in-depth analysis of the audit reports and the report from the auditors in the Supervisory Board meeting.

The Supervisory Board approves the annual financial statements and the management reports of the MAHLE Group and of

MAHLE GmbH, and agrees with the proposal of the Management Board for the appropriation of the income of the business year.

The Supervisory Board would like to express its thanks to the Management Board and all employees of the MAHLE Group for their commitment to the long-term success of the MAHLE Group.

Stuttgart/Germany, April 25, 2017

For the Supervisory Board

Professor Dr. Heinz K. Junker
Chairman of the Supervisory Board
of the MAHLE Group

Professor Dr. Heinz K. Junker
Chairman of the Supervisory Board of the MAHLE Group

IMPRESSIONS OF 2016

NEW MECHATRONICS DIVISION

MAHLE merges the product divisions of Electric Drives and Applications as well as Actuators into the Mechatronics division. The aim is to strengthen its market position in this promising market segment.

January

LAUNCH OF GLOBAL PURCHASING EXCELLENCE PROGRAM

The central purchasing project "Global Purchasing Excellence Program" (GPEP) commences. The goal is to identify and implement savings along the entire supply chain.

VOLVO AWARDS MAHLE

The Volvo Group presents MAHLE with the Supplier Award in the "Innovation and Fuel Efficiency" category and particularly praises the MAHLE Monoweld® steel pistons in the power cell unit for commercial vehicles.

February

EXPANSION OF THE COOPERATION WITH SCUDERIA FERRARI

The commitment to motorsports has decades of tradition at MAHLE. In this context, the long-standing cooperation with Scuderia Ferrari has been stepped up. The scope of the cooperation now includes the optimization of the crank mechanism and the development of high-performance materials, among others.

March

April

START OF THE ACTIVATR INNOVATION PROGRAM

MAHLE joins forces with other renowned companies to take part in the ACTIVATR innovation program. During an eight-month project, interdepartmental teams work on potential future products and business models.

TEN YEARS OF MAHLE TECHNOLOGIES HOLDING CHINA

MAHLE Technologies Holding China (MTC) Co., Ltd.—MAHLE's Chinese headquarters and R&D center in Shanghai—looks back on a ten-year success story; during this period, it has already been expanded twice.

"IGNITION DAY" ON THE TOPIC OF INDUSTRY 4.0

MAHLE organizes the "Ignition Day" at the group headquarters. MAHLE product experts exchange ideas with external specialists on the possibilities of Industry 4.0—a topic of great importance at MAHLE.

FORD AWARDS MAHLE THE Q1 STATUS

Ford awards MAHLE Behr Charleston Inc./ USA the Q1 status in recognition of its continuous achievement.

MAHLE RECEIVES THE 2016 "RETROCLASSICCULTUR" AWARD

The RetroClassicCultur association awards MAHLE this prize for its special contribution to the preservation of the historical automotive cultural heritage. Whether Porsche, Mercedes-Benz, or Jaguar: MAHLE Aftermarket offers a broad spectrum of engine parts for vintage, neoclassic, and modern classic cars.

A WORLD FIRST FOR THE OIL SUPPLY IN COMMERCIAL VEHICLES

With our world's first controllable pendulum-slider oil pump, which is now also available for commercial vehicles, the pressure and volume flow are generated on demand, reducing the required power to a minimum.

May *June*

MAHLE WINS SUPPLIER AWARD FROM PSA

The plant of MAHLE Metal Leve S.A. in Itajubá/Brazil wins the PSA Peugeot Citroën supplier award LATAM in the "Best Plant" category for its special achievements.

MAHLE IN SOUTH KOREA RECEIVES SEVERAL AWARDS FROM GENERAL MOTORS

MAHLE Donghyun Filter Systems Co., Ltd./ Korea receives the "GM Supplier Quality Excellence Award" for the fourth time already for its plant in Ulsan, while the Hwasung plant wins it for the second time running.

AWARD FROM RENAULT-NISSAN FOR SPEED

Renault-Nissan presents MAHLE Izmir A.S./ Turkey with the Supplier Achievement Award for starting the production of steel pistons both quickly and efficiently.

MAHLE OPENS THE VEHICLE ENGINEERING CENTRE

MAHLE Powertrain, the Engineering Services subsidiary, opens the VEC in Northampton/ Great Britain. It extends the range of products and services offered to automobile manufacturers in the field of trendsetting powertrain technology.

MAHLE SIGNS THE DIVERSITY CHARTER

With this signature, MAHLE underscores its commitment to the principles of the charter and to stepping up its measures to embed diversity in the corporate culture. This initiative to promote diversity in companies under the patronage of German Chancellor Dr. Angela Merkel is one of the largest diversity corporate networks in Germany.

charta der vielfalt

MAHLE BECOMES ONE OF VW'S "A SUPPLIERS"

The Volkswagen Group assigns MAHLE Filter Systems GmbH in Lorch/Germany the "A supplier" status for plastics and inline fuel filters and certifies the "Formula Q Delivery Capability."

July *August* *September*

AUTOMECHANIKA—THE LEADING TRADE FAIR FOR THE AFTERMARKET

MAHLE exhibits world premieres at Automechanika, such as the CareMetix® cabin air filter, which absorbs odors perceptibly, as well as the Recovery Only Unit for refrigerant recovery. The trade fair presence with tuning specialist and video blogger JP is featured in the MPULSE web magazine.

IAA COMMERCIAL VEHICLES —EFFICIENCY, RELIABILITY, AND DRIVING COMFORT

MAHLE addresses these core issues with its new products at the IAA. EU Commissioner Günther Oettinger (center) and VDA President Matthias Wissmann pay a visit to the MAHLE stand.

PERFECT THERMAL MANAGEMENT OF BATTERIES

Thermoelectric battery conditioning is one of the MAHLE highlights at the IAA. A single component cools or heats the temperature-sensitive lithium-ion battery, which increases its durability.

BADEN-WUERTTEMBERG'S MINISTER OF ECONOMIC AFFAIRS PAYS A VISIT

Dr. Nicole Hoffmeister-Kraut pays a visit to MAHLE in Stuttgart/Germany. The central topic of her visit is the integration of refugees and their training at MAHLE. The Minister is impressed by MAHLE's commitment and the opportunities it offers to displaced people.

2016 DTM CHAMPION WITH MAHLE

First-class performance: Marco Wittmann wins the 2016 DTM in his BMW M4 DTM at the final race at the Hockenheimring. The winning car has technology from MAHLE on board, including forged pistons and pins.

MAHLE TEAM IS WORLD CHAMPION OF THE 2016 FORMULA STUDENT

The "Rennteam Uni Stuttgart," sponsored by MAHLE, takes first place in the world ranking list of Formula Student. As a technology partner, MAHLE supports a total of 24 teams worldwide in the "Formula 1 for Students," of which seven are so-called "E-teams" with electrically driven vehicles.

October *November* *December*

EXTENDED TESTING CAPACITIES IN NORTH AMERICA

MAHLE Powertrain opens a new 4,200 square meter testing center in Plymouth, Michigan/USA. It is equipped with seven lift platforms, a four-wheel-drive chassis dynamometer, five powertrain test cells, and a wiring-and-instrumentation laboratory for the development of powertrains.

FIAT CHRYSLER AUTOMOBILES AWARDS MAHLE IN MEXICO FOR ITS QUALITY

Fiat Chrysler Automobiles selects the best 20 suppliers out of around 500 in Mexico as well as Central and South America. MAHLE Componentes de Motor de México, S. de R.L. de C.V. in Ramos Arizpe/Mexico is one of the award winners; the plant is distinguished with the "Outstanding Quality Performance Award."

HIGHEST SALES IN THE HISTORY OF THE COMPANY

With over EUR 12 billion, MAHLE achieves the highest sales in the history of the company. This result consolidates our position among the 20 largest automotive suppliers worldwide.

MAHLE—A WORLDWIDE NETWORK

As at December 31, 2016

WORLDWIDE

About 170 production locations
15 major development locations
About 77,000 employees

EUROPE

COUNTRIES
Bosnia and Herzegovina, Germany, France, Great Britain, Italy, Luxembourg, Austria, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Czech Republic, Turkey, Hungary, Belarus

68 production locations
34,601 employees[1)]

AFRICA

COUNTRIES
South Africa

2 production locations
1,054 employees[1)]

DEVELOPMENT LOCATIONS

Bascharage/Luxembourg
Northampton/Great Britain
Šempeter pri Gorici/Slovenia
Stuttgart – Bad Cannstatt/Germany
Stuttgart – Feuerbach/Germany

NORTH AMERICA

COUNTRIES
Canada, Mexico, USA

29 production locations
15,578 employees[1)]

SOUTH AMERICA

COUNTRIES
Argentina, Brazil

13 production locations
9,338 employees[1)]

DEVELOPMENT LOCATIONS

Amherst, New York/USA
Detroit – Farmington Hills, Michigan/USA
Detroit – Troy, Michigan/USA
Lockport, New York/USA
São Paulo – Jundiaí/Brazil

ASIA/PACIFIC

COUNTRIES
China, India, Indonesia, Japan, Philippines, Singapore, South Korea, Thailand

54 production locations
16,061 employees[1)]

DEVELOPMENT LOCATIONS

Numazu/Japan
Pune/India
Shanghai/China
Tokyo – Kawagoe/Japan
Tokyo – Okegawa/Japan

[1)] *Respectively total number of employees by region, incl. development locations and sales branches*

You will find the detailed list of our locations here:
mahle.com/mahle/en/about-mahle/locations/locations.jsp

IN DIALOG

"TODAY, MAHLE IS MUCH MORE BROADLY POSITIONED AND GEARED TOWARD THE CHANGE IN THE AUTOMOTIVE INDUSTRY."

"WE ARE CONSISTENTLY EXPLOITING OUR OPPORTUNITIES."

Wolf-Henning Scheider on the change at MAHLE

The MAHLE Group has changed dramatically over the past few years. On the one hand, it has grown considerably. The company ranks among the leading automotive suppliers worldwide and is number four in Germany today. On the other hand, MAHLE is undergoing an intense process of structural change. Wolf-Henning Scheider, Chairman of the Management Board and CEO, explains how the company is implementing this change and its underlying strategies.

MR. SCHEIDER, HOW HAS MAHLE CHANGED IN THE 2016 BUSINESS YEAR?

We took a number of important steps in 2016 and have made significant progress. This includes the integration of 9,000 employees from our acquisitions along with the hiring of numerous new employees. We were very successful in integrating these people and the knowledge they bring along into our company. This will help us to tackle the challenges ahead of us.

COMPARED WITH MAHLE TEN YEARS AGO: WHAT IS DIFFERENT?

At first glance, the size of the company and our global presence. Our structural changes, however, are of crucial importance to us. Today, MAHLE is much more broadly positioned and decisively geared toward the changes in the automotive industry. This is because we want to be one of the companies that significantly shape the change in our sector. Examples include electrification, connectivity, and increasingly complex systems in vehicles.

WILL THE BUSINESS FOR COMBUSTION ENGINE PRODUCTS SOON BE A THING OF THE PAST?

No, I don't think so. But what many people may not know: today, MAHLE is already generating less than 50 percent of its total sales from business segments that are dependent on the passenger car combustion engine. However, our sales from combustion engine products have increased in absolute terms compared with 2006. This shows we should do anything but neglect this business segment. On the contrary: we still see great growth potential here because the combustion engine will continue to play an important role in the automotive industry for many years to come. For example, in hybrid vehicles, or also in clean and economical vehicles for the emerging markets. These vehicles will also need an efficient combustion engine. In addition, MAHLE is working intensively on the electrification of auxiliary aggregates. The trend toward hybridization is a very positive development for us.

IN YOUR EYES, WHAT SIGNIFICANCE DOES ELECTRIFICATION HAVE?

Electrification covers more than just vehicles with purely electric drives. It will still take some time before e-mobility becomes a mass phenomenon in this form. We are already working intensely on promising solutions in this field. We need to look at it from a different angle: electrification is a trend that affects all areas of the vehicle —from the drive to the auxiliary aggregates, such as pumps and air conditioning compressors, through to new concepts for efficient interior air conditioning. MAHLE already offers many innovative solutions that are in series production—both in conventional vehicles and in electric vehicles.

SO YOU WANT TO ALIGN THE COMPANY ON TWO FRONTS AT THE SAME TIME?

Yes, we are quite clearly orienting our company toward a dual strategy because we want and need to consistently exploit the opportunities that come our way. But we need to design the process responsibly and with good judgement. It is undeniable that the future belongs to electric drives. But it is equally clear that this change will not happen overnight, since there are still many structural and technical issues to be resolved. You only have to think of the charging station infrastructure, which is still limited today. The combustion engine will thus continue to shape our business. This is why we are developing further in this direction and are continuing to offer our customers very promising solutions in this field.

HOW CAN MAHLE MANAGE THIS DUAL STRATEGY?

This is undoubtedly a challenge. Since we need to focus our development activities on two types of powertrains, we have substantially expanded our research and development division over the past few years. We thus invested around EUR 750 million, i.e., 6.1 percent of our total sales in it in 2016. With success: in 2016, MAHLE registered at least one patent a day and received major new orders in cutting-edge technologies. We can only go down this path, however, if the group is successful and consequently generates the necessary funds to invest in research and development. We are therefore questioning more than ever whether our current activities will advance the group or not.

WHAT DOES THIS ASSESSMENT MEAN IN CONCRETE TERMS?

Our strategic goal is “best in class.” We want all our business segments to rank among the best. If there is no prospect of achieving this goal in the medium term, we need to assess whether we should divest ourselves of these activities in keeping with our sense of corporate responsibility. In 2016, for example, we found a buyer for our industrial filtration business, who has integrated and is further developing the business segment as a core activity. And at the beginning of 2017, we decided to look for a buyer for our joint venture Bosch Mahle Turbo Systems, who is willing to invest further to achieve larger quantities and the associated economies of scale.

WILL MAHLE THUS BECOME SMALLER AGAIN?

On the contrary, the company will continue to grow and its structure will continue to change. In 2016, we initiated smaller acquisitions that will be completed in 2017. These are associated with the expansion of our electronic and thermoelectric activities and will thus further strengthen our mechatronics and thermal management business segments.

WHAT WILL MAHLE LOOK LIKE IN 2030?

In 2030, our company will rank among the leading systems suppliers for the powertrain and thermal cabin comfort, regardless of which engine is powering the vehicle. Structurally, MAHLE will have an even broader position than today, and it will be close to its customers in all major markets with corresponding production and development locations. Despite this considerable change, one thing will remain

"WE WANT TO DECISIVELY SHAPE THE CHANGE IN OUR SECTOR."

unchanged: the enthusiasm of the people at MAHLE for technology, new solutions, and their proximity to the customer. This enthusiasm is the DNA of MAHLE and ensures that even tomorrow the customers will say: it's good that it comes from MAHLE.

WHAT DO YOU HAVE PLANNED FOR 2017?

In 2017 too, the ongoing development of innovative ideas and products for the combustion engine will make an important contribution to achieving our goals. What's more, we want to win additional large-scale production projects for electrified and electric powertrains within the framework of our dual strategy. Nagares, our latest acquisition in the field of electronics, will give us further impetus in this area. We can now fully tap and expand this additional electronics expertise for the benefit of our customers. Moreover, we are again aiming to strengthen our market position in the aftermarket business in 2017. In short: we see the various challenges of our industry as an opportunity for MAHLE and want to further consolidate our position as a leading international development partner to the automotive industry in 2017 as well.


EU14 UWF

GREAT BRITAIN

THE CRADLE OF FUTURE POWERTRAINS

A GLIMPSE BEHIND THE SCENES
AT MAHLE POWERTRAIN
IN NORTHAMPTON,
EAST MIDLANDS/UK

"IT REALLY TAKES OFF, DON'T YOU THINK?"

Mark Underwood, *engineer at MAHLE Powertrain*

Several jumbo jets without engines here, a few old sport aircraft there. Between them a discarded trailer from a shipping company: the scenery at what was formerly Bruntingthorpe airfield in the English Midlands seems somewhat bizarre. The silence is broken by a thundering silver VW Golf. A racing car secretly making its first laps on the test track? The roaring engine suggests this may be the case. "It can really take off, don't you think?," laughs Mark Underwood, accelerating the Golf on the back straight that once saw Royal Air Force machines take off and land.

Later, when Underwood allows a look under the hood, the surprise is huge. The charge air cooler with the bold MAHLE logo hides anything but a large-volume engine. "The displacement is only 1.2 liters. But the Golf has more than 260 hp," explains the young engineer, grinning with satisfaction. He is one member of a very talented team, which has developed this highly impressive demonstrator, and such a speedster is totally to his liking. "I have always been fascinated by cars and technology," he explains. He is currently spending some of his free time trying to give an old hatchback somewhat more pep for the racetrack—with the engine of a sports car.

WAY AHEAD OF THE MARKET

However, Underwood is not whizzing around the test track in Bruntingthorpe for the fun of it. The data from each lap is meticulously recorded on a laptop and later evaluated at MAHLE Powertrain in Northampton, 40 kilometers away. Over 400 MAHLE colleagues are based there, providing top-notch engineering services for the global automotive industry. This is where the engines are tested and analyzed, ranging from mechanical inspections through to complex optimizations in drivability. "Manufacturers very much appreciate the fact that we are often way ahead of the market and can respond very quickly to customer demands at the same time. For instance, when it comes to optimizing engines or even developing completely new units," explains Simon Reader, Head of Engineering at MAHLE Powertrain UK.

It is interesting to note that there are a lot of young people on the company premises. "This is a visible sign that we are continuing

Simon Reader is the contact person for customers all over the world.

to grow," says Marketing Manager Daren Mottershead, reinforcing this observation. In 2016 alone, 40 new colleagues were recruited in Northampton. And more are still needed due to the enormous demand from customers. The young engineers come to the East Midlands from universities and colleges spanning the entire United Kingdom. In addition to an exciting job, the young people can also find affordable accommodation and pleasant living conditions here. This is in total contrast to London, where the cost of living is astronomically high.

PROUD TRADITION OF ENGINEERING

The specialists at MAHLE Powertrain have also enjoyed an outstanding reputation for generations. Legendary powertrains have been developed here for decades. The engineering company was known as Cosworth Technology before MAHLE took over in 2005. All are incredibly proud of this tradition to this day. As a matter of fact, all of the engines for the Formula 1 racing cars —with the exception of Ferrari—were developed in Northampton in the 1970s. Today, the former racing division of Cosworth operates under this name in the immediate vicinity.

However, the momentum for the powertrains of tomorrow comes from the rather inconspicuous brick buildings across the way. "Through MAHLE, we have gained a much larger operating radius," reports Reader. "Today, our customers come from Europe, the USA, China, and the Middle East." In the meantime, the MAHLE subsidiary has accordingly adopted a global

“WE OPTIMIZE ENGINES OR DEVELOP COMPLETELY NEW DRIVES.

Simon Reader, *Head of Engineering at MAHLE Powertrain UK*

position. What’s more, it can fall back on the broad expertise of an established group, which has long-standing experience of the entire powertrain. And it goes without saying that MAHLE Powertrain is right at the forefront when it comes to shaping change in the automotive industry. “With the hybridization of vehicles, we are no longer just talking about engines. We are now tackling more and more cross-system projects,” says Reader, explaining the new strategic orientation of MAHLE Powertrain.

This approach means that the knowledge of the developers in Northampton needs to be as broad as it is deep. Mark Underwood, who joined MAHLE Powertrain as a graduate more than five years ago, reports from his own experience: “It takes more than a year until the newcomers can really tackle projects by themselves.” By then, the specialists from Northampton are so well acquainted with the technical details of the powertrain and control that they can achieve noticeable improvements from an engine.

New approach in the shadow of old technology: test drive on the former runway

For example, by making a decisive contribution to the design process or the design of new components. Or—like Underwood—by developing the software for the ECU, which is responsible for the precise management and control of the engine.

SMALL ENGINES WITH A GREAT FUTURE

In Bruntingthorpe, the team tests to see whether the supposedly underpowered Golf can be adjusted to attain the performance profile of a sports car, for example. "We want to show our customers that powertrains can also be designed differently," explains Reader, Head of Engineering. From his point of view, small engines have a great future for various reasons. On the one hand, as impressively demonstrated by the MAHLE Golf, driving pleasure need not necessarily depend on a large displacement. And by using the electric motor as a support unit for the combustion engine, the latter can also be somewhat smaller in future.

The experts in Northampton, however, are concerned with much more than engines in the compact car category. Parked in the courtyard—well shielded from prying eyes—are vehicles that would make any sports car enthusiast's heart beat faster. And on the former Bruntingthorpe airfield, whose access is likewise heavily regulated, one of Mark Underwood's colleagues announces himself with a British luxury brand as he prepares to flash past the discarded aircraft at high speed. Under the hood of this GT car is yet again a machine that will undoubtedly power a new model one day—equipped once more with lots of new technology and know-how from MAHLE Powertrain.

Mark Underwood tests his new software on the track.

POWERTRAIN SOLUTIONS FROM A SINGLE SOURCE

MAHLE Powertrain is a development service provider that offers solutions across the entire powertrain. The MAHLE subsidiary researches, develops, and manufactures conventional combustion engines as well as hybrid systems and electric units. The goal is to optimize powertrains, systems, and components so that they work more efficiently, economically, and produce fewer emissions. MAHLE Powertrain supports vehicle manufacturers across all development phases: from initial trials through to prototype construction, implementation of series production, and subsequent optimizations of the solution reached. One focal point for the powertrain engineers is downsizing engines. These are extremely powerful, despite their significantly lower displacement. A further example of MAHLE Powertrain's achievements is the MAHLE Jet Ignition® lean burn combustion process, which is instrumental in improving the combustion of the fuel mixture.

MAHLE Powertrain has its origins in England. In 1958, Mike Costin and Keith Duckworth founded the engine manufacturer Cosworth Engineering. The company moved to Northampton in 1964. Following a period of Audi ownership, Cosworth Engineering was taken over by MAHLE and has been operating as MAHLE Powertrain since 2005.

Besides its largest branch in Northampton, MAHLE Powertrain now operates additional locations in Stuttgart and Munich/Germany, Shanghai/China, São Paulo/Brazil, and Plymouth in greater Detroit/USA. In 2016, the development service provider employed around 600 people in total. Today, MAHLE Powertrain supports customers all over the world and was the first service supplier to gain approval from the Vehicle Certification Agency for the so-called Real Driving Emissions (RDE) test routes, a new vehicle emissions testing procedure for Europe. MAHLE Powertrain is at the forefront of test procedure development to provide ever greater support to the auto industry over the coming years.

SMALL DISPLACEMENT DELIVERS FULL POWER

Small, but powerful: With a displacement of only 1.2 liters and three cylinders, the downsizing engine developed by MAHLE Powertrain is anything but an underperforming midget. The unit, which is located under the striking cover, develops up to 190 kilowatts (262 hp). The engine can thus achieve a specific output of 160 kilowatts per liter; its maximum torque is 313 newton meters. The engine was fitted in a silver Golf GTI. The comparison shows: the MAHLE downsizing demonstrator vehicle is in no way inferior to the original as far as engine output is concerned. Moreover, its fuel consumption is up to 25 percent lower.

MAHLE Powertrain has been developing downsizing engines since 2007. The technologies are being systematically further optimized with a view to achieving more output with lower consumption and emissions. The latest generation is equipped with a 48-volt electric supercharger combined with a turbocharger. The electric supercharger builds up a continuous additional pressure of up to 2 bar. It thereby makes it possible to achieve high torques even at low speeds. In other words: the MAHLE solution closes the so-called turbo lag—i.e., the low rpm range where conventional turbocharging can't kick in—whereas the latter ensures the required mass flow for high outputs at high speeds. What's more, significant energy recovery is achieved with the 48-volt system, which in turn contributes to up to 25% less CO_2 emissions.

This example also shows the possibilities offered by a 48-volt electrical system. It can power many auxiliaries, which can thus be disconnected from the engine and electrically operated on demand. This relief increases the efficiency of the combustion engine and lowers consumption. Electrically powered auxiliaries such as pumps, air conditioning compressors, or even nonhydraulic brakes can also be found in electric vehicles. MAHLE is thus already developing solutions today for vehicles of the future, independently of the powertrain technology used.

GERMANY

ONLY THE TEAM WINS

CHANGES ARE PART OF EVERYDAY LIFE AT THE MÜHLACKER LOCATION—INCLUDING A DEPARTURE FROM THE FAMILIAR

Peter Knieknecht, Head of the Mühlacker plant, is strongly committed to promoting entrepreneurial thinking and an open approach. He is talking to production employee Vasiliki Pafili.

The boss is coming! Has something gone wrong?—In the past, it's probable that the appearance of plant management in production triggered a queasy feeling in some. Today, however, there is no sign of this when Peter Knieknecht strides through the high-tech production hall of one of the largest MAHLE plants in Europe. On the contrary: the employees encounter the Head of the Mühlacker plant without reservations. They greet each other openly with a handshake, briefly exchange words—sometimes on private matters, too. And if something is not running as it should, the "boss" gets to hear about it directly during his regular rounds. "Our open approach is one of the most important changes here at the location and is definitely part of our success," explains Knieknecht, who has been working at Mühlacker, located roughly 30 kilometers west of Stuttgart, since 2001.

TRADITIONAL LOCATION REINVENTS ITSELF

Changes are part of everyday life here. In MAHLE's leading thermal management plant, around 1,300 employees manufacture a wide variety of products—from cooling components through to complete modules. Components from Mühlacker are installed by vehicle manufacturers all over the world. Mühlacker is a location where labor costs are high, which means it needs to offer efficiency and flexibility in order to hold its own in the top league of the automotive industry. It simply can't afford to stand still. So it's not surprising that the focus here is more on implementing complex ideas in an innovative way to create maximum added value for the automotive industry and internal customers.

Powerful production technologies, lean processes, and a production system that is being continuously refined over the years have long been a matter of course at Mühlacker, forming the basis for high quality and delivery reliability. At the end of the day, however, it's not the technologies and processes that are pivotal, but the people behind them who, through their committed teamwork and ongoing exchange of knowledge and experience, are contributing to our success story on a daily basis.

"The cost pressure is tremendous. If we don't constantly improve, then we're out of the race," Production Supervisor Patrick Lachnit says, putting it in a nutshell, and points at a man-high structure with glittering aluminum fins and two tubes at the top corners. What looks like an oversized heater blower with ram horns, is in reality an impressive cooling module for a DAF truck.

INDUSTRY 4.0 IN PRACTICE

Production and assembly is done on one level. "The shortest possible distances save time and space," explains Production Manager Vincenzo Sabetta. Over the last few years, production has been constantly optimized according to the basic "one-piece-flow" principle—just one of many modifications. After final assembly, the finished giant coolers thus only need to be brought through one single gate before they stand in the courtyard, ready for shipment. The preparation of such optimizations is meanwhile done using 3D scanners—just one example of how Industry 4.0 has since been adopted in everyday plant life.

However, competitive advantage is not created by low-cost production alone. "The individual folded tubes on the cooler have a totally new shape," Sabetta points out a detail. This saves up to 25 percent in weight. The cooling capacity is also greater, which in turn improves the performance of the engine and ensures the strict Euro VI emission standard is met.

At Mühlacker, where labor costs are high, lean processes are a must. Employee motivation, however, is crucial to success.

“OUR OPEN APPROACH IS ONE OF THE MOST IMPORTANT CHANGES HERE AT THE LOCATION.”

Peter Knieknecht, *Head of MAHLE’s Mühlacker plant*

The change in Mühlacker is also impacting the training workshop of the thermal management lead plant.

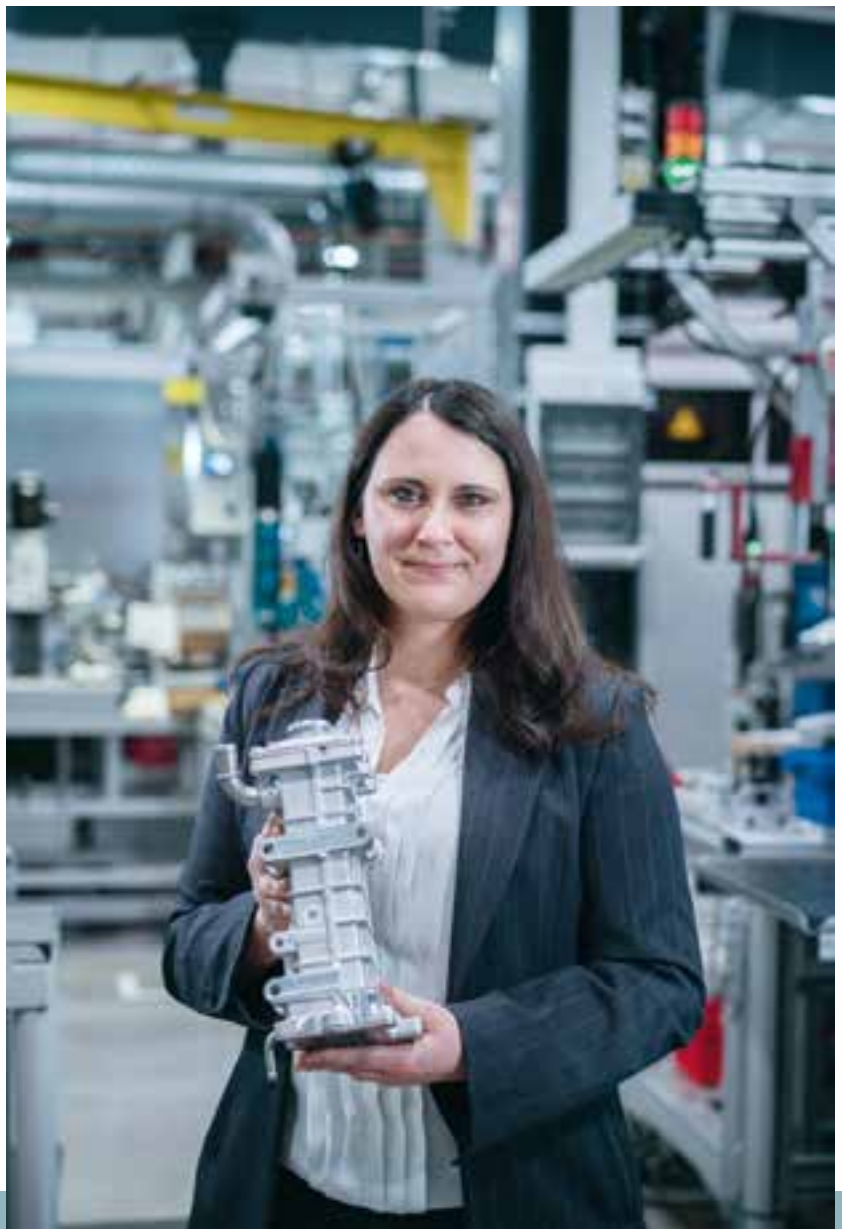
A cooler is much more than just a frame with a few flat tubes to cool down the temperatures of the hot fluids from the engine area. This becomes apparent when you look over Dieter Essig's shoulder. The experienced machine setter carefully examines a metal strip bent in the shape of a concertina. "The height must be exact and the gills need to have a clean form," he says, explaining the purpose of the inspection. Gills? Sure enough, each metal strip consists of a delicate structure with fine incisions—just like gills. This improves the air permeability and increases the cooling capacity.

If everyone fully participates, all can further improve and save costs.

MORE DIALOG AND RESPONSIBILITY

A lot has changed for Essig since his first day at the plant way back in April 1980. Back then, masters behaved more like patriarchs. Discussions were the exception. "Today, I am specifically asked for my opinion," says Essig, describing the culture change, and adds: "This also means, however, that each of us has considerably more responsibility." Patrick Lachnit—a Supervisor who is responsible for 35 employees—also appreciates this open dialog: "I would have had problems with the former type of interaction," he admits. What's more, this leadership style would no longer lead to the desired result. On the contrary: "We can only improve ourselves and save costs if we all pull together and everyone fully participates," Lachnit stresses.

The change in Mühlacker is also impacting training manager Rüdiger Weik's training workshop. Industry 4.0 is already included in the young people's curriculum. "While they are still using the filing vice as before, the young people are simultaneously learning how handle a robot, among other things," explains Weik. Yet, not only the curriculum, but also the tone or attitude toward the young people have changed. Nowadays, instructors treat the trainees differently. "Today, it's more about coaching the youngsters find the right path to the solution,



rather than just defining what's right and what's wrong. We therefore see ourselves more as learning partners than as master teachers," states Weik. Saying that, the instructors still need to establish a few basic rules: "We make it quite clear that they are not allowed to play around on their smartphones while working," Weik grins about this newfangled fad, which is banned from his training workshop.

NATURE OF TEAMWORK REDEFINED

To ensure team thinking benefits the entire plant, Peter Knieknecht and his management colleagues have redefined the nature of teamwork and have even imposed appropriate rules of late. "That was quite an adjustment," the manager admits. No phones or laptops during meetings is just one example of how these rules are implemented in everyday working life. The change goes much deeper, however. "Today, entrepreneurial thinking encompasses all areas and concerns every single one of us," notes Knieknecht. "We can only deal with the market pressure if we all pitch in." Speed and versatility define everyday life in Mühlacker today. "In 1980, we had two products in our range. Today, there are a good 80", machine setter Essig says, describing the change. "What's more, not only are the products becoming increasingly more complex, but the work is getting more intricate because the raw materials are not only expensive but also difficult to process," clarifies Knieknecht. "Vehicle manufacturers expect Mühlacker to deliver solutions that are as easy and cost-effective as possible."

TEAMWORK AS KEY TO NEW PRODUCTS

Nadine Michels, Quality Manager in the area of exhaust gas heat exchangers and vacuum brazing, has been observing the growing pressure for more than ten years. "The requirements have increased significantly," she notes in retrospect. What's more, flexibility and the ability to quickly adapt to market changes are more in demand than ever. Nadine Michels underpins this with the example of a palm-sized aluminum part, behind which an exciting development is concealed. "The demand for such battery coolers has increased considerably within a short period of time," she explains. These new MAHLE products, which are to be used in small electric vehicles in China, are brazed under special conditions, i.e., in a vacuum. Top precision is called for here. "If something goes wrong, a whole batch is affected at the same time—with correspondingly high costs," notes Michels in explaining the challenge.

Such complex products and production processes are created together with the developers in Stuttgart using state-of-the-art CAD technology. The requirements for new products: high mechanical strength, low material usage, and the lowest possible production costs. Innovative approaches are being simultaneously sought to give the customer a technical advantage. All of the divisions are involved: from development to production planning, to quality control, and logistics. The optimized processes now also mean that the machine setters can record the latest data from the machines on site using a tablet. They are thus able to detect wear and tear and any deviations at an early stage and react quickly.

And the next change for Mühlacker is already starting to materialize. Following the move of the MAHLE location from nearby Pforzheim, the plant in Kornwestheim is now due to follow. This recent merger will lead to further reorganization in Mühlacker. The facade is already covered with scaffolding, and the cranes have been set up. Dozens of workers dressed in orange are scurrying in and around a construction pit: a clear sign that MAHLE in Mühlacker is once more in the process of reinventing itself. Yet one thing will remain constant behind the old and new walls: only the team wins.

> **TODAY, ENTREPRENEURIAL THINKING IS EXPECTED FROM EACH AND EVERY INDIVIDUAL.**
>
> **Peter Knieknecht,** *Head of MAHLE's Mühlacker plant*

BETTER PERFORMANCE, LESS WEIGHT

The strict Euro VI emission standard also poses a new challenge for thermal management, since the components have to cope with increased loads due to the higher temperatures, pressures, and quantities of heat. To that effect, MAHLE has improved the individual elements of the truck cooling module while further reducing its weight.

MAHLE cooling modules for commercial vehicles consist of a coolant cooler, a charge air cooler, a condenser, an expansion tank, and the necessary connecting lines. To make it Euro VI compliant, it would have been easy to just make the cooler bigger. But that would have made the overall weight of the cooling module heavier—with negative consequences for fuel consumption.

MAHLE thus decided to take a different approach: the coolant cooler has thus now been equipped with four-chamber, winglet folded tubes and optimized trapezoidal corrugated fins, making it only 42 mm deep instead of 52 mm. It thereby weighs 18 percent less, yet it is much more powerful than its predecessor.

The charge air cooler also received optimized corrugated fins and turbulators, reducing the pressure drop by ten percent. This also has a positive effect on fuel consumption. What's more, new tube headers were used for the charge air cooler, further improving its operational strength.

The individual components come from Mühlacker itself as well as from various European MAHLE plants. They are assembled into five different cooling module variants in Mühlacker and then sent to the customers.

CHANGE BASED ON TRADITION

The Mühlacker plant, which sits just outside Stuttgart, has been in operation for more than half a century. Its origins date back to March 1959. At the time, Dr. Manfred Behr wrote a letter to the mayor about buying premises for his company. Four years later, production started in Lienzinger street. Incidentally, the building with its striking tower was created by architect Fritz Leonhardt, who also designed the landmark for the Swabian metropolis—the Stuttgart television tower.

As with all other MAHLE locations, the products and production processes in Mühlacker are subjected to constant change. From 1975 onward, coolers were no longer made from nonferrous metal, but rather aluminum due to the fact that this material is lighter and more effective. 1990 saw the ten millionth aluminum cooler roll off the production line. One year later, the lean production pilot project was launched with the goal of making production leaner and more efficient. At the same time, employees were given more responsibility and cost-saving improvement suggestions were rewarded with an appropriate bonus.

Further changes followed at the start of the new millennium, such as the just-in-sequence supply for BMW—a sophisticated logistics concept. Already in 2009, a special robot was commissioned to take over monotonous work steps in the welding process and deliver more accurate results. More complex requirements also led to new career fields, such as warehouse logistics specialists or mechatronics engineers. The Mühlacker location has been part of the MAHLE Group since 2013, following the acquisition of Behr.

The plant is now already preparing its next big step: Industry 4.0. It is thus currently investigating the future direct interaction between humans and robots and how the use of tablets can simplify maintenance work. Much has thus changed here. However, a location like Mühlacker, where labor costs are high, can only achieve such sustainable success when the willingness to change is backed by an equally dedicated and experienced team.

JAPAN

LOVING ATTENTION TO DETAIL FOR TOP QUALITY

ABSOLUTE PERFECTION IN THE MANUFACTURING OF THOUSANDS OF PRODUCTS— DAY AFTER DAY


MAHL
MAHL
MAHL
MAHL
MAHL

The Shihan, or tea mistress, lovingly rotates the 200-year-old clay cup in her hands. A scrutinizing look. She rotates it again and inspects the treasure. Then she pauses, a brief satisfied look flitting across her face. During the more than 500-year-old Japanese tea ceremony, each hand movement is prescribed. It takes about ten long years of learning about the many different aspects of Japanese culture and a lot of practice before she passes to become a Shihan. Tradition, rules, the search for perfection in both the big and small things in life: this is Japan. These values are internalized at a very young age. Gaikokujin, or foreigners, are largely unaware of how important rituals, precise procedures, and processes are and how intensely they are practiced—that is, until they become a natural part of everyday Japanese life.

Turn, inspect—turn again and scrutinize once more. The polished piston goes through this procedure several times during its genesis. As with the Shihan, the hand movements here are also rehearsed, but have a significant meaning. Personal accountability is implied each time a piston is picked up. Because only absolutely perfect parts are permitted to leave the MAHLE plant in Tsuruoka/Japan. Deviations are inconceivable.

Even the slightest variation in color, which has nothing to do with its functionality, will not be accepted. Neither on the production line in Tsuruoka nor of course, by the Japanese customers. For they also expect absolutely perfect quality. And MAHLE in Tsuruoka delivers: zero defects. Day after day—all year long.

QUALITY BY TRADITION

MAHLE has a long tradition of placing a high value on quality. “Good quality is of crucial importance. We can always do everything a little better!” was the motto of the company founder Ernst Mahle. Today, quality management using standardized tools and processes is integrated in all MAHLE business processes across the world—from product development to series launch and beyond. And, just as in Ernst Mahle’s days, lessons learned from all of our production locations are used to continuously improve all processes.

Quality, costs, delivery reliability: Japanese manufacturers use this triad to measure their suppliers. Like everywhere else in the world, actually. And yet: something is different. “Our customers trust our processes right down to the tiniest detail,” explains Plant Manager Hiroshi Ariji. His customers inquire about all the production steps and processes long before the start of production. This can sometimes be a tight balancing act, because the supplier obviously does not want to divulge all his business secrets. It is therefore always a particular honor when a foreign company is allowed to supply Japanese car manufacturers. All the more remarkable if this then evolves into long-term partnerships. “In the meantime, our customers see us more as a Japanese company than a German one,” notes Ariji, visibly satisfied. The figures substantiate the ongoing success story of his team: a good 85 percent of the trucks on Japan’s roads are powered by MAHLE pistons from Tsuruoka.

How do the employees implement the quality specifications? The Japanese customers

WE ARE TAUGHT FROM AN EARLY AGE TO HAVE A SPECIAL AFFINITY EVEN TO THE SMALL THINGS.

Takahisa Yamashita, *Head of the Filtration and Engine Peripherals business unit in Japan*

look very closely at this area too. Because they know: the human is the decisive factor. This is also apparent in Tsuruoka. While robots are also in use here, turning, inspecting, turning again, and checking the semi-finished parts, the community of flesh and blood is still way ahead of the machines: due to their long-standing experience, high sense of responsibility, and incredible tenaciousness. “On average, our employees have been working for the company for more than 25 years,” says Plant Manager Ariji, perhaps revealing the biggest secret behind the daily precision. They are well versed and skilled in every single hand movement.

ONE GLANCE IS ENOUGH

Yuichi Kobayashi found out how crucial this detail can be. The MAHLE filter expert had the task of building a new production location for filters in Indonesia. “We adopted the technology from our plant in Tochigi. Nevertheless, there were significant differences. It was only then that I realized just how deeply ingrained and how perfectly our Japanese employees understood the processes and the importance of quality,” states the production manager. Takahisa Yamashita, responsible for the MAHLE Filtration and Engine Peripherals business unit in Japan, is not surprised by this finding. “Our employees are so attuned to one another, one glance is enough and the colleague knows what is meant,” he says, revealing another secret of the Japanese recipe for success.

"SAFETY IS AS IMPORTANT TO US AS GOOD QUALITY."

Hiroshi Ariji, *Head of the Tsuruoka plant*

Top quality, day after day: Hiroshi Ariji, Head of the Tsuruoka plant, can be proud of his team.

And again a small ceremony. The teams in Tsuruoka use it to tune themselves in at the beginning of each shift. The colleagues gather in a semicircle as the group leaders provide them with information for that day: which of the 4,200 products are lined up, as well as important observations from the previous shift. This is followed by the daily reminder to observe the safety regulations. "Safety is as important to us as quality," emphasizes Ariji. "Yoshi! Yoshi! Yoshi!—OK!," chorus the team as they confirm the goals ahead. Each individual in the semicircle is aware that they are taking over responsibility for the community—and that nothing is allowed to go wrong.

WITHOUT ANY DEVIATION

On every shift, the teams also go to the next "gemba", or the department next door, for a so-called "three-minute quality check." Is there is something to improve or learn there? It is a finely spun network of test processes and communication at many different levels—always on the lookout to make things better. "Keizokuteki Kaizen," or continuous improvement, is a term that has long been an integral part of the global production systems and has been implemented everywhere in the MAHLE world for many years. And yet: Japan, as the motherland of the Kaizen philosophy, continues to have that extra edge.

Change of location to MAHLE Tochigi. Drive two-and-a-half hours north of the metropolis of Tokyo and you will proudly be shown a long row of awards from Japanese customers. In Tochigi, oil filters, oil coolers, plastic cylinder head covers, and air intake

Each day before the start of the shift, the employees tune in to ensure each hand movement fits faultlessly.

systems, among others, are being produced for the MAHLE Filtration and Engine Peripherals business unit. Each hand movement of the good 320 employees here also often resembles a small ceremony. The young employee's hands smoothly rotate a bright blue oil filter as she inspects the details. Because she knows: the customers will not even accept a printing error on a label. Here it is totally irrelevant whether this rather insignificant deviation can be detected in the assembled state later on or not.

Again this loving gaze. Just like the Shihan—the tea mistress. It only takes a blink of the eye, but is bestowed upon each individual filter. A short moment of personal attachment. "In Japan, we are trained from an early age to develop this special affinity to the things that we do. The teachers are strict and teach us the processes until they really stick," explains Yamashita. "With Kaizen, we can develop processes until they are absolutely perfect. However, we sometimes find it difficult when taking an innovative or creative approach," admits Yamashita modestly. He therefore deliberately encourages interaction with MAHLE colleagues in other countries. "We need to be more agile. We can learn this from our colleagues all over the world to get even better on a continuing basis." And they in turn visit the Japanese MAHLE plants on a regular basis in order to get a feel for this very special quality philosophy which also drives the entire MAHLE world along this path.

TEA PLEASURE IN ALL ITS PERFECTION

Traditions and rituals are fundamental aspects of the Japanese culture. For centuries, this has also included the tea ceremony, which has its origins in the Zen philosophy. The ritual prepares the “Way of Tea” (Chado) and is aimed at turning participants into “Tea People” (Chajin). According to Japanese teachings, these are people who exercise self-restraint and promote the well-being of others.

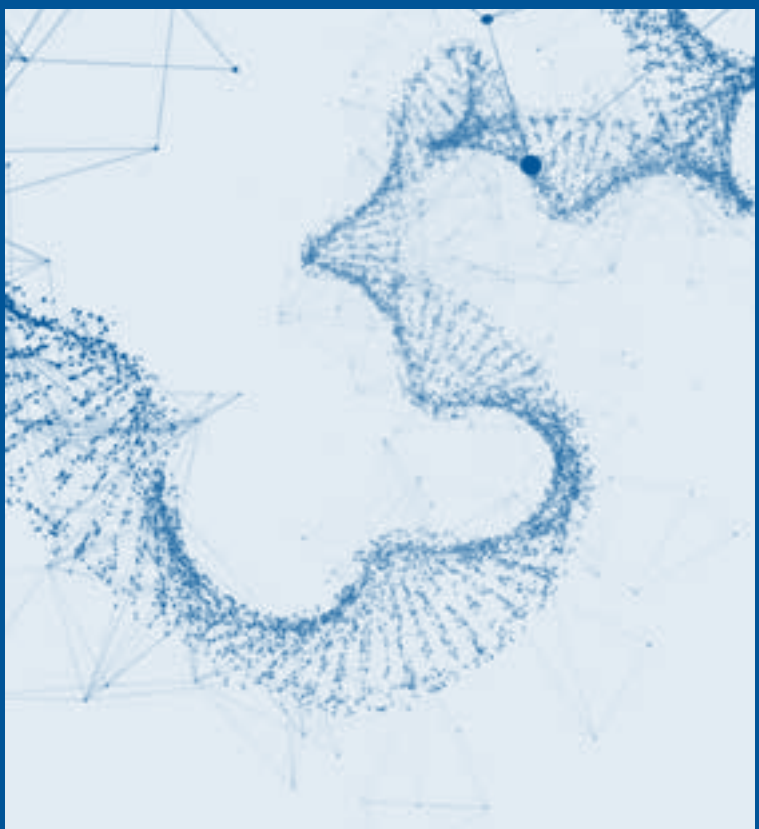
The ceremony is based on four principles: Harmony describes the peaceful interaction between participants as well as with nature and space. Then there is respect for the host, guests, and utensils. Purity not only implies the cleanliness of the objects, but also the spiritual purification of the mind. Tranquility stands for the shared experience of inner peace.

The ritual is prescribed down to the smallest detail. The ceremonies take place in a teahouse, which is located in a garden. A small path (Roji) leads to the teahouse on which guests disengage themselves from their everyday life. The hosting tea master or mistress welcomes the guests at the teahouse with fresh water, with which the guests wash their mouths and hands to cleanse themselves of all that is bad and evil.

The guests then remove their shoes and enter the teahouse. They either kneel or sit cross legged on the floor to show humility and respect for the ceremony. The gong sounds five times and the ceremony begins. The tea master symbolically polishes the utensils with a silk cloth, then brews the tea according to the prescribed steps. Matcha tea is often used, which is told to have a positive effect on the body and mind.

Once the tea has been prepared, the highest ranking guest receives a bowl. He accepts it with a bow and offers it to the person sitting beside him, whereupon the latter declines and asks the main guest to drink first. He then takes three sips and passes the bowl back to the tea master who washes it and prepares new tea. In this fashion, each guest receives the bowl in turn.

This attention to detail and the identification with routine process steps—which are key features of the tea ceremony—can also be found at MAHLE’s Japanese locations. This clearly illustrates the positive impact that a country’s culture and tradition can have on everyday industrial life in the 21st century.



MAHLE IN JAPAN

The first intensive cooperation in the Japanese market dates back to 1968, when MAHLE entered into a close partnership with the piston specialist Izumi Industries. In the following years, the group continued to expand its presence in Japan, soon strengthening its position in this important vehicle market with products from the Filtration and Engine Peripherals business unit as well as the piston business. 2002 saw the complete takeover of the filter manufacturer Tennex Corporation, which is now trading as MAHLE Filter Systems Japan Corporation.

MAHLE acquired Izumi Industries in 2003, and thus MAHLE Engine Components Japan Corporation came into being. Today, MAHLE mainly produces pistons, filter modules and systems for the Japanese market. When it comes to pistons for commercial vehicles, MAHLE is the country's undisputed number one among suppliers: 85 percent of all trucks on Japan's roads are powered by these MAHLE products.

ABS motors, ESC units for driving dynamics control, and EPS motors for passenger cars, as well as products for small-sized engines in industrial and recreational markets are also developed and produced by MAHLE in Japan. These products come from the Mechatronics division, which has combined all activities from this business segment since 2016. Kokusan Denki, which was acquired in 2015 and today trades under the name of MAHLE Electric Drives Japan Corporation, contributes to the Japanese mechatronics expertise. Production takes place in Numazu, Gotemba, and Gojomemachi.

Overall, the MAHLE Group employs more than 2,500 people at 16 different locations in Japan, including three development centers in Okegawa, Kawagoe, and Numazu.

NORTH AMERICA

THINK BIG.
AND ELECTRIC.

BETWEEN THE CLASSIC
DRIVE AND THE MOBILITY OF
TOMORROW


Bay
POWELL AND MARKET
HYDE & BEACH
FISHERMANS WHARF
6
torque

The engine is a real power pack: a swept volume of 6.3 liters and more than 500 HP drive the Dodge standing nearby. Despite the impressive performance figures, this is an everyday car—at least in the USA. In the neighboring stand are RAM pickups; these are powered with engines that are fitted in medium-duty trucks in other parts of the world. At the Detroit Motor Show, American automobile manufacturers are primarily demonstrating how they interpret mobility—or rather, what expectations customers have when they buy a car. The principle: a little more is welcome. Just think big.

"The challenges facing the North American market cannot be compared with those in Europe or Asia," explains Scott Ferriman. The MAHLE Vice President of Sales in the United States illustrates the difference using a Chrysler Pacifica, which was just recently named "Utility Car of the Year," or most useful everyday car, at the most important American automotive show. "This is a typical second car with which mothers drive their children to school or do the shopping," says Ferriman, explaining the seven-seater's general use, which has a length of more than five meters.

FLEXIBLE AND EXPERIENCED

When it comes to automobiles, North America is a world of its own. "MAHLE is very successful here because we meet the exact requirements of this market," Ferriman proudly emphasizes. "Although our products are global, we were able to adapt perfectly to local conditions." Indeed, there is a lot of MAHLE technology in the Chrysler Pacifica: the power cell unit, intake manifold, air cleaner module, carbon canister, and last but not least, the HVAC module including compressor. Numerous MAHLE products can also be found in the pickups. For Ferriman, precisely these vehicles, which are primarily used across the length and breadth of America, are evidence that the combustion engine will still play a very influential role for a long time to come. And what may at first come as a surprise in view of the current debate: the pickup manufacturers are increasingly opting for diesel technology.

MAHLE is already working closely with customers on the development phase of new models. In Plymouth/Michigan, about half an hour's drive from Detroit, MAHLE Powertrain is working on new solutions. We are not talking about individual components here, but rather complete systems and engines. "Customers come to us because they appreciate our flexibility and expertise," Hugh Blaxill confirms with satisfaction. He is Head of Engineering at the powertrain branch in Plymouth. This is where MAHLE develops solutions specifically for the American customers. "One of the reasons is the particular consumer expectations in this region. The legal requirements and other technical standards are also different to those in Europe or Asia, for example." The customers also appreciate the special software knowledge of the MAHLE experts in Plymouth, confirms Rob Vischer, Sales Manager of MAHLE Powertrain North America: "For instance, we are currently working intensively on solutions to further protect the complex systems of modern vehicles against cyberattacks."

MORE THAN
500 HP
AND
A DISPLACEMENT OF
6.3 liters

"WE ARE VERY SUCCESSFUL BECAUSE WE MEET THE EXACT EXPECTATIONS OF THIS MARKET."

Scott Ferriman, *Vice President of Sales North America*

Scott Ferriman is forging ahead with MAHLE's dual strategy in the North American region.

MAHLE is already successful in North America with its e-mobility solutions.

Mauricio Silva has direct contact with tthe e-mobility startups in California.

IN SAN FRANCISCO, CABLE CARS HAVE BEEN IN EXISTENCE SINCE

1837,

WHERE THEY USE STEEL ROPES TO MASTER THE STEEP STREETS.

THE ACCELERATION! INCOMPARABLE!

Mauricio Silva, *Head of the MAHLE sales office in Silicon Valley*

Large engines and big car bodies should not obscure the fact that the automotive industry in North America is also in transition. “The Chrysler Pacifica is a good example of this. It is the first in its class to be equipped with a plug-in hybrid drive. Electrification is also in full swing here,” asserts Scott Ferriman during a tour of the Motor Show. An e-drive in conjunction with a combustion engine: here he sees a strong trend for his market. All the manufacturers exhibiting their products in Detroit are presenting appropriate solutions: European, Asian, and even all the major American suppliers.

FOCUSSING ON CHANGE

As far as Ferriman is concerned, hybrid drives will play a large role in the future: “This form of electrification also means that the combustion engine will still be used for a long time to come. With our dual strategy of optimizing products for the internal combustion engine and concurrently developing products for e-mobility, we are therefore absolutely on the right path at MAHLE.” When it comes to its e-mobility solutions, MAHLE has even adopted an offensive approach at the Motor Show in Detroit. Particularly striking is the “bad boy,” a kind of golf cart with rough tread wheels. With an electric drive on both axles, you can even negotiate difficult terrain. “We want to show that we are already in a position to offer solutions that are ready for series production—from auxiliary aggregates through to fully electric vehicles,” stresses Ferriman. “Our company embodies the transition in drive technology and that is exactly what we want to show here.”

Cut to the west coast of America: there, Mauricio Silva is completely in his element when he is on the road with an electric car. “The acceleration! Incomparable!,” he enthuses. The sleek car is virtually silent as it hums through the streets of San Francisco. He sails past the famous cable cars in the Tesla “Model S.” The tram, which masters the steep streets with the aid of a steel rope, is proof that they were pioneering innovative drive concepts as early as in 1873. You don’t need to worry about being stranded on the wayside with an empty battery when traveling with an electric car, Silva assures: “The infrastructure is currently very good—at least here in California.”

In terms of e-mobility, California is thus several vehicle lengths ahead of the other U.S. states. Numerous electric vehicle manufacturers have set up their company headquarters between San Francisco and Los Angeles. Mauricio Silva has also been running a MAHLE office there since mid-2016. In the heart of Silicon Valley. Tesla, Google, or Apple are only a few minutes’ drive away. “We want to establish contacts and of course show what we at MAHLE have to offer,” he explains. In fact, the company can score points on the electric vehicle market with a whole series of products. “For example, we have solutions which optimally control the battery temperature,” explains Silva. This is crucial, because the energy storage systems develop a considerable heat when they deliver power, and even fluctuations in the outside temperatures can quickly have a detrimental impact on the precious cruising range. Besides battery conditioning, for which the MAHLE Thermal Management business unit is responsible, the newly founded Mechatronics division offers a series of electric drives for main and auxiliary aggregates—and is focusing more heavily on passenger car applications.

DIFFERENT SPEED

However, new players in the field of e-mobility not only need different products to those of established vehicle manufacturers. Mauricio Silva also knows that the newcomers to the automobile market have quite a different approach. “They move at a much different speed and are very open to innovation. Like everyone who works in Silicon Valley,” indicates Silva. And end consumers opting for an electric vehicle also have different habits to those which are customary in the market. Americans normally want to immediately take their car with them when they go to a dealership. In the case of an electric vehicle, however, they will need to reckon with waiting times of several months. In many respects, the transition in North America has already begun.

MAHLE IN NORTH AMERICA

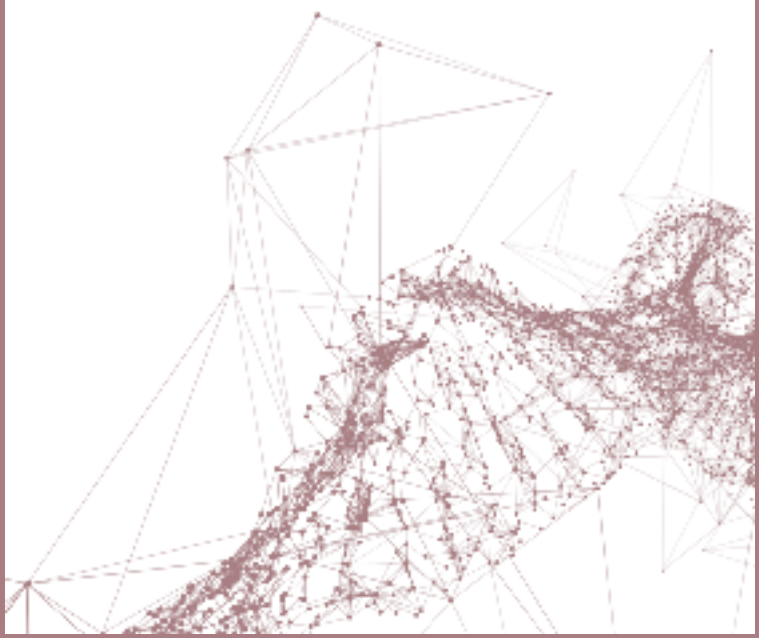
MAHLE has been present in North America since the 1970s—albeit initially only with deliveries to customers in the region. In order to expand the cooperation, it soon set up its first production location in Morristown/Tennessee. 1978 saw the first pistons roll off the production line.

When numerous vehicle manufacturers started to relocate their production to Mexico, MAHLE expanded its North American presence there, too. The first Mexican MAHLE plant was thus established in Ramos Arizpe in 1995—with MAHLE becoming the first piston manufacturer to produce these components in the USA's southern neighboring country. Today, MAHLE employs the highest number of people in Mexico after Germany.

It also wasn't long before MAHLE set up its filter business on the North American continent. The acquisition of the filtration activities from Siemens VDO in 2007 paved the way to the further addition of locations in Mexico, the USA, and Canada. The course for expansion in this business segment was also set with the integration of the Behr Group and the thermal management business from Delphi.

Today, MAHLE is represented in North America with all four business units—Engine Systems and Components, Filtration and Engine Peripherals, Thermal Management, and Aftermarket—as well as with its profit centers. Overall, the group employs more than 15,500 employees in the region, with sales of EUR 3.3 billion in 2016. They are employed at 29 different production locations and four development centers.

Production comprises systems and components for all of the market's established manufacturers of passenger cars and commercial vehicles. MAHLE is already a strong partner of the new, fully electric vehicle suppliers that have sprung up in the USA in recent years. In order to intensify this cooperation, the company opened an office in Palo Alto/California in the heart of Silicon Valley in 2016.



CALIFORNIA—DRIVER OF NEW MOBILITY IDEAS

The USA, along with China and Japan, is among the countries with the highest number of electric vehicles—although with a total of almost 500,000 registered e-mobiles, this is still less than one percent of the entire fleet. The State of California is the main driver of this development with its "Mobile Source Strategy," which aims to reduce vehicle emissions by up to 50 percent by 2030. To achieve this goal, car manufacturers are obliged to market a set percentage of vehicles with alternative drive systems.

California suffers from chronically congested roads and high pollution levels like no other region in the USA. In order to promote car sharing, many highways are equipped with special lanes on which only cars with at least two passengers are allowed to travel. California wants to bring one million hybrid, plug-in hybrid, electric, or fuel cell vehicles onto the state's roads by 2020. This figure is expected to increase to 1.5 million by 2025. As a purchasing incentive, Californians are receiving a bonus of up to USD 10,000, depending on the drive type. This objective has benefitted the founding and establishment of new manufacturers, such as Tesla in Palo Alto, for example. The Californian newcomer is attracting much attention with its all-electric saloons. And Lion Bus has developed eLion, a school bus with an e-drive, which is also to be produced in the region. Meanwhile, nowhere else in the USA is the charging infrastructure as good as in California.

In Silicon Valley, south of San Francisco, other companies are also experimenting with alternative vehicle concepts and drives. Above all, IT companies, such as Google or Apple, are working on automated driving solutions as well as the networking of vehicles, infrastructure, and users. One of the scientific breeding grounds is Stanford University, which is also located in Palo Alto. And since the summer of 2016, MAHLE can now also be contacted directly as a supplier of innovative drive solutions thanks to its local office.

NORTH AMERICA

EFFICIENTLY AND FLEXIBLY TAILORED TO THE CUSTOMER

MAHLE MAINTENANCE AND DIAGNOSTIC SOLUTIONS


The
FARMINGTON
GARAGE

Open the garage door, bring the vehicle inside, connect it to the laptop: the silver Chrysler is a routine case for Gary Chopp. His computer quickly announces: ignition system check. “This device saves me an enormous amount of time. And time is money,” states the 28-year-old mechanic to the point. The more maintenance orders he works through a month, the more he earns—everyday life in an American repair shop. Gary therefore paid for a MAHLE TechPRO® diagnostic system out of his own pocket. For this is also customary in the U.S. repair shops: the mechanics bring some of their own equipment to work. “All in all, this amounts to an investment of several thousand dollars,” he reports.

At his place of work in the Farmington garage, located in front of the gates of the motor city of Detroit, Chopp works on models from various brands. “I therefore need a diagnostic system that can help me with all kinds of cars,” he emphasizes. “And that is what makes the MAHLE system unique. It finds defects fast and reliably—no matter which vehicle is on the lifting platform,” the young mechanic nods with satisfaction. His boss Andy Massoll agrees with him. He himself has bought additional equipment from the MAHLE diagnostic family. “These devices are playing an increasingly important role in our business,” stresses Massoll.

FUNDAMENTAL CHANGE

When his father founded the company in 1980, electronic helpers were still the absolute exception in the repair shop business. “Today, they are indispensable,” says the garage boss. “We are all the more dependent on reliable systems.” Most customers are unaware of this fundamental change in repair shops: “The majority of them are only interested in getting their car running again. They have no idea what kind of complex technology is meanwhile involved.” Repair shop owner Massoll found out about the

Repair shop boss Andy Massoll (left) wants to offer his customers quick problem solving.

“THE MAHLE SYSTEM ENABLES US TO SERVICE A WIDE RANGE OF VEHICLES.

Andy Massoll, *owner of Farmington Garage, Detroit*

The diagnostic results can be retrieved via the smartphone.

MAHLE solutions through his trade association, where these systems were being praised as a useful aid. Today he knows: "I made the right decision with the MAHLE diagnostic system. Because it has enabled us to service a wide range of vehicles."

Andreas Huber, who is responsible for MAHLE Service Solutions in North America, is delighted to hear such praise from the Farmington garage. "It shows us that we are on the right track." The MAHLE Aftermarket operating he is in charge of may still be young, but there is no mistaking that it has a great deal of potential. It came into being through the takeover of RTI's service business in 2013. The company already had a strong position in North America; MAHLE Service Solutions can thus ultimately look back on a quarter of a century's experience. "Now we want to offer more solutions to repair shops," says Huber. One of the best sales arguments for this is the fact that major North American manufacturers also use the same systems to check their new cars before they are shipped to the customer. "You won't get a bigger vote of confidence than that," says Huber. "In the repair shops, not many associate diagnostic competence with MAHLE yet. We want to change that."

However, the experts at the car manufacturers—especially in the USA—are already very aware of the accuracy, performance, and ease of use of the MAHLE. Kia is just one of the manufacturers who trust in the "Made by MAHLE" software competence. In Irvine, a good hour's drive south of Los Angeles, maintenance processes are tested for new vehicle models. In the process, the A/C service diagnostic tool ArcticPRO® from MAHLE is used. "Modern refrigerants are very expensive. Exact dosing and complete recuperation are therefore crucial," says Mohan Sethi, who supports Kia Motors in California on behalf of MAHLE. "We were the only company that could offer the solution our customers wanted," he adds proudly.

QUICK AND EASY

The MAHLE system independently recognizes the various vehicle models and thus automatically knows exactly how much of the expensive refrigerant is required. It also complies with the stringent legal requirements of the U.S. authorities. "The Kia ACX 1299 is a state of the art and easy to use air conditioning diagnostic tool. The ACX Mobile application further helps with the technician's convenience and efficiency. What's more, we can also integrate the solution in to our warranty system," explains Kia Manager Lewis Thompson. The Korean manufacturer's service department is testing how the maintenance work on new models can be handled more efficiently and with industry compliance. These lessons learned will then be passed on to their dealerships throughout the USA. "However, these findings are also very important for automobile manufacturers in order for them to boost customer satisfaction and forecast the scope of work, particularly when it falls within the warranty period," explains Mohan Sethi.

Word about the success of the MAHLE diagnostic systems in North America is also spreading to Europe. The MAHLE operating line is enjoying the growing popularity. "Customers appreciate that we can quickly tailor our solution to their specific needs," stresses

“WE WERE THE ONLY ONES WHO HAD A SOLUTION AS REQUESTED BY CUSTOMERS.

Mohan Sethi, *MAHLE Service Solutions, California*

Erkan Dokuz, who is pressing ahead with MAHLE Service Solutions’ establishment in Europe. “We want to play our part in making work in the repair shops run more efficiently,” he adds. The operating line may still be young, but the industry is already talking about it a lot. “We are highly enthusiastic because the increasing recognition among our customers is inspiring us. “The intuitive and easy operation of our systems is being praised time and again,” says Dokuz happily.

He no longer needs to convince Andy Massoll and Gary Chopp. The garage boss in Farmington, who has three businesses with more than 30 employees, has long noted that rapid order processing makes the customer happy and reduces costs: “I am therefore thinking about investing even more in diagnostic equipment in future, instead of leaving the employees to come up with their own financial resources.”

Mohan Sethi is the contact person for the major customers of MAHLE Service Solutions in the USA.

YOUNG OPERATING LINE WITH A WEALTH OF EXPERIENCE

Established in 2013 as an operating line for the Aftermarket business unit, MAHLE Service Solutions handles the development, production, and distribution of repair shop equipment. It also supports customers with a wide range of services, such as special training in the use of equipment, technical documentation, as well as direct contact with the respective product specialists. MAHLE Service Solutions emerged from the acquisition of the American diagnostic specialist RTI, which built up an excellent reputation over many decades, especially in North America. Well-known manufacturers have been using the systems for the final inspection of their newly manufactured vehicles for years. This provides a good basis for MAHLE Service Solutions to rigorously expand in North America and Europe with its growing number of products and services.

Apart from the ArcticPRO® A/C service unit series, the MAHLE subsidiary's portfolio also includes automatic transmission flushing equipment, as well as tire inflation systems. At the beginning of 2016, the vehicle diagnostic tool TechPRO® was launched on the U.S. market, adding another highlight to its portfolio. TechPRO® detects the respective vehicle identification number and performs a fault diagnosis within seconds. The system works in real-time, automatically downloads all the necessary vehicle information and software updates from the Internet, and thus stays up-to-date. Already 30 million vehicles in total are being scanned each year at more than 25,000 different aftermarket dealerships and repair shops with a product developed by MAHLE Service Solutions.

THE ALL-ROUNDER IN A/C SERVICE

Vehicle A/C service made easy: with the ArcticPRO® ACX 1299 service unit, which was developed by MAHLE Service Solutions for the R1234yf refrigerant, the A/C service practically runs on its own. The unit is fully automated, saving the user a considerable amount of both time and money. To service the HVAC system, the equipment is connected to the vehicle where it begins by completely extracting the refrigerant from the air conditioning system. Only then can the actual maintenance take place. Once done, the system feeds the refrigerant back into the vehicle HVAC system again. Thanks to this device, the repair shop can now offer an environmentally friendly service.

However, this is by no means all that the A/C service unit can accomplish: during maintenance, the equipment constantly checks for any leak within the system. This ensures that the very expensive refrigerant does not escape. The ArcticPRO® ACX 1299 unit is equipped with the TechPRO® diagnostic software. The user can thus get a quick overview of the status of the air conditioning system, including the vehicle's identification number. The maintenance process can also be monitored via a smartphone app.

What's more, the ArcticPRO® ACX 1299 service unit also offers the possibility to immediately and automatically reorder consumables such as oil or filters because the unit can be networked with the warranty processing system of the vehicle manufacturer. These integrated functions help the repair shops to carry out their service work both efficiently and economically. The advantages offered by MAHLE Service Solutions speak for themselves: since March 2016, Kia Motors America has equipped more than 750 of its franchised dealerships in the USA with ArcticPRO® ACX 1299 units.

SLOVENIA AND JAPAN

FROM LOCAL EXPERTS TO KEY GLOBAL PLAYERS

THE NEW MECHATRONICS DIVISION PROMOTES THE DEVELOPMENT OF ELECTRIC DRIVES

White pyramids project from the walls of the room, which is secured by a heavy metal door. In its center is a directional antenna, consisting of pairs of metallic rods, which is aimed at a motor. It's a futuristic scenario vaguely reminiscent of the Starship Enterprise in the American science fiction series, Star Trek. One is tempted to call out: "Beam me up, Scotty!" "Should I turn on the devices now? Oh wait, that wouldn't be too good for us," proclaims a laughing voice through the loudspeaker. "Scotty," the Head Engineer of controls and devices on the other side of the metal door, is called Gregor Ergaver in real life. He explains the actual reason behind the chamber with the white pyramids: "Here, we are testing whether an electromagnetic environment impacts our motor's performance and whether our motor produces electromagnetic emissions that could disturb communication devices." Electric motors are a sophisticated technology, but developments such as WIFI and mobile networks are having completely new effects that must be looked into.

VERSATILITY, POWERED BY ELECTRICITY

The EMC chamber, where electromagnetic compatibility (EMC) is investigated, is one of many testing facilities at MAHLE Letrika in Šempeter pri Gorici/Slovenia, a 30-minute car ride away from Trieste/Italy. The MAHLE location—with its approximately 1,500 employees—manufactures electric drives for steering systems, starter motors, forklifts, scooters, and, recently, also for a passenger car that's scheduled to hit the market in 2018. Over 60 different electric drives are produced here. Šempeter pri Gorici is a hands-on example of what a motor factory of the future will look like when vehicles are no longer powered by combustion engines. Glints of copper shine here, there, and everywhere; electric motors of every size are being assembled, tested, and packed for shipping to the customer.

All the while MAHLE engineers are experimenting with new solutions. Before such a series electric motor can roll off the assembly lines, it must be adapted to meet a broad range of customer demands, as well as passing numerous tests and undergoing load testing. One such test involves subjecting up to four starter motors simultaneously to intense vibrations on a shaker system, to determine whether the components are capable of withstanding these stresses. NVH (noise, vibration, harshness) engineer Andrej Baša explains the reason behind the vibration test: "In a large electric motor, the rotor alone can weigh more than ten kilograms. If the electric motor is subjected to high vibration levels, the unwanted movement of the rotor can cause damage or even break a heavy-duty motor housing." Here, the drives of the future are subjected to as much stress in just a few hours as they might normally experience only over a long motor life.

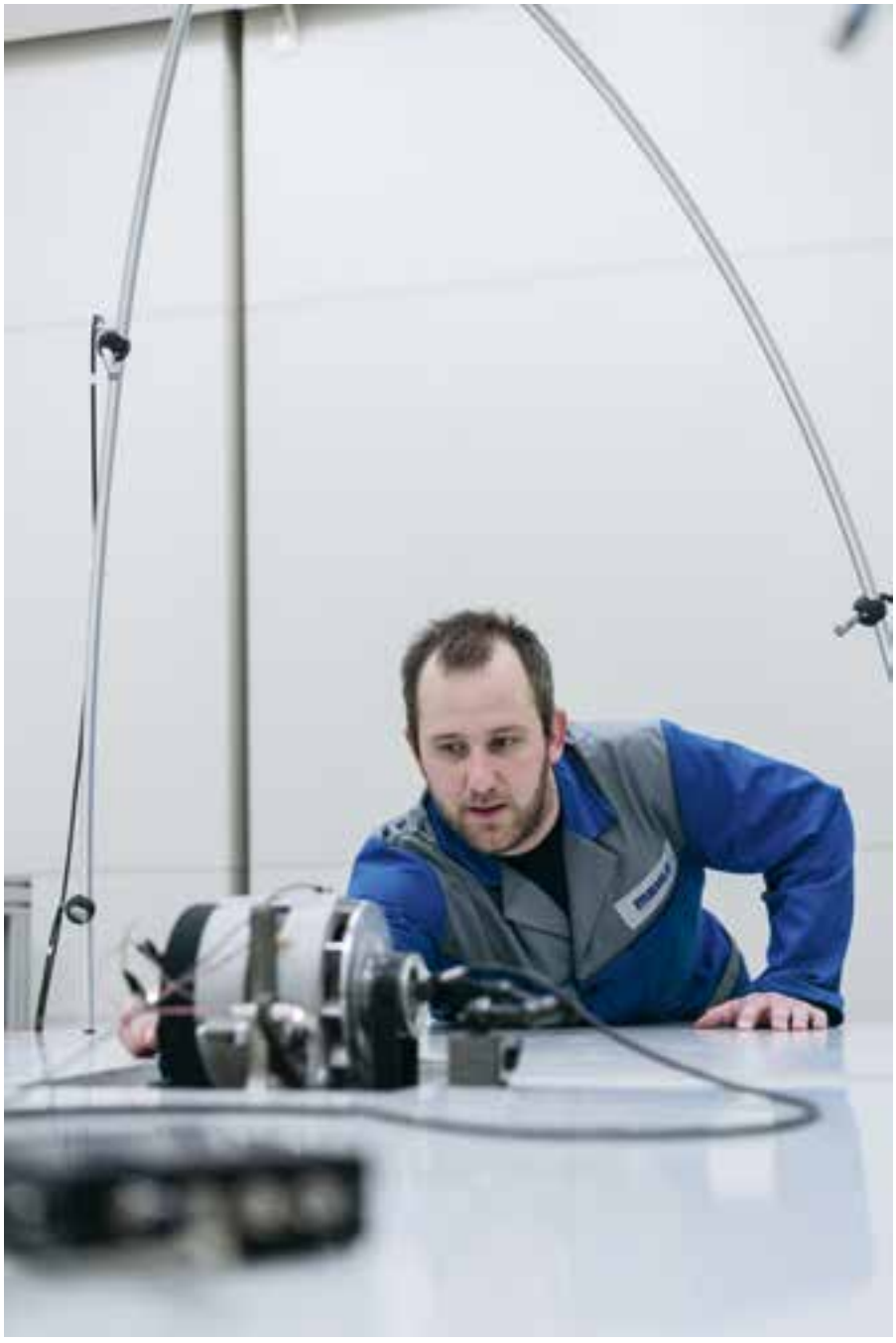
"WE PREFER TO PRODUCE OUR SENSORS OURSELVES. THEY ARE BETTER AND MORE COST-EFFECTIVE."

Marijan Kerševan, *electronics production manager at MAHLE Letrika, Slovenia*

NOISE TRACKERS

In the next room over, they're working at a more subtle level: NVH experts Borut Peljhan and his colleagues are attempting to root out the sources of noise produced by an alternator. Their quest unfolds in a soundproof room equipped with sensitive microphones. "Sometimes, it's the position of the fan blades that causes disturbing noises. In that case, we have to reposition the blades," says this detective of noise annoyance. Fans are a critical component in electric machines because these can generate enormous amounts of heat and would not last long without a cooling system.

Wrapping miles of copper wire around a coil is just the beginning when it comes to making advanced electric motors. Here, too,



Highly sensitive microphones detect disturbing ambient noises coming from alternators.

there's no getting around electronics. The right controls and sensors are produced in clean rooms under the watchful eye of Marijan Kerševan, electronics production manager: "We used to buy the sensors that measure things like drive axis revolutions from outside sources." But the quality was extremely inconsistent. So they decided to manufacture their electronic components in-house. And, as Kerševan happily reports: "Eventually, we were able not only to make better sensors, but also to save money doing it."

A PILLAR OF THE MAHLE GROUP

"We have over 50 years of experience with all types of electric motors," says Head Developer Robert Vodopivec. Until just a few years ago, the Slovenian manufacturer was only active in a few regional markets. Today, MAHLE Letrika is a pillar of the new Mechatronics division, which encompasses all the Group's operations in electric main and auxiliary drives. "Since we've been a part of MAHLE, our range of operations has expanded significantly. Today, we operate on a global scale, and customers from all over the world are interested in our products," reports Vodopivec, whose primary task is to promote the development of drives for the automotive industry.

SOLUTIONS FOR NEW EMISSIONS LIMITS

Interest from the automotive industry is keen. Iztok Špacapan, Head of Development at MAHLE Letrika, tells why: "Manufacturers are under immense pressure because they will need to comply with the emissions limit of 95 grams CO_2 per kilometer by 2021." One way to meet these stringent regulations, he says, is to use electric drives in combination with combustion engines. "Our 48-volt mild hybrid system with a 15-kilowatt output is an attractive solution that we can deliver to customers," Špacapan points out. The system is the result of years of experience devoted to developing and manufacturing drives for industrial applications. "That's how we know exactly what requirements these drives have to meet."

As electrical systems evolve from 12 to 48 volts, Špacapan sees a trend that will change the car in the coming years: "It's a step that makes sense for vehicle manufacturers, because they'll achieve a lot with relatively straightforward investments," explains the lead developer. Thanks to the higher voltage, many engine accessories such as pumps and fans can be decoupled from the engine. This lessens the load on the engine, lowering fuel consumption and emissions. "We can deliver the right drive for all these units," Špacapan notes.

Since the Slovenian location has been part of MAHLE, much has changed for the mechatronics experts—not just in terms of what they're working on, but also how they work. "Today, we operate in a global R&D alliance," explains Vodopivec. Instead of traveling just a few hundred kilometers to the nearest customer in Europe, as he used to do, he now travels the world for MAHLE. The Slovenian is also a frequent visitor to Asian destinations, including Japan. He finds common ground, in technology and in other aspects alike. The Japanese colleagues are advancing this evolution toward e-mobility at MAHLE along with their Slovenian counterparts. "Previously, as Kokusan Denki we focused primarily on our domestic Japanese market," recalls Rikio Yoshikawa, President of the Japanese operations. "Today, as MAHLE Electric Drives Japan, we're part of a global player."

As part of the Mechatronics division established in 2016, the Numazu location manufactures a range of electric drives. And like Letrika, Kokusan Denki—a company with a deep heritage that's located not far from the snow-capped Mount Fuji—brought a vast trove of knowledge to the table as it joined the new MAHLE operation. "We have an extremely well-developed supplier network, for instance, that gives us access to excellent quality in a range of materials and intermediate products," Yoshikawa reports.

TOWARD NEW MARKETS

"One of our focus points is drives with an output of under one kilowatt," remarks the Japanese mechatronics specialist. His teams are currently hard at work on developing solutions aimed at tapping another market for MAHLE—one that is completely new for the company. Yoshikawa remains tight-lipped about the details. Series production is scheduled to launch in 2018, he intimates. Then, with a knowing smile, he quips: "In urban areas in particular, lots of people want to get around without relying on cars. Now, wouldn't a comfortable bicycle sporting an e-drive be an appealing solution?"

“ONE OF OUR FOCUS POINTS IS DRIVES WITH AN OUTPUT OF UNDER ONE KILOWATT.

Rikio Yoshikawa, *President of MAHLE Electric Drives Japan*

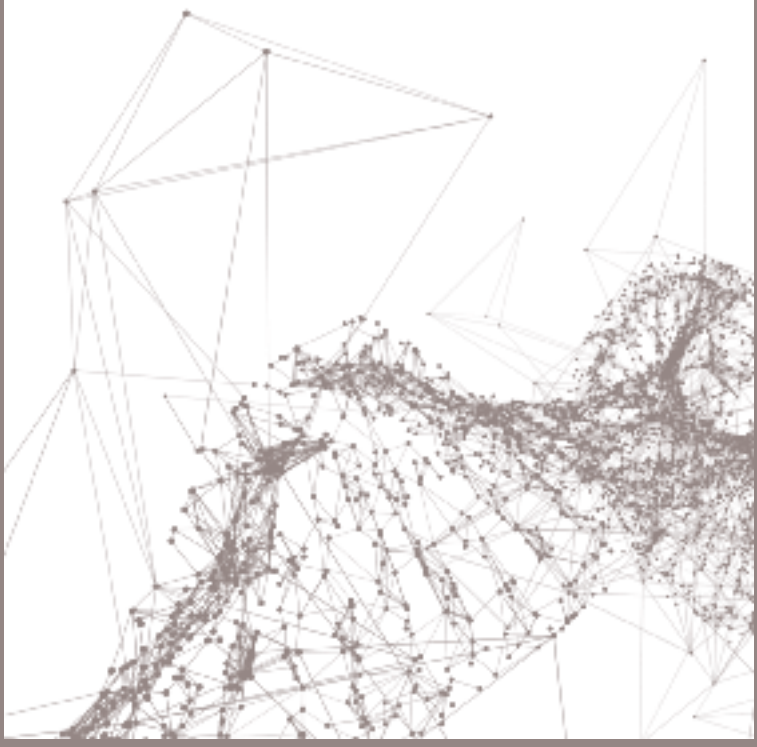
Rikio Yoshikawa wants to tap new market segments with the drives from Numazu/Japan.

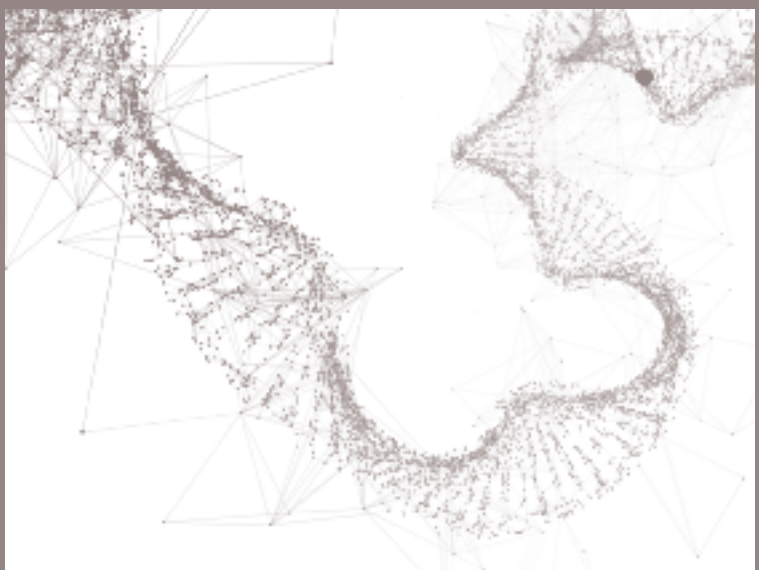
NEW DIVISION WITH INNOVATIVE STRENGTH

2016 was the first full business year for the Mechatronics division. All MAHLE activities relating to electric main and auxiliary drives are concentrated in this unit. The division is present in Europe and Asia with eleven production locations and 3,500 employees in total. The already existing MAHLE activities have been merged with the newly acquired expertise. One essential factor here is the takeover of Slovenia-based Letrika in September 2014. The electric motor manufacturer from Šempeter pri Gorici can draw on more than 70 years of experience. In addition to its electric motors, MAHLE Letrika also manufactures alternators as well as electric and mechatronic drive systems for scooters and work machinery.

The division has a second top performer in the form of mechatronics specialist Kokusan Denki, which was acquired in 2015 and today operates as MAHLE Electric Drives Japan. The Japanese company was founded as early as 1931. It has four different locations in Japan and Thailand where it develops and manufactures electric motors for ABS and ESC functions in brake systems, and brushless electric motors for electric steering assistance and industrial applications. What's more, the portfolio of the division also includes ignition components, alternators, and fuel injection systems for motorcycles and small engines.

Today, MAHLE is mainly concentrating on large, powerful drives in Slovenia whereas in Japan, the focus is on further developing smaller electric motors, which are used in two-wheelers, among others. Nevertheless, the development alliance in Germany, Slovenia, and Japan, ensures that the still young division exhibits its remarkable innovative strength, which has awakened the interest of many well-known customers around the world. Several newly developed products from 2016 are by now ready for the start of production.





OLD PRINCIPLE WITH NEW APPLICATIONS

The basic principle of an electric motor is based on the phenomenon of electromagnetism, which was discovered in the early 19th century. The first e-drive was used on a motor boat in St. Petersburg/Russia in 1838, and the first electrically driven tramway was already running in the streets of Berlin in 1881.

The operating principle is simple: a fixed element—the stator—generates a permanent magnetic field. Encased in it is a rotor, around which a coil of wire is wound. When a battery is connected, the electricity flows through the windings and thus creates a second magnetic field. The same poles then repel each other and set the rotor in motion. A commutator ensures that the polarity of the magnetic field is repeatedly reversed so the rotor remains in constant motion.

Electric motors have long been a reliable drive system in trains and machines. Nevertheless, it would take almost 200 years before they could also be considered as an alternative to the combustion engine in automobiles. This is mainly due to the supply of energy—i.e., the battery—since the charging capacity and infrastructure are the critical issue.

Batteries supply direct current, whereas e-drives—for vehicles, for example—require three-phase current. The respective conversion is done by the inverter, which is fitted with modern power electronics. These also make it possible to convert the electricity produced by braking and feed it back into the battery—the so-called recuperation process.

Electric drives for auxiliary components such as pumps, however, are also gaining importance in automotive applications, because these drives can be controlled when required and thus reduce fuel consumption. In order to ensure a powerful operating voltage for such applications, a 48-volt electrical system is therefore gaining greater popularity in vehicles.

INTERNATIONAL

CUSTOMER PROXIMITY, WITH AN EYE TOWARD THE FUTURE

INNOVATIONS AT MAHLE'S RESEARCH AND DEVELOPMENT CENTERS ARE HELPING SHAPE CHANGES IN THE AUTOMOTIVE INDUSTRY


MAHLE

Keiichi Maekawa's development team in Kawagoe is working on filter solutions for Japanese manufacturers.

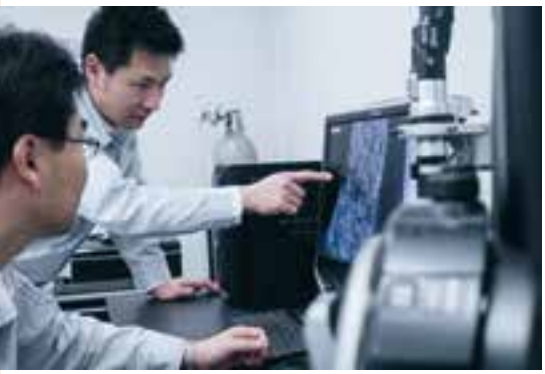
Elegant and efficient: these activated carbon parts bind gasoline vapors.

A cross in a circle—hardly bigger than a lentil. Numbering in the thousands, elegant, activated carbon particles such as these ensure that no gasoline vapors can escape from the fuel tank. MAHLE's high-tech solution in a carbon canister is called macroporous activated carbon. From the outside, the canister looks like a black box with random openings. Nothing out of the ordinary, at first glance. But without it, no vehicle would be granted type approval in the United States. "At least 80 percent of all Japanese vehicles sold in the United States today are fitted with our activated carbon canisters," notes Keiichi Maekawa, Head of the MAHLE research and development center in Kawagoe/Japan.

The think tank located just over an hour north of Tokyo focuses primarily on filtration and air supply systems for vehicles. Their latest development is a flap system to optimize the engine air supply on demand. "Before, there were two settings: open and closed. Today, we can finely tune the system to dispense the just amount needed, and even save fuel," explains R&D engineer Junichi Matsuzaki. As he speaks, his colleagues are pushing a new van into the soundproof test workshop. Soundproof? That's typical for the Tokyo metropolitan area, where open spaces are rare and people live and work in close proximity. In the workshop, the flap solution will undergo countless intensive tests before it will be presented to customers. But the testing is not just taking place in the vehicle. Engineers are also running tests in a cold chamber, for instance,

"AT LEAST 80 PERCENT OF ALL JAPANESE VEHICLES SOLD IN THE U.S. TODAY ARE FITTED WITH ACTIVATED CARBON CANISTERS."

Keiichi Maekawa, *Head of the MAHLE development center in Kawagoe/Japan*



Can it be further improved? The macroporous activated carbon is examined under the microscope.

to determine whether the flaps will continue to operate properly even if the system is subjected to icy temperatures of minus 30 degrees Celsius.

RESEARCH AND DEVELOPMENT IN A GLOBAL NETWORK

The research and development center in Kawagoe is part of a global network in which MAHLE develops new components and systems in near-world conditions. As Dr. Otmar Scharrer, Vice President Corporate Research and Advanced Engineering, points out: "These facilities are a continuation of the work of our Research and Advanced Engineering." This division has been a fundamental building block of our MAHLE DNA since the company was founded almost 100 years ago. At that time, Ernst Mahle developed the innovations that contributed to the success story of the combustion engine from his workshop in Stuttgart. Today, MAHLE engineers in 15 research and development centers worldwide are joining forces to make engines and vehicles last longer and perform better—regardless of the chosen powertrain—and their efforts are actively shaping the changes currently taking place in the automotive industry. They are also developing tailor-made solutions to address specific requirements of local markets.

To conduct research and development in a global network, it takes an extensive knowledge base and a great deal of experience. But the ability to take a broader view of things is equally essential. "We create expert committees to tackle defined strategic issues, divide up the jobs to be performed, and come together on a regular basis to discuss our work," says Scharrer, in describing the integrated approach to work that ensures an efficient transfer of technology at MAHLE.

As diverse as the work is, however, engineers are continuously called upon to strike a balance between diversification and standardization. Particularly in markets that seem quite disparate at first glance, it can be particularly useful to identify synergies and economies of scale, as these can give MAHLE fresh momentum going beyond the regional scale.

FROM NATURAL GAS TO TWO-WHEELERS

The range of topics is multifaceted. Developers in Stuttgart, for example, are currently directing much of their effort to discovering how to make engines run on natural gas (CNG). "It's an interesting alternative to conventional fuels, since it lowers CO_2 emissions by nearly one third," explains Scharrer.

But a number of technical questions still remain, such as how to handle the increased pressure and friction that arise in the combustion chamber. MAHLE is currently developing a strategy to address this phenomenon in a partnership with a large German manufacturer.

In Numazu/Japan, within reach of Mount Fuji, the MAHLE colleagues are working to come up with technical solutions for two-wheeled vehicles. Their R&D efforts are aimed specifically at addressing the needs of Japanese motorcycle manufacturers. Scharrer provides the reasoning behind this strategic approach: "The focus at our facilities simply rests on the customer—because we need to have a sense today of what our customers will be asking for eight or ten years from now."

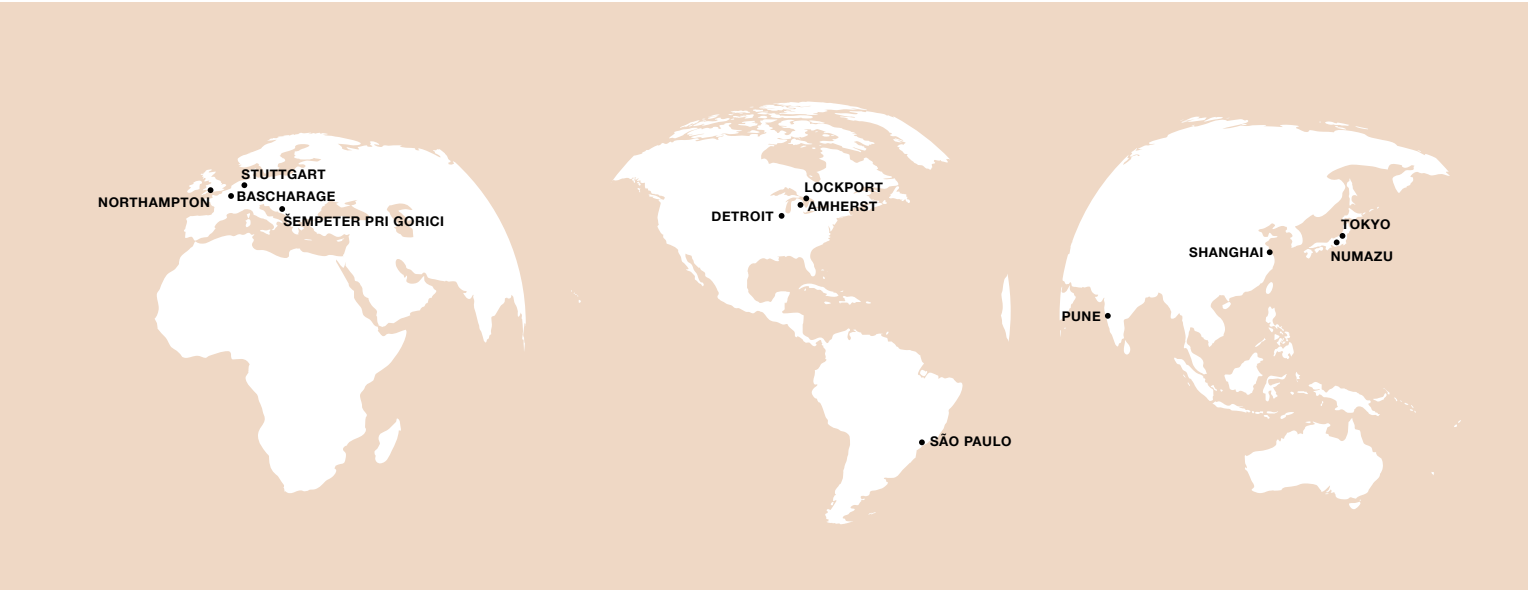
A HOLISTIC VIEW OF THE VEHICLE—FROM A SYSTEMS PERSPECTIVE

That's just one reason why, for quite some time now, developers at MAHLE have been monitoring the changes currently transforming the automotive industry. "We're still looking at how we can improve the combustion engine, since it will continue to power vehicles for a long time to come. At the same time, however, we're giving a great deal of thought to how we can play an active role in shaping e-mobility," explains Scharrer. The way this visionary sees it, the focus is not just on the electric drive. "That's already a mature technology. In the future, the battery will be the actual engine. And ultimately, the battery determines a vehicle's performance," says Scharrer, summing it up in a nutshell. He goes on, stressing just how crucial it will be to take a holistic view of the vehicle as a system and to develop solutions that will advance this approach: "MAHLE's R&D centers will play a key role in this effort."

GLOBAL STANDARDS AND AN ADDED-VALUE NETWORK

An active exchange of ideas among the MAHLE think tanks calls for uniform standards across the various divisions. "We develop many of our measurement methods in-house, since we typically break into new areas of technology in a pioneering role," explains Scharrer. This work is an ongoing process and cannot be underestimated, he says, adding that it's the only way to exploit the facilities' full capability. Findings from a test bench in Jundiaí or Northampton can thus be implemented by colleagues in Stuttgart or Shanghai and used to develop new products there. "This is where it becomes evident that MAHLE's global R&D network really does provide tremendous prospects for the company," says Scharrer.

Tetsuya Handa, an R&D engineer in Numazu, describes an example of the results of such global cooperation: "Working together with our Thermal Management colleagues in Stuttgart, we developed a new fan. We suspected that a need would arise for such a cooling unit at some point." And indeed, as the Japanese engineer proudly recounts: "A short time later, our colleagues in the U.S. were looking for a solution that would maintain the battery of an electric vehicle at the optimal temperature." The new MAHLE product is planned to go into series production in 2017—developed in Numazu and Stuttgart for a customer in the United States. For R&D head Scharrer, that's no coincidence; it's the result of the perfect collaborative interplay among MAHLE engineers around the world: "It's exactly this type of cooperation that accounts for MAHLE's strength today."



Present in all world regions:
the 15 MAHLE development centers

> **WE NEED TO HAVE A SENSE TODAY OF WHAT OUR CUSTOMERS WILL BE ASKING FOR EIGHT OR TEN YEARS FROM NOW.**

Dr. Otmar Scharrer, *Vice President Corporate Research and Advanced Engineering*

Dr. Otmar Scharrer sees great market opportunities for MAHLE in the combustion engine as well as in the electric drives.

Tetsuya Handa is doing development work it in collaboration with colleagues from Germany and the USA.

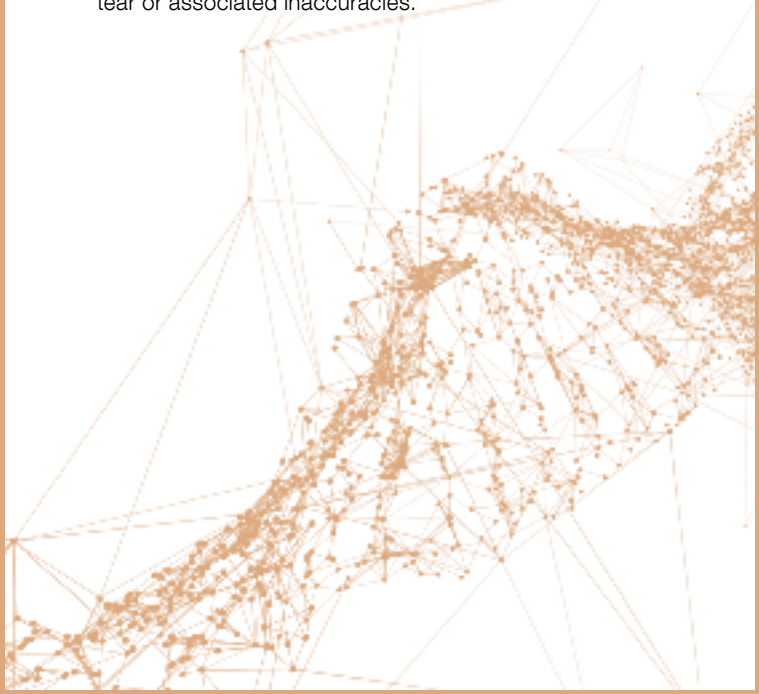
IDEAL FOR ALL ENGINE SPEEDS

One of the innovations that emerged from the MAHLE development center in Kawagoe/Japan is a controllable tumble flap system for the air intake systems of highly efficient gasoline engines. Thanks to the tumble flow, the engine receives the actual volume of air that is required for each speed. The tumble flow is created by a rotating flap valve around a horizontal axis. A precise air supply provides the basis for the correct mixture of fuel as it is the prerequisite to achieve optimum combustion in the cylinder, which in turn minimizes consumption and emissions.

The previous systems only had two positions: open or closed. By contrast, the controllable flap solution from MAHLE has five different intermediate positions to regulate the air flow with pinpoint accuracy. The shape has also changed, reducing the flow resistance.

But how exactly does the flap system work in detail? Low speeds mean low engine output. A limiting narrow opening of the flap generates tumble flow which promotes robust combustion even with large volume of inert exhaust gas by EGR (exhaust gas recirculation), which in turn contributes to CO_2 reduction. Conversely at higher speed, the engine requires a higher air flow. In this instance, a wider opening of the flap generates optimum tumble flow with minimum flow resistance, which also promotes robust combustion with a larger volume of inert exhaust gas. The flap system hence ensures an optimum air-fuel mixture in each speed range. As a result, combustion is more stable, facilitating a boost in exhaust gas recirculation. The CO_2 savings thus achieved amount to roughly 0.5 percent.

An electric actuator controls the flap whereby a sensor detects the rotation of a magnetic field and thus the position of the tumble flap. The sensors used so far work with a grinding resistor. They therefore tend to wear out after a certain time, thereby preventing calibration. MAHLE uses a contact-free sensor instead. Calibration takes place after the assembly with the intake manifold, providing high accuracy and preventing any wear and tear or associated inaccuracies.



ACTIVATED CARBON CANISTERS

Automotive fuels can contain hydrocarbons (HC), which are harmful to people and to the environment. For this reason, these gases should not be permitted to escape from the fuel system. Hydrocarbons are formed, for example, by high outside temperatures, which heat the tank and thus cause part of the fuel to evaporate. Without any countermeasures, the gases formed would escape into the environment. The activated carbon canister developed by MAHLE ensures that these vapors are captured, stored, and burned in the engine instead.

The hydrocarbons from the tank are adsorbed in the carbon canister by small, specially shaped carbon pellets—such as the macroporous activated carbon patented by MAHLE—whose molecular properties ensure that the HC molecules remain in the activated carbon canister. As soon as the engine starts running, fresh air is drawn into the carbon canister and cleans out the gases. The hydrocarbons are sucked into the combustion chamber where they are burned along with the fuel. As a result, these harmful gases are not released into the environment.

The carbon canister fulfills a number of tasks, depending on the regulatory standard. In European fuel systems, the fuel filler nozzle dispenses fuel out of the fuel storage tank whereby the displaced vapors are immediately drawn back to the storage tank. In this instance, the activated carbon canister only needs to absorb the HC gases that are produced in the vehicle tank. It's completely different in North America: here, the carbon canister not only needs to capture gases generated by the vehicle tank but also those produced during the refueling process. It is therefore hardly surprising that the activated carbon canister is an extremely important component when it comes to getting approval to sell vehicles for the U.S. market.

GERMANY

THIRTY TIMES AROUND THE EARTH AND NO WEAR AND TEAR

POWER CELL UNITS FROM MAHLE RELIABLY WITHSTAND ENORMOUS LOADS

Without them, food would neither get to the consumers, products to the customers, nor production material to the factories. They reach even the remotest of regions and are crucial to our modern logistics. We are talking about trucks: in Germany alone, they carry almost three quarters of all the goods transported and cover distances in the order of 70 billion kilometers in total each year. And the trend is on the rise: "We expect the truck, especially in long-distance hauling, to become even more crucial," explains Matthias Fix, who is responsible for the sales of commercial vehicle products at MAHLE. According to a study, the quantity of goods to be transported in Germany will significantly increase again by 2030. And though electrification will also find its way into commercial vehicles, the focus in the foreseeable future is more on equipping light urban distribution vehicles and city buses with the new powertrain technologies. Conversely, the beginning of the next decade will still see the combustion engine playing a significant role in heavy-duty, long-distance hauling trucks.

A look inside the engine in return for a free engine rebuild.

RISING EXPECTATIONS FOR DIESEL ENGINES

This initial position already makes it clear that the demand for high-performance diesel engines for trucks will continue to rise over the coming years. However, the expectations for these units are also increasing, as Matthias Fix confirms: "For logistics companies, the total cost of ownership (TCO), or overall operating costs, is an extremely decisive factor. This is because they are under increasing pressure to reduce costs despite the rise in freight rates. Low fuel consumption thus plays a significant role in the bigger picture." Trucks therefore not only need to be fuel-efficient, but they also need to run for as long as possible and, above all, without any problems. MAHLE has already been accompanying the development of trucks since the company's foundation in 1920. Over the decades, the MAHLE technologies for diesel engine solutions have been constantly refined and optimized to meet the increasingly stringent emission standards and make the trucks "cleaner." Modern trucks have little in common with the trucks of earlier days. Forty years ago, the fuel was injected with a mere 180 bar. Today, injection pressure amounts to 2,700 bar, with a much finer diesel distribution in the combustion chamber—with top precision and electronic operating map control for the optimum time of injection. The fuel thus burns much more efficiently at combustion chamber pressures of up to 250 bar.

TAKING STOCK AFTER 1.2 MILLION KILOMETERS

The so-called power cell units—consisting of pistons, pins, piston rings, and cylinder liners—need to reliably withstand this high cyclic pressure and the temperatures that occur during combustion: kilometer after kilometer, route after route, year after year. During the course of the field observation, MAHLE grappled with the question: how does a mileage of more than one million kilometers impact a power cell unit? This was the starting point of an exciting examination. In the spotlight: a white Volvo truck, which at first glance had obviously already experienced quite a lot on its countless journeys through Europe. The truck was borrowed from a dealership. "We were allowed to look inside the engine and in return the Volvo received an engine rebuild with new power cell units from MAHLE," relates Dr. Andreas Pfeifer, Head of Development Engine Systems and Components. The MAHLE team then took a look at the unit that so interested them under the driver's cab: a six-cylinder turbocharged diesel engine with a displacement of 12.8 liters and an output of 480 hp (353 kW). The Volvo has already travelled a long, long distance with this engine—more than 1.2 million kilometers in total, which corresponds to almost 30 times around the earth.

Before (left) and after 1.2 million kilometers (right): the MAHLE components had survived the prolonged stress unaffected.

PROVEN DURABILITY

The quality of the components was quite apparent during the examination: "We

Together, they work on solutions for the truck engines of tomorrow: Matthias Fix (left), Vice President Sales Commercial Vehicles, and Dr. Andreas Pfeifer, Head of Development Engine Systems and Components.

"BESIDES RELIABILITY AND DURABILITY, LOW FUEL CONSUMPTION PLAYS AN EXTREMELY CRUCIAL ROLE."

Matthias Fix, *Vice President Sales Commercial Vehicles*

"WITH OUR SYSTEMIC APPROACH, EFFICIENCY AND FUEL CONSUMPTION CAN BE IMPROVED BY UP TO THREE PERCENT."

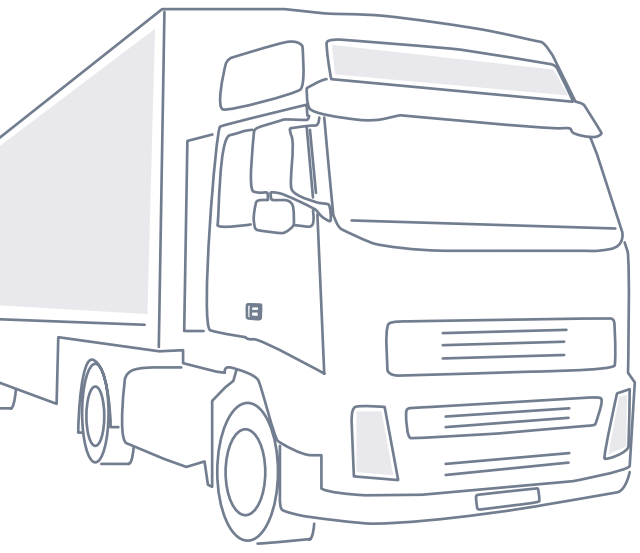
Dr. Andreas Pfeifer, *Head of Development Engine Systems and Components at MAHLE*

measured the pistons and even we were somewhat surprised: after this long period of time, their tolerances were virtually indistinguishable from a new product." The pistons weren't the only parts that survived the prolonged stress totally unaffected. The other MAHLE components in the PCU also demonstrated their high quality and durability by showing no significant wear. "Our analysis has shown that we have developed components, which delivered what we promised the customer at the time: high quality and reliability," reports the MAHLE truck developer with satisfaction.

SOLUTIONS FOR THE TRUCK ENGINES OF TOMORROW

The investigated piston comes from an engine that meets the Euro IV standard. The emissions limits for the current "Euro VI" are considerably stricter, among other things. Lower fuel consumption is also required in order to reduce the total operating costs. "The critical aspect of this approach today, is not only to implement individual measures for each component, but to ideally tune the complete system consisting of engine and peripherals," stresses Dr. Andreas Pfeifer. Improvements to the engine mechanics can also off-load the oil circuit. "The optimization then takes place across the engine—especially at the functional interfaces. The overall efficiency of the powertrain derives even greater benefits: "Efficiency and thus fuel consumption can be improved by up to three percent in total."

Here, it becomes clear: changes in the commercial vehicle are the sum of many innovative steps, which not only have a novel approach but also view the truck as a complete system. Matthias Fix and Dr. Andreas Pfeifer unanimously define the goal in this way: "We want to ensure that, in the future, truck engines run reliably for even longer, require less fuel, and are less harmful to the environment. We are well on track with our systemic approach."



IN GERMANY ALONE, THEY CARRY

3/4

OF ALL TRANSPORTED GOODS

AND

COVER TOTAL DISTANCES OF

70 BILLION KILOMETERS

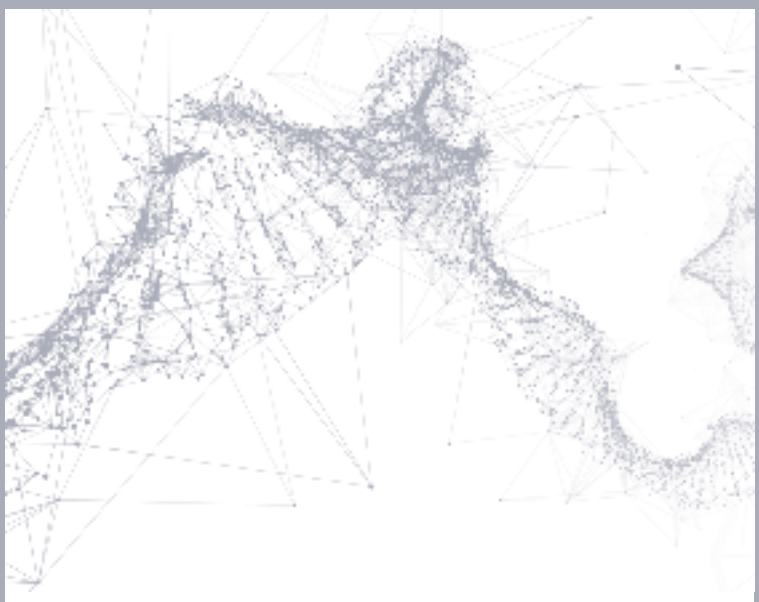
An exciting examination with a white Volvo Truck as the main actor

THE COMPLETE SYSTEM IN VIEW

Commercial vehicles are subjected to extremely high loads. It is therefore all the more important that their components and systems can withstand this stress. However, the efficiency and driving comfort of trucks are also a crucial criterion. This is why MAHLE takes a holistic systems approach when developing new products. In this context, not only individual components but also their complex interplay with other systems in the vehicle are considered and optimized.

One ideal solution offered by MAHLE is the controllable pendulum-slider oil pump, which generates pressure and volume flow on demand. This saves up to 1.5 percent of fuel. Because it is both insensitive to contamination and extremely resilient, it works efficiently and reliably. MAHLE also has developed solutions to off-load the complete oil system. MAHLE Stratum honing—a special surface treatment for cylinder liners—optimizes the oil-holding capacity at the reversal points of the piston rings, relieving the strain on the oil circuit. The new camshaft technology also protects the oil system, whereby conventional bearings are replaced by wear-free rolling bearings, which don't require pressurized oil. Overall, the improved engine components and more efficient oil supply achieve fuel savings of up to three percent. This is only possible because MAHLE consistently focuses on the overall powertrain system and not just the individual components.

This holistic systems approach is also applied to HVAC systems. Conventional air conditioning systems consume on average around 0.2 liters of fuel per 100 kilometers. With the ECO A/C system developed by MAHLE, the increase in consumption is limited to only 0.03 liters per 100 kilometers, which corresponds to a reduction of 83 percent. All components are optimized here too with regard to their interactions with each other and the climate control system.



TIRELESSLY IN USE

The requirements for heavy-duty commercial vehicles are high: the engine must be able to deliver a mileage of 1.6 million kilometers. The power cell unit—the heart of the engine—consists of pistons, piston pins and rings, cylinder liners, and the connecting rod with bearing bushings. One of the PCUs MAHLE examined from a randomly selected truck, which had already negotiated 1.2 million kilometers, provided proof of its quality: the components showed virtually no signs of wear and tear.

Some impressive figures were derived from the investigated PCU: in its cylinder liner, the piston itself had covered roughly 370,000 kilometers. In around 600 million ignition cycles, more than 65,000 liters of fuel were burned per cylinder. This gave rise to piston temperatures of up to 450 degrees Celsius and a pressure of up to 210 bar. At 1.2 million kilometers, the crankshaft had accomplished a total of 1.2 billion revolutions and the piston 2.4 billion piston strokes. Over this period, 5.6 million liters of oil made sure the piston stayed cool.

The power cell unit contributes to the engine's highest proportion of friction losses—around 40 percent. To optimize this high-performance system further, MAHLE takes the interaction of all the individual components into account and further develops their interplay—for even less friction and thus reduced fuel consumption while keeping wear and tear to a minimum.


MAHLE
MAHLE
MAHLE

RESPONSIBILITY

COMMITTED EMPLOYEES:

FOUNDATION OF OUR SUCCESS

Committed employees with outstanding skills and capabilities are the foundation of our success. Our HR activities have thus been focusing on their careful selection, appropriate promotion, and further education for many years. The ongoing technological changes in the automotive industry, the advancing digitization, and the unremitting high competitive pressure are currently influencing the working environment more than ever before and are presenting our HR activities within the MAHLE Group with new challenges.

Our processes and organizational structure need to adapt to these new requirements so we can fully tap the considerable potential of our employees worldwide and continue to acquire new talented and motivated employees as an attractive employer. Last year, we launched the "HR Boost!" strategic project to support this development. It combines various subprojects in the areas of employer branding, recruiting, career development, and diversity. Existing HR processes and activities are to be further developed, and structures and processes examined, optimized, or even redesigned.

EMPLOYER BRANDING AND RECRUITING

In order to position ourselves on the market as an even more attractive employer, we have further intensified the employer branding activities of MAHLE. We are already using social media activities and trade fairs not to mention specific recruiting events and collaborations with selected universities to target pupils, graduates, and young professionals in particular. We want to pursue and support these measures in the coming years through the use of new media and technologies.

One example of this is the project we launched in 2016 to use new virtual reality (VR) formats for employer branding and recruiting purposes. The first MAHLE VR image video was used with great success at IAA Commercial Vehicles, Automechanika, and Formula Student Germany on the Hockenheim Ring. In the meantime, MAHLE is involved in Formula Student worldwide, whereby 24 teams "sponsored by MAHLE" in Europe, North and South America, as well as Asia are now participating—both in the Formula Student Combustion (FSC) and the Formula Student Electric (FSE). In 2016, two new teams from Germany were included as well as an FSE team from Slovenia for the first time. By supporting aspiring engineers with our production and development expertise as well as financially, we are able to come into direct contact with precisely the committed and innovative target group we want to attract for the future successful development of the MAHLE Group.

We also maintain direct contact with students through our worldwide, close cooperation with around 28 selected key universities, of which there are five in Germany alone. These cooperative ventures include guest lectures from MAHLE experts at the universities, close contacts with professors, as well as sponsoring activities and local events. MAHLE awards scholarships to support young academics and honors students with MAHLE Performance Awards for their special achievements. In Germany, for example, we are involved in German scholarship programs at seven technical colleges, support technical students with scholarships in Poland, and sponsor key universities in Brazil. In the USA, MAHLE is engaged in the Society of Women Engineers (SWE) in order to

New ways of recruiting and employer branding: the first virtual reality image video was met with great interest at IAA Commercial Vehicles.

MAHLE is meanwhile involved in Formula Student on a worldwide basis.

approach female engineering students and motivate them to join MAHLE, among other things.

Since we want to present ourselves to candidates in a uniform manner and make the internal job market more transparent, we began with the successive rollout of our worldwide recruiting portal "eMploy" some time ago. It was rolled out to China in 2016; the portal is thus now being used in Europe, North and South America, and Asia. Over the coming years, our recruiting activities will be increasingly concentrated in specialized recruiting organizations in order to facilitate even more efficient staffing. What's more, our own employees will also assist us in the search for new professionals within the framework of our newly created employee referral programs.

For us, qualified employees are essential guarantors of success—all over the world.

In the "vehicle mechatronics e-Mobility plus" cooperative study model, the specialists of tomorrow are gearing themselves up for e-mobility.

CORPORATE TRAINING

In our commitment to attracting the brightest minds and most capable employees, we at MAHLE not only rely on our targeted personnel search, but have always placed great emphasis on the internal training and further education of our professionals. Apprenticeships and cooperative studies are also of particular significance here.

In the German MAHLE Group companies, a total of 357 apprentices were trained in 18 occupational profiles, and 114 cooperative studies students were trained in eleven courses of study in 2016. In order to meet the new requirements, we have also incorporated new courses of studies, which explore the new technologies in much greater depth with regard to digitization.

The numerous awards and accolades that our apprentices again won in 2016 show just how successful the training is. Especially noteworthy here is the success of a production engineer from the Gaildorf location in Germany, who completed his apprenticeship with the best national score.

Our training is also active in shaping new courses of studies, in order to ensure that our students are taught the necessary expertise for the challenges of the future. For example, together with the Esslingen University of Applied Sciences and other partners, MAHLE conceived the "vehicle mechatronics e-Mobility plus" cooperative study model in order to teach future specialists the necessary basics in dealing with new drive concepts and e-mobility. The successful cooperation of the Mechatronics, Electrical Engineering, Computer Science, and Vehicle Technology faculties of the University of Esslingen, as well as vocational schools and training organizations enables students to do a practical mechatronics engineer apprenticeship in this five-year model before graduating as a Bachelor of Engineering.

However, training doesn't just play an important role in Germany. It is also of great significance to our solid foundation of employees with outstanding skills and knowledge in other countries. In Austria, 106 young men and women took part in similar programs in eight apprenticeship opportunities. In order for Polish production to meet the high demand for qualified technical personnel, a total of 110 apprentices embarked upon several years of training in 2016. Brazil has considerably intensified its internal training activities over the past few years for the same reason. In 2016, 412 junior employees were trained in 15 occupational profiles in view of their subsequent takeover by MAHLE. In Mexico, 84 specialists were trained in a comprehensive, 18-week internal program that was specially tailored to MAHLE's specific requirements.

We cooperate with associations, schools, and even kindergartens to promote interest in MINT subjects (mathematics, informatics, natural sciences, technology) within the framework of numerous initiatives and projects worldwide. The group is meanwhile firmly committed to some of these, such as

"Girls' Day" or "Technolino," on an ongoing basis. Other activities have been added and new ones are to be introduced. MAHLE has been a member of the "Wissensfabrik" (Knowledge Factory) since 2016—an initiative to promote education and entrepreneurship in Germany. It works with scientific partners to develop projects that can be implemented in kindergartens and schools throughout Germany.

In addition to this professional commitment, MAHLE also takes its social responsibility very seriously: In the 2015 and 2016 business years and on the initiative of the Management Board, a total of 23 refugees were offered vocational orientation internships in Germany; five were within the framework of an orientation internship, and eight involved attaining entry qualifications over a period of six to eleven months. So far, three of the refugees have been successfully taken on as trainees by MAHLE, and we even made it possible for two refugees to enroll for a course of studies. We are planning to take on more in the future.

GLOBAL DEVELOPMENT OF PROFESSIONALS

With our comprehensive catalog of educational measures as well as national and international training programs, we ensure that our employees obtain the necessary expertise and skills in order to meet the requirements of the future. Thus equipped, our employees play a crucial role in securing and shaping the success of the company.

On these grounds, one of the MAHLE Group's strategic goals is to primarily fill all managerial positions from within the company. Various national, regional, and international development programs are instrumental in specifically preparing our employees and executives for new or enhanced areas of responsibility within the company. Participants in these programs are identified by means of regular potential assessments and development conferences. The company can thus recognize the strengths of the individual employees in a timely manner and systematically promote them. Leadership skills are specifically trained and developed.

The executive development programs at the different hierarchical levels not only strengthen personal and professional skills, they also serve to build and expand networks across countries and functions. In order to meet the various challenges of the different management levels and cultures, we also offer specially tailored leadership and management training activities on a regional and global basis. Individual development plans are increasingly being used to expand our active career management process. We are enhancing the content of our personnel development programs with new topics, such as innovation management, digitization, and Industry 4.0.

MOBILITY

As a globally operating company, we need people who think outside the box and work together to advance the right ideas for MAHLE. We have thus consistently encouraged the mobility of our employees over the past years. The international assignment of professionals supports the transfer of expertise. It opens up new prospects for employees and executives, promotes their individual professional development, and expands their personal horizons. A globally binding mobility policy governs the framework conditions for worldwide assignments and helps to make these both uniform and attractive.

What's more, MAHLE even promotes foreign assignments during training and the first few years of work. For management trainees, residing outside the home country is an integral part of the training program. Students of cooperative studies also have the opportunity to work at a MAHLE location around the globe and gather intercultural experiences as part of their practical training. Around 70 percent of the MAHLE students of cooperative studies in Germany had completed such an overseas placement by the time they graduated in 2016.

Since 2016, MAHLE has been involved in the "Wissensfabrik" (Knowledge Factory)—an initiative to promote education and entrepreneurship in Germany.

Our aspiration is to promote diversity at MAHLE. We are therefore expanding our worldwide activities within the framework of a strategic project.

DIVERSITY AND ADVANCEMENT OF WOMEN

International assignments are of prime importance when it comes to sharpening intercultural understanding, as well as promoting openness in an internationally oriented corporate reality. Diversity, the keen sense of appreciation for variety and difference, is an important area of activity for globally operating companies such as MAHLE. By this, we particularly mean variety with regard to gender, generations, as well as countries of origin, and cultures. Our goal and aspiration is to promote this diversity at MAHLE. We are convinced this will not only bolster our innovative strength, but also the future viability of MAHLE. We are therefore rigorously expanding our global activities to promote diversity in our company within the scope of the "HR Boost!" strategic project.

The focus here particularly lies on the further internationalization of management, stepping up measures to further the advancement of women and provide family support, as well as the introduction of working time models geared to the phases of life. To this end, we are compiling a comprehensive package of measures encompassing employer attractiveness, recruiting, personnel development, flexible working times, as well as work-life blending, leadership behavior, and communication.

We made this objective public with MAHLE's successful admission to the Diversity Charter business initiative ("Charta der Vielfalt") at the end of 2016. As a nonprofit association, the initiative is driving the substantive discussion on diversity and its promotion thereof in several projects under the patronage of German Chancellor Dr. Angela Merkel.

RECONCILING FAMILY AND CAREER—HEALTH

With our employee-friendly working conditions such as flexible working hours, part-time work, or home office, we are already helping MAHLE employees to reconcile their family and professional lives. MAHLE helps women in particular to return to work during and after parental leave through special part-time models, for example. Our in-house day-care center with 40 places in Stuttgart/Germany has been making an important contribution to easing the pressure on families for years. In many countries, MAHLE either organizes its own holiday programs for the children of employees, or runs them in cooperation with associations.

Occupational health management and health promotion are also integral parts of our corporate culture. Numerous worldwide projects and measures aim to improve the working environment and raise employees' awareness about maintaining their own health. The activities and benefits we offer range from company sports teams and special fitness programs to free vaccinations and other medical services as well as health classes and advice on social issues. We particularly attach great significance to awareness, prevention, and encouraging people to take responsibility for their own actions. Health days at the MAHLE locations in numerous countries serve to familiarize employees with a healthy diet and lifestyle concepts.

charta der vielfalt

RESPONSIBILITY

CHANGE THAT RESPECTS PEOPLE AND THE ENVIRONMENT

At MAHLE, social commitment and sustainable business activities have always been key principles of the group. As an international company, MAHLE also feels socially responsible. We therefore incorporate these aspects into all our decisions—this is what responsible change means to us. The group is thus working in all areas to consistently lower the impact on people and the environment with its innovations, resource-saving technologies, and modern manufacturing processes. What is more, we see ourselves as an active member of the community in which we operate and therefore assume social responsibility.

ENVIRONMENTAL MANAGEMENT

MAHLE strives to make its products as energy- and resource-efficient as possible. Environmentally sound product design is an important consideration when developing new products.

These basic principles also apply to our operational processes, which are designed to conserve energy and resources, following the ISO standards 14001 and 50001, as well as OHSAS 18001. By taking appropriate measures, MAHLE also ensures that environmentally harmful events are avoided and limited in the case of damage. To this end, we invest in environmentally friendly, state-of-the-art technologies and actively support global climate protection efforts. Species conservation and diversity considerations are also taken into account in planning measures. Fulfilling the general obligation of due diligence in protected areas is second nature to MAHLE.

ACTIVITIES IN 2016

In the 2016 business year, the environmental activities of the MAHLE Group—such as FSC certification—were refined and expanded further throughout the world. These include a variety of modernizations, audits, and new investments. In November 2016, the MAHLE Group obtained FSC (Forest Stewardship Council) certification, after audits were carried out at the headquarters in Stuttgart and the production location in Gebze/Turkey. This confirms, for example, that all paper filters in MAHLE products are derived from plants from sustainable sources.

In North and South America, the use of acids containing chromium has been discontinued. At the Mühlacker location in Germany, a thermal exhaust gas after-treatment system was commissioned, which has significantly reduced the plant's emissions.

In Brazil and India, MAHLE has received awards for its sustainable business operations. The Chennai location in India received the "Golden Peacock" award from the Indian industry association for its sustainable measures to ensure the health and safety of its employees.

MAHLE received acclaim for its sustainable business practices in Brazil in 2016— here we take a look at our plant in Mogi Guaçu.

CORPORATE SOCIAL RESPONSIBILITY

For years, the MAHLE Group and its employees have been supporting numerous projects and initiatives in many countries to promote social interaction, education, and the fight against poverty and disease—often in collaboration with the MAHLE Foundation. At MAHLE, social commitment and the assumption of corporate responsibility are an integral element of our corporate culture.

LOCAL COMMITMENT TO EDUCATION AND HEALTH

For several years, MAHLE has been involved in the project "Focus on iThemba"

("iThemba" means "hope" in Zulu) in South Africa, which promotes the schooling and further education of orphans. The focus here is not just on financial support. The young people are offered real prospects, and some are subsequently taken on as MAHLE employees. MAHLE also launched the "Science2Go" initiative in 2015: a bus was converted into a mobile laboratory to offer 15,000 pupils in the vicinity of Durban the possibility to experience physics and chemistry experiments. Due to the unsuitable equipment in many schools in the rural areas of South Africa, this would otherwise not be possible. In order to draw public awareness to the importance of education as the key to social advancement, MAHLE and the nonprofit organization CASME (Center for the Advancement of Science and Mathematics Education) organized the world's largest scientific lesson with 2,100 pupils and 60 teachers in Durban in 2016, and thus even made it into the Guinness Book of Records.

Education is the key to social advancement. That's why we are sponsoring specific educational projects such as "Science2Go" in South Africa (left) and "Formare" in Brazil (right).

INITIATIVES AROUND THE GLOBE

Offering prospects to socially disadvantaged youngsters is also the goal of the MAHLE Formare School in Brazil. Our employees have been looking after and teaching around 130 young people in technical subjects at six of our Brazilian locations each year for the past 15 years. More than 1,430 young people were thus able to make a successful transformation: 75 percent subsequently found a job, many of whom are now MAHLE colleagues. The Dança e Cidadania project, which was launched 15 years ago, is aimed at getting children from low-income families off the street and providing them with new prospects through dance, art, and music. MAHLE is supporting around 400 children at the Brazilian locations Campinas and Mogi Guaçu through this initiative. Another class in Itajubá with around 50 children and young people was added in 2016.

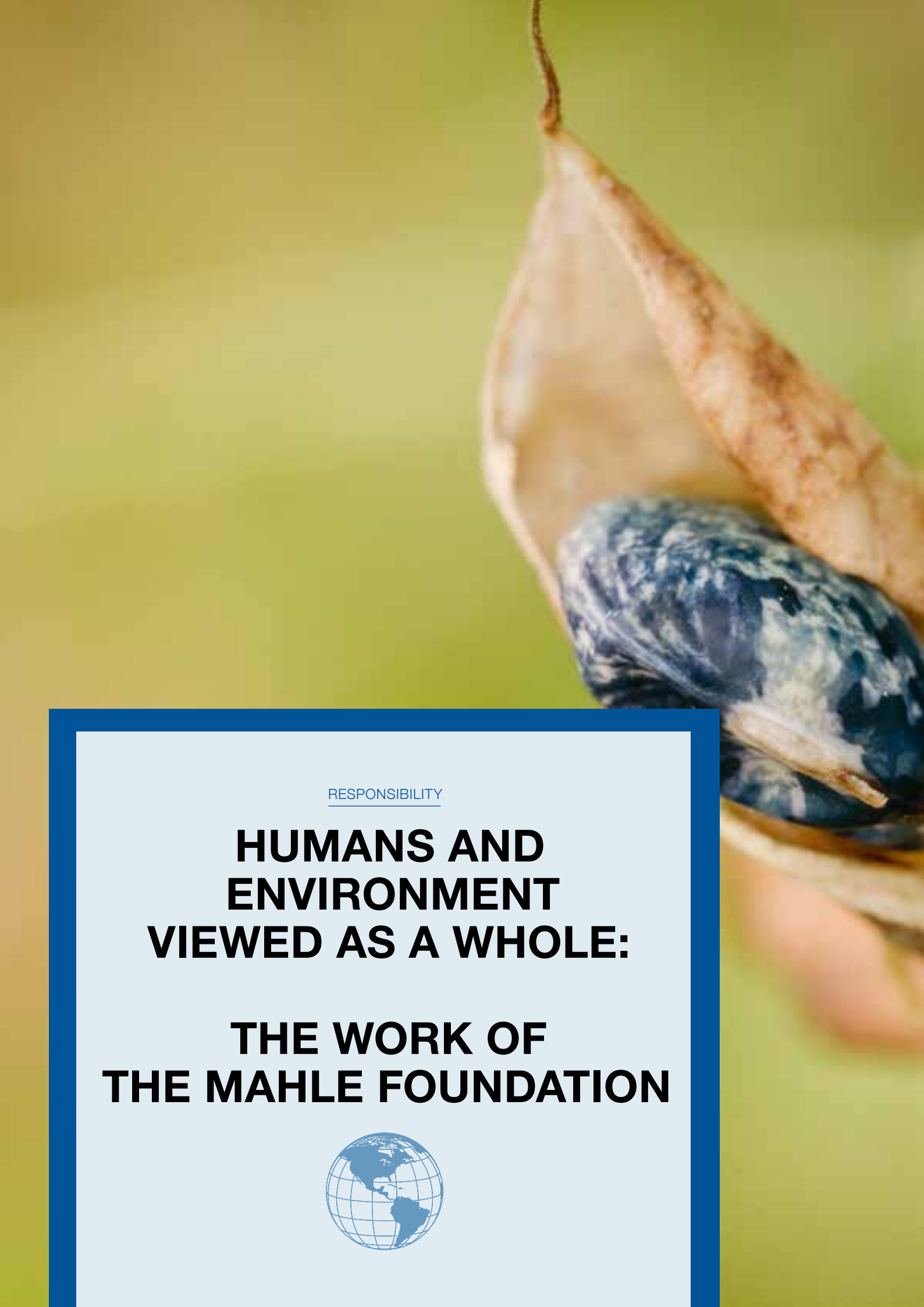
MAHLE is supporting local primary schools and kindergartens in Mnichovo Hradiště/ Czech Republic with regular cash and non-cash donations. MAHLE donations are also helping an orphanage near the Ostrów location in Poland, providing children in need with school meals, food, and clothing. Our North American locations, in contrast, have a long tradition of fund-raising and commitment to general health promotion. In 2016, MAHLE sponsored a running event, whose proceeds were donated to various charitable organizations that look after children in the Charleston area. MAHLE employees have also been involved for many years in the "Tour de Cure" cycling race organized by the American Diabetes Association. By means of active participation and donations, they thereby contribute to further advancing the development of improved treatment options for diabetes.

SUPPORTING SUSTAINABLE HELP TO SELF-HELP

MAHLE is supporting the "Vergel" agricultural community near the Mogi Guaçu location in Brazil, where around 100 small farmers are operating a cooperative. They are now even supplying our canteen in Mogi Guaçu with organically grown produce. Until now, there has been a lack of childcare places in the Vergel community, which is why MAHLE joined forces with Instituto MAHLE and the MAHLE Foundation to sponsor the construction of the Centro Educacional Ernst Mahle, which opened in 2016. A total of 75 children ranging between the ages of four months and six years now receive full-time care there. What's more, further kindergartens in Brazil have been expanded in cooperation with Instituto MAHLE. In 2016, a total of 262 new childcare places were created, and around 190 will follow in 2017.

NUMEROUS EMPLOYEE VOLUNTEER INITIATIVES

Above and beyond the aforementioned exemplary activities, MAHLE employees at our worldwide locations display a high degree of social commitment with their voluntary participation in many other initiatives—from supporting international aid organizations and hospitals, to providing help to people in need as well as children's and old people's homes, through to various educational opportunities designed to improve career prospects. The charitable projects, donations, and fund-raising campaigns are often instigated and carried out on their own initiative. The MAHLE Management Board would like to express its heartfelt thanks and high regard to all the dedicated helpers for their commitment.



RESPONSIBILITY

HUMANS AND ENVIRONMENT VIEWED AS A WHOLE:

THE WORK OF THE MAHLE FOUNDATION

Change born from responsibility—this is one way to summarize the activities of the MAHLE Foundation in 2016, too. "We have made a number of changes, especially in the Filderklinik—our biggest funding project," explains Jürgen Schweiß-Ertl, Managing Partner of the MAHLE Foundation. It was the driving force behind the founding of the anthroposophical acute care hospital on the outskirts of Stuttgart back in 1975 where it held 40 percent of the shares, without, as yet, being represented on the Supervisory Board of the clinic. The MAHLE Foundation has significantly expanded this position in 2016: it now holds 70 percent of the shares and its own members are also actively involved in the Supervisory Board.

Integrative medicine is based on a particularly trusting relationship between doctor and patient.

"In this way, we want to accommodate the dynamic change in medicine and strengthen the clinic's special orientation toward the holistic perception of humans," Schweiß-Ertl says, emphasizing this step. Dr. Bernhard Volkmann, MAHLE's former Chief Financial Officer, brings a great deal of group experience to the hospital's supervisory body. "We have meanwhile implemented some major changes in a bid to improve the institute's position in an environment heavily influenced by cost pressure," states Schweiß-Ertl.

In the context of sustainable agriculture, the MAHLE Foundation is also funding seed research. One current project is to promote the return of the "Alb lentil," which is an integral part of the Swabian national dish (previous page).

FLAGSHIP FOR INTEGRATIVE MEDICINE

The clinic takes a holistic approach to caring for its patients, taking their personality, biography, living conditions, and potential into consideration. As a result, the relationship between doctor and patient is usually very trusting. "Integrative medicine is becoming increasingly popular, which is why we want to promote the clinic as the flagship of integrative anthroposophical medicine," stresses Schweiß-Ertl. The interest among patients and physicians is equally high. This has thus given rise to interesting collaborations: for example, the pediatric oncology department of Charité in Berlin and the university clinic in Sao Paulo have also started to use anthroposophical treatment methods. "The three clinics also exchange information with each other, despite their very different local conditions," enthuses Schweiß-Ertl.

The Filderklinik's approach, which treats patients on a holistic and individual basis, is also of particular concern to the MAHLE Foundation. This can be traced back to the founders of the MAHLE Group. Inspired by anthroposophist Rudolf Steiner's presentations on social, economic, and societal issues in the handling and use of capital, brothers Hermann and Dr. Ernst Mahle decided to transfer their company shares in the nonprofit foundation in 1964. In doing so, they thus based the activities of the company on these anthroposophical concepts.

MORE THAN 5,000 PROJECTS SPONSORED SINCE FOUNDATION

The MAHLE Foundation holds 99.9 percent of the group's shares and receives an annual dividend with which it finances its funding projects. The charitable company is thus the guarantor for MAHLE's independence. It also ensures that 97 percent of the group's net income for the year is reinvested in the MAHLE Group. To ensure the nonprofit

Jürgen Schweiß-Ertl has supported over 150 projects of the MAHLE Foundation all over the world.

"WE ARE FUNDING SCHOOL PROJECTS BECAUSE THESE YOUNG PEOPLE WILL BUILD THE COMMUNITIES OF TOMORROW."

Jürgen Schweiß-Ertl, *Managing Partner of the MAHLE Foundation*

status remains intact, the MABEG (Verein zur Förderung und Beratung der MAHLE Gruppe e.V.) exercises the voting rights and not the MAHLE Foundation.

Promoting holistic nursing and health is just one of the key topics addressed by the MAHLE Foundation. In 2016, it funded more than 150 projects. Over 500 inquiries in total were recorded and reviewed by four employees. At least two of the seven shareholders are always involved in the decision on whether to approve funding. Since its inception, the MAHLE Foundation has accompanied and sponsored more than 5,000 different projects and initiatives in this way.

EDUCATION—NUTRITION —SUSTAINABLE AGRICULTURE

Education is another priority for Jürgen Schweiß-Ertl and his employees. That's why educators and teachers working at the Waldorf schools and kindergartens are also supported and trained to some extent. "We are witnessing a growing interest in eastern Europe—for example, in Russia and Ukraine," reports Schweiß-Ertl. However, the demand for qualified personnel is also huge in China, where several hundred Waldorf kindergartens have also sprung up in the meantime. "As we see it, education has many facets. We are thus also funding school projects because the young people of today will build the communities of tomorrow. Every cent is well invested here."

A healthy diet is also one focus point of the MAHLE Foundation's work. "Unlike industrial suppliers, we promote seed propagation, which means the seeds can be used by the farmers for years to come, instead of having to repeatedly buy them anew. This accords with our understanding of sustainable agriculture," emphasizes Schweiß-Ertl. The demand for appropriately grown produce is rising significantly, especially in Europe. The Foundation is promoting seed research, which also takes regional particularities into account. Such new seed propagation is a very lengthy process: "It can take ten to even fifteen years until such seeds have reached market maturity."

The MAHLE Foundation is sponsoring sustainable agriculture and educational projects in Brazil together with Instituto Mahle, which was founded in 2007. Instituto Mahle is also supporting the Casa Angela—a birthing clinic located in a disadvantaged district of São Paulo—which has even received state recognition as Brazil's sole birthing clinic outside a hospital. In India, the MAHLE Foundation has been backing the "Shining Eyes" initiative to improve the food and hygiene situation of the poorer social classes since 2010. Nutrition programs, in which children and mothers learn how to prepare a healthy meal, are an integral part of this project. The initiative also works together with the villagers to create kitchen gardens in which fruit and vegetables are grown. The health and weight of children are checked on a regular basis and vitamins and minerals are prescribed, if necessary. In this way, "Shining Eyes" is contributing to permanently overcoming chronic malnutrition on the subcontinent and is preventing many health problems from the outset.

The "Shining Eyes" initiative in India improves the food and hygiene habits of the poorer social classes.

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FUNDAMENTAL INFORMATION ABOUT THE MAHLE GROUP

- Products for the combustion engine and its peripherals, for electrified vehicles as well as the complete thermal management system independent of the drive configuration
- Dual strategy characterized by consolidation of technology and cost leadership in established business segments while expanding activities in the areas of e-mobility and alternative powertrains
- Expanded mechatronic activities now a strategic business segment

BUSINESS ACTIVITIES AND CORPORATE STRUCTURE

MAHLE is a global development partner and supplier to the automotive industry, and a technological driver for innovative and efficient mobility. Our products cover all crucial issues relating to the powertrain and air conditioning technology. We are not only working on the ongoing development of the combustion engine, but are simultaneously developing new drive concepts and solutions in the area of e-mobility.

MAHLE products are fitted in every second vehicle worldwide. They are used in two-wheeled vehicles, passenger cars, and commercial vehicles, as well as off the road—be it in stationary applications, mobile machinery, rail transport, or marine applications. Our motorsports components turn the world's best racing teams into winners and champions—from Formula 1 through to long-distance races and rally championships.

The MAHLE Group is organized in four business units: Engine Systems and Components, Filtration and Engine Peripherals, Thermal Management, and Aftermarket. At the beginning of 2016, we consolidated our mechatronic activities in a newly founded division. Six further business fields are geared toward specific market and customer segments.

The nonprofit MAHLE Foundation holds 99.9 percent of the company's shares. The voting rights are held by Verein zur Förderung und Beratung der MAHLE Gruppe e.V. (MABEG), which exercises the shareholder rights and holds 0.1 percent of the shares. This structure safeguards the MAHLE Group's corporate independence and allows us to plan for the long term and make appropriate investment decisions. As a foundation-owned company, we voluntarily implement in a comparable manner the key elements of the German Corporate Governance Code in its version dated May 5, 2015, insofar as they are suitable and appropriate with regard to the shareholder and governance structure of MAHLE.

The operating result, a key figure similar to the EBIT, is an important management tool for the MAHLE Group. Any differences compared with EBIT are essentially due to the amortization of goodwill as well as depreciation and amortization on disclosed hidden reserves within the framework of purchase price allocations. Profitability must be pursued in all areas and processes. In doing so, MAHLE secures stable corporate development and generates sufficient funds for necessary investments.

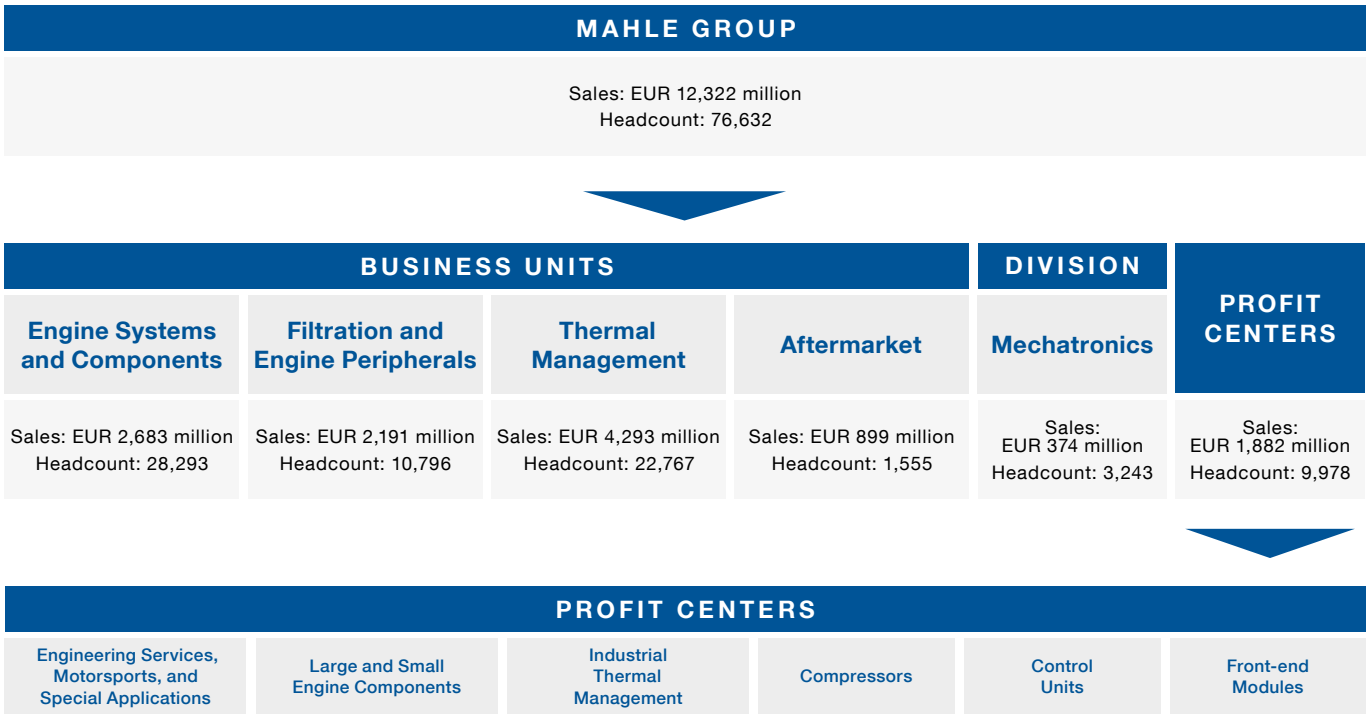
BUSINESS SEGMENTS

ENGINE SYSTEMS AND COMPONENTS BUSINESS UNIT

This business unit is the global market leader in its relevant market segments and can build on decades of development and systems competence as well as comprehensive production experience. Its products include pistons, piston rings, cylinder liners, and bearings, as well as valve train systems and components. These products are used worldwide in two-wheeled vehicles, passenger cars, commercial vehicles, and large engines. We are continuously developing our portfolio to further reduce emissions and fuel consumption in combustion engines in the future.

FILTRATION AND ENGINE PERIPHERALS BUSINESS UNIT

With its products, the business unit provides for clean air and prevents contaminations in oil and fuel from damaging the engine. We produce filter and pump systems as well as oil coolers for engine and transmission applications and our products make a decisive contribution to increasing the efficiency and service life of engines and to reducing emissions. Because the peripherals for even identical basic engines frequently differ due to varying regional emission laws, individual car body shapes, and various power classes, we, as a development partner to our customers, have built modular systems for all major product groups over the past years. MAHLE is one of the global market leaders in this area, too.



As at January 1, 2017

THERMAL MANAGEMENT BUSINESS UNIT

The increasing electrification of the powertrain requires a high degree of innovative strength in the thermal management of batteries and the entire electric powertrain. In addition, the downsizing of engines toward reducing CO_2 and other emissions has resulted in thermal management playing an increasingly crucial role in the performance of the combustion engine. What's more, the air conditioning has the task of providing comfort inside the cabin while keeping energy consumption low. We have steadily expanded our thermal management activities over the past few years and are the world's second largest supplier in this segment today. When it comes to the thermal management of batteries, we are a technology pioneer and with our solutions; we can ensure a constant temperature level and distribution between the battery cells—this is a prerequisite for the high performance and long service life of the energy storage system.

AFTERMARKET BUSINESS UNIT

This business unit supplies the trade, as well as workshops and engine repair partners worldwide with spare parts in original equipment quality—be it engine parts, filters, thermostats, or mechatronic components. It also supplies diagnostic and air conditioning service units and offers a comprehensive range of services, including training and technical support through our global network. Due to the diverse nature of today's vehicle technologies, cutting edge expertise is an essential criterion for the success of our business partners. At the same time, our short delivery times contribute significantly to the satisfaction of our customers because they can rely on limited downtimes in workshops.

MECHATRONICS DIVISION

With the help of electric components, the efficiency of modern powertrains can continue to grow; they are thus increasing in importance. For this reason, we consolidated our mechatronics expertise in a newly founded division, with the product groups of electric drives as well as actuators and auxiliaries, at the beginning of 2016. At the heart of our activities is our development and production expertise in electric motors and electronics, which although used in a wide range of applications, are technically very closely related. They thus afford economies of scale and synergies relevant for the automotive industry.

PROFIT CENTERS

Six business fields, organized as profit centers, serve special market and customer segments. With this structure, we can offer our customers the highest degree of flexibility, support them in the development of specific new products, and provide them with tailor-made applications and components. These business fields include Engineering Services, Motorsports, and Special Applications, Large and Small Engine Components, Industrial Thermal Management, as well as Compressors, Control Units, and Front-end Modules for automotive manufacturers.

GROUP STRATEGY

Crucial, long-term megatrends that the automotive industry needs to confront are global population growth, increasing urbanization, the even stronger economic importance of Asia in future, as well as climate change and the political climate targets derived therefrom. We have analyzed these trends and compiled several future scenarios based on this information. The findings gained from this work serve as the basis for developing our group strategy.

These megatrends will have a far-reaching impact on future mobility solutions and thus on the automotive industry. Key issues here are the increasing electrification of the powertrain, car sharing, the expansion of public transport, as well as connected and autonomous driving. As to how fast this structural change takes place depends heavily on political guidelines, on the one hand, and on the technical solutions that hold their ground in the market, on the other. In the case of passenger cars and light commercial vehicles used for urban distribution transport, technologies such as hybrid and electric drives, as well as alternative usage models such as car sharing will gain in importance. For heavy-duty commercial vehicles, no substitution products for combustion engines are yet in sight in the short to medium term.

Over the next few years, the combustion engine will remain the technology of mobility both for passenger cars and for commercial vehicles—in light of the global increase in vehicle production and the fact that even hybrid vehicles cannot exist without the combustion engine, we assume that demand for the corresponding components and systems will even rise to begin with.

MAHLE has derived a dual strategy from these market conditions: we will continue to be a technology leader in the ongoing development of the combustion engine and ensure the highest possible level of competitiveness in terms of quality and costs. At the same time, we will develop more innovative solutions and products for alternative drive technologies and build the appropriate business segments in a targeted manner. Business segments, which are independent on the OE business with the passenger car combustion engine, are already accounting for more than 50 percent of group sales today.

Our dual strategy is also reflected in thermal management. Thus, efficient thermal management will play an even more important role in future—not only in conventional but especially in alternative drive systems. We have expanded this business segment over the past few years and pioneered the development of numerous innovations for the thermal management of batteries and of electric powertrains in electric vehicles and plug-in hybrids, making them ready for series production. Moreover, we will be significantly intensifying our electronic and mechatronic activities over the coming years. In doing so, we want to offer our customers a wider portfolio of electric motors for passenger cars as well as two-wheeled vehicles such as e-scooters and pedelecs, which in the context of urban mobility, are growing in importance around the world. This also applies to the electrification of auxiliary aggregates, such as electric air conditioning compressors.

REPORT ON ECONOMIC POSITION

- Increased group sales by 7.3 percent to EUR 12.3 billion, with an organic growth of 3.4 percent
- Significant growth impulses in the Thermal Management, Mechatronics, and Aftermarket business segments
- Stable result from operational business activities with simultaneous increase in cash flow from operating activities

ECONOMIC CONDITIONS

OVERALL ECONOMIC DEVELOPMENT

According to the January 2017 report by the International Monetary Fund (IMF), the global economy grew by 3.1 percent in 2016. It thus remained slightly below the forecast made at the beginning of the year and remained at the previous year's level. With a plus of 1.6 percent, growth in the advanced economies was significantly lower than in the previous year (+2.1 percent). In contrast, development in several emerging markets was considerably stronger.

Growth in the European Union—which is still the most important region for the MAHLE Group—was slightly lower than in the previous year with a plus of 1.9 percent; the euro zone grew by 1.7 percent.

In the USA, the economy grew by 1.6 percent during the period under review, while a reluctance to invest was observed ahead of the presidential election. Brazil, the largest Latin American economy, lost ground again with a minus of 3.5 percent. The governmental crisis and lower raw material prices led to a decline in consumer demand and a lack of state and private sector investments.

With a plus of 6.7 percent, China's economy exhibited a slightly more restrained performance than in the previous year (+6.9 percent). Apparently the economic restructuring toward more consumption and services is making progress. This should be viewed critically, as it is predominantly based on government investments and a sharp increase in credit services. In Japan, the government's monetary and fiscal policy measures were thwarted by the appreciation of the yen. As a result, growth remained slightly below the previous year at 0.9 percent. According to official figures, India achieved a growth of 6.6 percent.

EXCHANGE RATE DEVELOPMENT

Exchange rate movements are of great importance for transactions in foreign currencies and affect the conversion of financial data for accounting purposes. There were variations in the exchange rate development in the period under review.

On the one hand, many of MAHLE's major trading currencies depreciated against the euro as measured by the average market price compared with the previous year. These included not only the Argentine peso (–59 percent due to allowance of the floating exchange rate) and the British pound (–13 percent, as a result of the Brexit decision), but also the currencies of China, Mexico, and Turkey. Furthermore, the Brazilian real and the Russian ruble fell in value over the course of the year—even though the exchange rate of both currencies rose again by the end of the year. On the other hand, the Japanese yen continued its appreciation against the euro, which began in the previous year, by a further ten percent. On an annual average, the U.S. dollar remained almost unchanged against the euro, but gained considerable ground in the last quarter.

The partly severe exchange rate fluctuations underline the importance of MAHLE's production location strategy in all major sales regions around the world. Such "natural hedging" enables the group to increase its independence from currency fluctuations.

DEVELOPMENT OF THE MARKETS FOR PASSENGER CARS AND LIGHT COMMERCIAL VEHICLES

On the basis of our data collection, the global production of passenger cars and light commercial vehicles increased by around five percent in the 2016 business year, thus considerably surpassing our forecast made at the beginning of the period under review (+2 percent).

A significant impetus came from China, where production rose by 14 percent. This is due to an anticipatory effect, since the government granted tax incentives for vehicles with a displacement of less than 1.6 liters, which were originally only valid until the end of 2016. In the period under review, almost one third of the world's vehicles were produced in China.

The number of vehicles produced in Europe also rose more sharply than expected—with a plus of three percent. The sustained high demand in Spain, Italy, France, and Germany had a positive impact here, whereby declines primarily in Russia were more than offset.

In North America, production rose by two percent due to the increased demand in Mexico and Canada, whereas production in the USA stagnated. In South America, the negative trend continued with a double-digit minus due to the ongoing reluctance to buy.

In the Asia/Pacific region, the previous year's value was exceeded by seven percent. Not only China, but India, too, saw a significant rise in its production figures, especially in the last quarter, which more than compensated for the falling figures in Japan and Korea. More than half of all the passenger cars and light commercial vehicles produced worldwide came from Asia/Pacific in 2016.

DEVELOPMENT OF THE MARKETS FOR MEDIUM-SIZED AND HEAVY-DUTY COMMERCIAL VEHICLES

Based on our surveys, with a plus of almost six percent, the production of medium-sized and heavy-duty commercial vehicles exceeded the previous year's figure and was thus above our expectations.

Around three percent more trucks and buses were produced in Europe. The upturn in Spain, Italy, and France had a positive effect, whereas demand fell in Russia and slumped in Turkey.

The significant drop in production of 17 percent in North America was in line with our expectations. This can be attributed to a cyclical downturn and the reluctance of many fleet operators, in particular, to invest in heavy-duty commercial vehicles. Production figures in South America also experienced a double-digit decline; the market thus contracted for the third successive year.

The Asia/Pacific region recorded an increase in the double-digit percentage range—which was significantly higher than expected. China gave the decisive boost here, particularly in the final quarter, with a rise of 28 percent. Following the dramatic decline in production in the previous year (–22 percent), the market thus settled again at the level of 2014. More than a third of all medium-sized and heavy-duty commercial vehicles produced worldwide were manufactured in China in 2016. Production in India was also well up on the previous year. The weak domestic demand in Japan, however, had a detrimental effect; production figures remained below those of the previous year.

DEVELOPMENT OF THE MARKETS

2016	Overall economy	Passenger cars and light commercial vehicles	Medium-sized and heavy-duty commercial vehicles
	Actual	Actual	Actual
Europe	↗	↗	↗
North America	↗	↗	↓
South America	↘	↓	↓
Asia/Pacific	↑	↑	↑

BUSINESS DEVELOPMENT

DEVELOPMENT OF THE MAHLE GROUP

In the 2016 business year, we once again succeeded in increasing our total sales and achieved our forecast with a plus of 7.3 percent. At EUR 12.3 billion, we achieved the highest level of sales in the history of the company—following EUR 11.5 billion in the previous year. This result reinforces our position among the 20 largest automotive suppliers worldwide. Changes in the consolidation group contributed to this growth in sales in the amount of EUR 529 million, whereas exchange rate effects of EUR 104 million had a negative impact. Organic growth stood at 3.4 percent—which significantly surpassed the previous year's figure.

In 2016, we focused on the integration of the companies acquired in the previous year. In addition, we primarily concentrated on further optimizing our quality and processes, improving our competitiveness, and taking advantage of new market opportunities. The changes to the consolidation group are a clear indication that we have also strategically optimized and further developed our product portfolio. In the period under report, the sales from Delphi Thermal and MAHLE Electric Drives Japan (formerly Kokusan Denki), which were acquired on June 30, 2015, have now been included for the entire year for the first time. The additional consolidation effects amounted to a total of almost EUR 600 million. Through the acquisitions, we have considerably expanded our areas of competence in both thermal management and mechatronics as well as electric drives. With the acquisition of the electronics specialist Nagares at the end of 2016, which will be carried out in 2017, MAHLE is entering the field of vehicle electronics. As a result, we are sustainably

strengthening our competence in electrification and electric drives. The mechatronics segment can thus build on additional expertise in control units, power converters, and power electronics for electric motors in future. With the undertaken and agreed acquisitions, we will further strengthen our position as a systems provider to the automotive industry.

Through the sale of the Industrial Filtration business, we have further concentrated the group's orientation on mobility markets. The reason for the sale was the low level of synergies with our core business, which is primarily geared toward the automotive industry. The transaction was completed on October 31, 2016—as was the consequent deconsolidation of units with locations in Germany and eleven other countries. At the beginning of 2016, MAHLE König—a 50-percent joint venture—was deconsolidated and is now accounted for under the equity method. Both deconsolidations resulted in a negative effect on sales totaling EUR 70 million.

Exchange rate influences amounting to EUR 104 million also had a negative impact on sales. These can mainly be attributed to the devaluation of the Chinese renminbi, Argentine peso, and Brazilian real.

In addition to consolidation and currency effects, the effect from a change in the definition of sales was adjusted for the disclosure of organic growth. This new regulation complies with the requirements of the German Implementation Act (BilRUG) and had an effect of almost EUR 27 million for the 2015 business year.

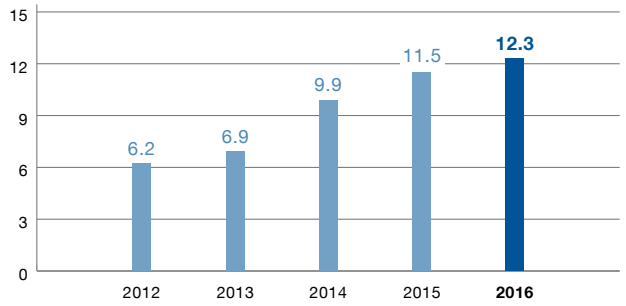
DEVELOPMENT OF THE BUSINESS SEGMENTS

The individual business segments experienced varying developments: whereas sales in the Engine Systems and Components as well as Filtration and Engine Peripherals business units remained at the level of the previous year, the Thermal Management and Aftermarket business units as well as the Mechatronics division and profit centers all achieved considerable organic growth.

In the year under review, structural changes in the group organization affected the profit centers; for better comparability we have included the adjusted values from the previous year. It is important to note that sales from the 2015 acquisitions in the Thermal Management business unit and Mechatronics division have been included for the entire year for the first time.

DEVELOPMENT OF SALES 2012–2016

in EUR billion



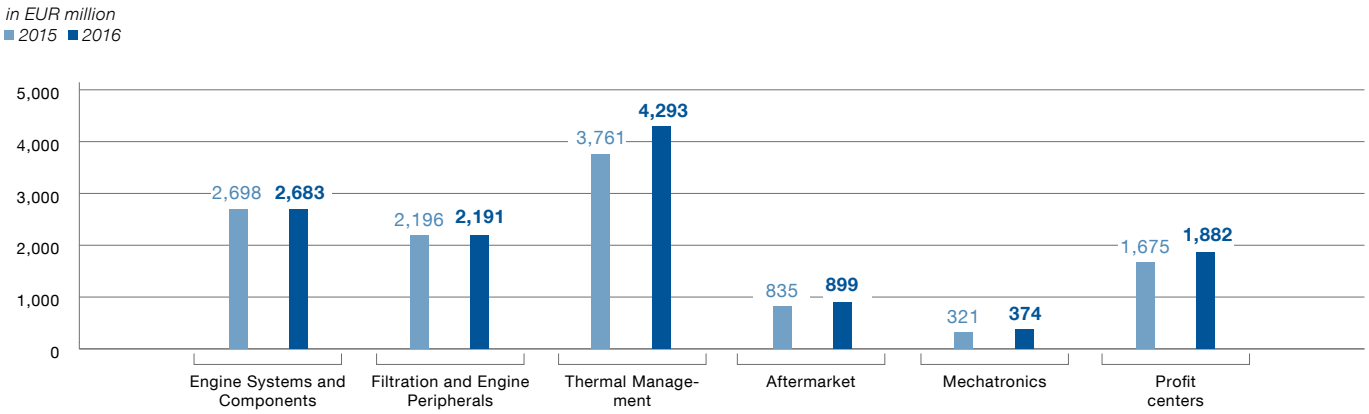
ENGINE SYSTEMS AND COMPONENTS BUSINESS UNIT

In the period under review, the business unit achieved sales of EUR 2.683 million, thus remaining 0.5 percent below the previous year's figure—when adjusted for exchange rate effects, sales were stable. We were able to make substantial gains in the assembled camshaft business, which were attributable to production ramp-ups in China and the USA as well as production expansion in Europe. The demand for valves and power cell units—for both passenger cars and commercial vehicles—also developed positively. For cylinder liners, bearings, and heavy-duty steel pistons, however, sales declined slightly. In the year under review, we also laid the groundwork for the sale of our forging activities in Germany.

FILTRATION AND ENGINE PERIPHERALS BUSINESS UNIT

With sales of EUR 2,191 million, the business unit concluded the year under review at almost the same level as the successful year of 2015 (EUR 2,196 million). Among the products generating the highest sales were air intake modules as well as air and oil filter modules. However, the biggest growth was achieved with cylinder head covers, oil pumps, and oil coolers. In Santa Catarina/Mexico, we have merged three locations into one plant and have expanded the plant in Timisoara/Romania. In addition, we have further optimized our processes in order to increase production efficiency.

SALES BY BUSINESS SEGMENT



THERMAL MANAGEMENT BUSINESS UNIT

Integrating the Delphi Thermal units acquired in 2015 was a priority for the Thermal Management business unit in the year under review. This involved, among others, location consolidations and the relocation of projects in the USA, Brazil, and India. The acquisition was also noticeable in the increased business volume: the business unit surpassed sales from the previous year by around EUR 532 million or 14.1 percent. Even though about two thirds of growth can be attributed to the first full-year inclusion of the acquired units, the business unit still achieved strong organic sales growth of around six percent. In total, it generated EUR 4,293 million—which equates to 35 percent of group sales.

AFTERMARKET BUSINESS UNIT

The business unit achieved sales of EUR 899 million and grew by 7.7 percent in the period under review. The integration of the spare parts business for starter motors and alternators as well as electric motors in the course of restructuring the Mechatronics division contributed largely to this growth. By contrast, negative exchange rate effects amounting to EUR 37 million had a detrimental effect. An increase in organic revenue was realized in particular through spare parts for filtration and engine cooling. However, the heavy expansion of the portfolio in the repair shop equipment segment, which led to a near doubling of sales, also contributed to the strong organic growth of around seven percent.

MECHATRONICS DIVISION

On January 1, 2016, we concentrated our mechatronics activities into a newly created division. The business year was therefore marked by the organizational merger and integration. We were able to increase the sales in this—for MAHLE—still young business segment, by EUR 52 million to EUR 374 million (+16.3 percent). The first-time full-year inclusion of MAHLE Electric Drives Japan (formerly Kokusan Denki), which we acquired on July 1, 2015, contributed significantly to this plus. This was partly offset by the intragroup transfer of the spare parts business in the Aftermarket business unit. Taking both effects into account, the Mechatronics division achieved a strong organic sales growth of almost seven percent.

PROFIT CENTERS

By addressing special market and customer segments, we generated total sales of EUR 1,882 million in the year under review and were able to increase sales by 12.4 percent. Adjusted for structural changes and exchange rate effects, the profit centers achieved an organic growth of a good five percent.

Noteworthy is the expansion of the air conditioning compressor business, which made progress in the year under review. Although a major part of the local sales growth stemmed from the first-time full-year inclusion of the newly added units in 2015, we were also able to achieve considerable organic growth. The Control Units and

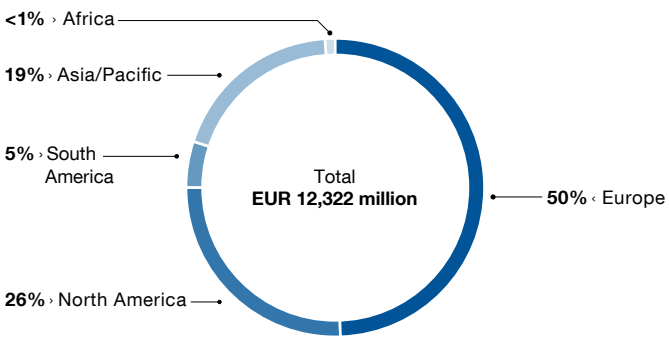
Front-end Modules profit centers, which are operated as joint ventures, once again experienced strong growth. Adjusted for exchange rate effects, the Engineering Services, Motorsports, and Special Applications profit center also grew by around three percent. Over the course of the business year, we expanded its capacity in North America through the acquisition of a development center with state-of-the-art powertrain test bench technology. However, the sale of the Industrial Filtration business and the deconsolidation of MAHLE König had a negative impact on sales.

DEVELOPMENT BY REGION

The MAHLE Group is represented in 32 countries with about 170 owned production or development locations. Thanks to this global presence, we can work intensively with our customers on site and are in a position to offset temporary fluctuations in individual markets.

The inconsistent development of the global vehicle markets in 2016 also affected our sales in the world regions. While we once again had to report declines in the relatively small market of South America due to poor market conditions, we achieved growth in all other world markets, with Asia/Pacific, in particular, exceeding our expectations. The business development by region illustrated below is based on sales by country of production.

SALES BY REGION



EUROPE

Europe again accounted for half of group sales in 2016. After achieving EUR 5,844 million in the previous year, we generated sales of EUR 6,119 million, which corresponds to an increase of 4.7 percent. Adjusted for consolidation and currency effects as well as changes in the definition of sales according to commercial law, sales were a good two percent higher than in the previous year. This growth was underpinned by the lively demand in western Europe in particular.

Sales in the Engine Systems and Components business unit remained constant compared with the previous year. Noteworthy is the expansion of production capacity for steel pistons for passenger car diesel engines. In the Filtration and Engine Peripherals business unit, our sales remained at the previous year's level. Declining sales revenues from individual filter components were offset by a growth in oil coolers and oil pumps. The Thermal Management business unit significantly increased its sales by 10.6 percent, whereby the Ostrow/Poland and Senica/Slovakia locations were included for a full year for the first time due to their consolidation. Organic growth amounted to a good two percent. The Aftermarket business unit achieved a plus of nine percent, which was mainly attributable to the integration of the mechatronics business; its organic growth lay at around two percent.

NORTH AMERICA

Our development in North America was encumbered by the strong cyclical decline in the commercial vehicle business. A slightly positive development in the passenger car and light commercial vehicle market could not compensate for this. Despite this critical market situation, we generated sales of EUR 3,267 million, which corresponds to a growth of twelve percent when compared with the previous year. Although the first-time full-year consolidation of the thermal management activities acquired in 2015 played a major role here, we were still able to grow organically by about four percent and thus significantly exceeded the general market development.

The business units developed inconsistently in the second largest market for MAHLE. In the Engine Systems and Components business unit, despite the good passenger car business, sales declined by around two percent due to the weak market for commercial vehicles. In the Filtration and Engine Peripherals business unit,

however, sales revenues remained virtually unchanged with a minus of 0.1 percent. The Thermal Management business unit benefited from higher sales in the passenger car sector. We thus achieved organic growth of more than six percent in this business unit and with sales of EUR 1,379 million, generated more than 42 percent of North American sales. The Aftermarket business unit also showed very positive development thanks to the increased demand for filter products and our newly established workshop equipment segment; it achieved an organic sales increase of about twelve percent.

SOUTH AMERICA

The severe economic crisis in South America continued to influence most of the Latin American markets in 2016. The production and sales of passenger cars and commercial vehicles declined once more. In this difficult environment, after adjustment for markedly negative exchange rate effects (EUR –44 million), we recorded an organic sales deficit of 2.2 percent and thus minimized our organic sales losses in comparison with the overall sluggish market. In total, we generated sales of EUR 572 million in South America—which corresponds to almost five percent of group sales.

Both the Engine Systems and Components (–13.3 percent), and Filtration and Engine Peripherals (–29.7 percent) business units were unable to elude the further decline in the vehicle market. The Thermal Management business unit, on the other hand, benefited from the start-up of a global platform for compact cars and increased its sales. The Aftermarket business unit, which contributed to around one third of group sales in this region, reported a drop in sales of around three percent. However, after adjustment for considerably negative exchange rate effects, notably due to the devaluation of the Argentine peso, it achieved an organic sales plus of around eleven percent.

ASIA/PACIFIC

In the Asia/Pacific region, we substantially improved our sales to EUR 2,316 million. The increase of 10.6 percent was favored by the highly dynamic growth in the vehicle market, particularly in China. The organic growth of 7.6 percent—to which all business units contributed—was thus approximately in line with the development of the market.

The Engine Systems and Components business unit concluded the period under report with a plus of 6.5 percent—mainly generated with pistons for passenger cars and commercial vehicles as well as camshafts at the Chinese locations. The biggest MAHLE business unit in this region, Filtration and Engine Peripherals, grew by 1.4 percent. Apart from the increased focus on Southeast Asian countries, we achieved sales increases in Japan thanks to several production ramp-ups for local manufacturers. Despite considerable negative exchange rate effects, the Thermal Management business unit accomplished significant sales growth with a plus of 16.8 percent. Here, we notably benefited from the rise in passenger car production and made significant gains with our engine cooling products, in particular. The Aftermarket business unit rounded off the successful business development in the region with a growth of 12.1 percent thanks to new sales platforms and improved market access in China and Japan.

AFRICA

In Africa, we achieved sales of EUR 48 million, which corresponds to an increase of 2.9 percent in comparison with the previous year. Sales were mainly generated by the Thermal Management business unit, which operates two locations in South Africa.

NET ASSETS, FINANCIAL POSITION, AND RESULTS OF OPERATIONS

RESULTS OF OPERATIONS

The increase in sales did not lead to an improved result in the 2016 business year, in particular owing to acquisition and valuation effects as well as increased warranty expenses. Moreover, higher expenses for future-oriented research and development adversely affected the result. At EUR 1,079 million, we achieved EBITDA at the previous year's level (EUR 1,093 million). The operating result, a key figure similar to EBIT used for internal steering, but adjusted for individual circumstances, also only marginally exceeded the value of the previous year.

Aside from operational influences, our profitability was reduced by special effects. The financial result thus includes a significant burden from the profit and loss transfer and from the impairment of the carrying amount of the joint venture Bosch Mahle Turbo Systems (BMTS). The depreciation and amortization on obligatorily disclosed hidden reserves in accordance with the German Commercial Code

(HGB) as part of the purchase price allocations also remained at a high level. Due to these effects, the result from business activities could not be improved; it amounted to EUR 228 million (previous year: EUR 309 million).

Our key income statement items developed as follows: Cost of sales rose to EUR 9,994 million—thus at a slower rate than sales—which resulted in a slight improvement in the gross margin from 18.7 percent to 18.9 percent. At EUR 1,089 million, selling expenses and general administrative expenses remained at the previous year's level in relation to sales. Compared with sales, however, expenditure on research and development grew disproportionately. The increase from EUR 657 million in the previous year to EUR 753 million in this year reflects our consistent pursuit of the dual strategy. The balance from other operating income and expenses was slightly negative with a minus of EUR 13 million and therefore fell by around EUR 50 million compared with the previous year. This decline is due, among other things, to exchange rate effects, expenses associated with corporate transactions, and higher planned amortization of goodwill. With the exception of research and development expenses, all cost items were adversely impacted by the effects of purchase price allocations in accordance with the German Commercial Code (HGB). In total, these amounted to EUR 149 million, of which EUR 56 million relate to planned amortization of goodwill.

Earnings before interest and taxes (EBIT) amounted to EUR 473 million with an EBIT margin of 3.8 percent. EBIT therefore remained under the previous year's value in absolute terms and in relation to sales. Adjusted for the effects of the purchase price allocations and the amortization of goodwill, the EBIT margin was at 5.0 percent.

Below EBIT, the aforementioned charges on the financial result in connection with the joint venture BMTS and an increased tax rate resulted in a reduction of our net income for the year to EUR 63 million. The net expenses from the compounding of future pension payments and from the increase in value of the pension assets remained at a high level, thereby negatively impacting the financial result. In contrast, the tax expenses declined due to the lower result from business activities. Taxes on income amounted to EUR 132 million, which corresponds to an income tax rate of around 58 percent. The high tax rate is primarily due to higher planned amortization of goodwill as well as increased losses from associated companies. While both issues put a burden on the commercial result, they did not fully lower the tax base. In addition, special effects connected with internal group reorganization raised the tax rate. Other taxes remained at the previous year's level.

CONSOLIDATED INCOME STATEMENT

in EUR million	2016	in %	2015	in %
Sales	12,322	100.0	11,486	100.0
Cost of sales	–9,994	–81.1	–9,335	–81.3
Gross profit on sales	**2,328**	**18.9**	**2,151**	**18.7**
Selling expenses and general administrative expenses	–1,089	–8.8	–1,020	–8.9
Research and development expenses	–753	–6.1	–657	–5.7
Other operating income and expenses	–13	–0.1	38	0.3
Financial result	–245	–2.0	–203	–1.8
Result from business activities	**228**	**1.9**	**309**	**2.7**
Taxes on income	–132	–1.1	–156	–1.4
Result after taxes	**96**	**0.8**	**153**	**1.3**
Other taxes	–33	–0.3	–31	–0.3
Consolidated net income	**63**	**0.5**	**122**	**1.1**
EBIT	**473**	**3.8**	**511**	**4.5**
EBITDA	**1,079**	**8.8**	**1,093**	**9.5**

NET ASSETS POSITION

Our balance sheet total rose slightly from EUR 7,849 million to EUR 8,032 million in the year under review. The development is therefore in line with the organic business expansion. Despite the extension of the balance sheet, we have reduced our net debt.

Fixed assets fell by EUR 62 million to EUR 3,750 million in the year under review. A significantly positive net expenditure on tangible fixed assets was more than offset by amortization on intangible assets and valuation allowances on our shares in the joint venture BMTS. Most of the amortization on intangible assets in the year under review related to goodwill and hidden reserves with respect to technology and customer relationships that were disclosed in connection with purchase price allocations.

As at the balance sheet date, current assets totaled EUR 3,992 million, corresponding to an increase of EUR 200 million. The rise of EUR 27 million in inventories to EUR 1,269 million reflects a disproportionately low increase compared with the organic sales growth achieved. The increase in trade receivables was only partly offset by slight declines in other assets. Overall, receivables and other assets rose by EUR 111 million to EUR 2,350 million. Thanks to a positive cash flow, securities and liquid funds were increased by EUR 62 million to EUR 372 million.

On the liabilities side, equity rose by EUR 55 million to EUR 2,722 million as a result of exchange rate effects and the retention of earnings, among other things. At 33.9 percent, the equity ratio is almost the same as the previous year (34.0 percent). The renewed increase in accruals for pensions by around six percent to EUR 575 million can be attributed in particular to a further drop in the interest rate level and the associated reduction in discount factors. Other accruals rose in the year under review by EUR 50 million to EUR 1,463 million, largely owing to exchange rate and interest effects. In warranty and risk accruals in particular, additions also exceeded consumptions and releases. As at the balance sheet date, trade payables amounted to EUR 1,257 million. This corresponds to an increase of EUR 160 million, which is disproportionately high compared with the development of sales and greater than the rise in trade receivables. Liabilities to banks fell substantially in the year under review and now amount to EUR 769 million compared with EUR 887 in the previous year. As no bonds were issued in the year under review, the corresponding liability remains at EUR 829 million. Other liabilities also were virtually unchanged in comparison with the previous year.

Besides the circumstances depicted in the balance sheet, as at December 31, 2016, there were significant off-balance-sheet transactions amounting to EUR 148 million (previous year: EUR 153 million) in connection with rental and leasing agreements for land and buildings. Moreover, there were off-balance-sheet transactions of EUR 125 million (previous year: EUR 146 million) relating to factoring, which contributed to the diversification of financing sources.

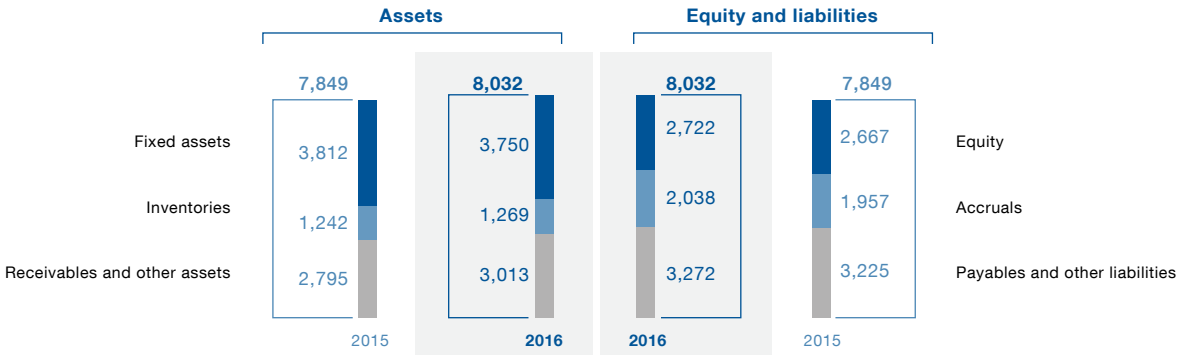
INVESTMENTS

In the past business year, we invested EUR 563 million in property, plant, and equipment (previous year: EUR 564 million). In relation to sales, the investment ratio remained slightly below the previous year's level (4.9 percent) at 4.6 percent. With a ratio of around 129 percent, the investments substantially exceeded the depreciation on tangible fixed assets (previous year: 134 percent).

Aside from Germany, the regional focus of the investing activities was primarily on eastern Europe and North America, as well as the Asia/Pacific region. In addition to those in connection with customer projects, investments in eastern Europe included the expansion of plants in Poland, the Czech Republic, and Romania as well as production facilities. Overall, capital expenditure on tangible fixed assets in European markets made up 47 percent of the total volume. Approximately one quarter of the investments were made

BALANCE SHEET STRUCTURE OF THE MAHLE GROUP

in EUR million



in North America, where the focus was on the expansion of the Mexican locations. Moreover, investments were carried out in the USA in connection with the integration of the locations acquired in the previous year. Around one fifth of all investments were accounted for in the Asia/Pacific region, particularly in China and Japan. In China, investments were increased, primarily for the new Changshu plant from the Compressors profit center. The investments in Japan included the plant modernizations of our Mechatronics division. Overall, the investments made served to set the course for the MAHLE Group to achieve further growth within the framework of its dual strategy.

FINANCIAL POSITION

In line with its global growth, MAHLE has created a broad basis for the group's financing over the past few years. Our financing portfolio not only includes syndicated credit lines, German private placement loans ("Schuldscheindarlehen"), and bilateral loans, but also euro-denominated corporate bonds. With a conservative financing policy, we are aiming for an implicit investment grade risk. This positioning is evident in the moderate leverage and adequate equity ratio.

In the 2016 business year, we considerably reduced our net debt. This was essentially driven by a substantially improved cash flow from operating activities of EUR 856 million. The increase in comparison with the previous year (EUR 638 million), despite the lower net income for the year, was primarily owing to a lower additional commitment of funds in working capital. Investing activities resulted in a total cash outflow of EUR 575 million. The cash flow from operating activities thus completely covered the cash requirements for investments in fixed assets. The considerably lower cash outflow compared with the previous year (EUR –1,224 million) was due to the company acquisitions undertaken in the 2015 business year. In addition, a cash inflow was attributable to the sale of the industrial filtration business in the 2016 business year. The negative cash flow from financing activities of EUR 266 million resulted, among other things, from the utilization of the cash flow from operating activities to repay existing financial liabilities.

The syndicated credit line was renegotiated in the 2016 business year. A credit line of EUR 1.6 billion with a term of five years and two renewal options, each for one year, was agreed with the core banks. The German private placement loans of EUR 128 million due in November 2016 were repaid from the cash flow from operating activities. As at the end of the year, the unused but firmly committed credit lines amounted to EUR 1,883 million which, along with the liquid funds, contributed to the financial stability of the group. The cash holding is diversified across various banks that are selected according to rating criteria.

ADDITIONAL KEY PERFORMANCE INDICATORS

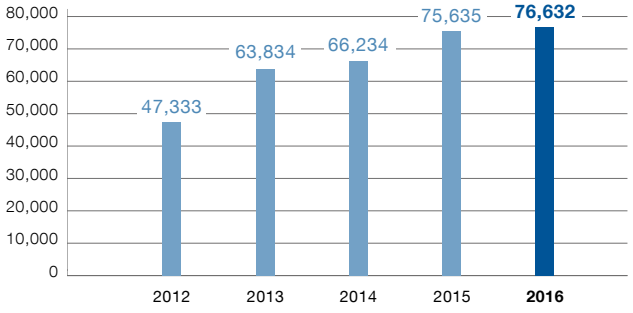
- High investments in the training and further education of employees, as well as in research and development to secure future viability
- Start of an interdivisional purchasing project to achieve cost synergies
- Expansion of quality management system

HUMAN RESOURCES

As at the reference date of December 31, 2016, the MAHLE Group employed 76,632 people worldwide and thus 1.3 percent more than in the previous year. The gain of 997 employees was primarily attributable to increased sales; temporary employees were taken on permanently in some instances. The sale of the Industrial Filtration business reduced the overall headcount by 865 employees (Europe 729, North America 60, and Asia/Pacific 76).

As an automotive supplier, we are facing strong competition for talent. Highly motivated and qualified employees are the key to success for the sustainability and growth of the group. This is why we once again invested intensively in the training and further education of our employees to the sum of EUR 11.9 million in 2016 (EUR 11.8 million in the previous year). In addition to a variety of workplace-related instructions, our employees took part in 71,345 qualification activities in the year under review. The global absence rate (excluding joint ventures) was 3.9 percent on average (previous year: 3.6).

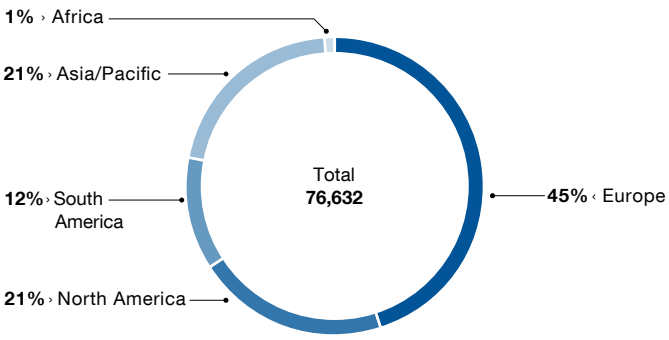
HEADCOUNT DEVELOPMENT 2012–2016



HEADCOUNT BY REGION

As at the reference date of December 31, 2016, there were 34,601 employees in Europe; this corresponds to a decrease of 1.2 percent. Although we recorded growth in our eastern European locations due to the increase in sales, the growth was overcompensated by the sale of the Industrial Filtration business and the deconsolidation of the MAHLE König joint venture. In Germany, the staffing level also fell by 3.0 percent to 13,803 as a result of the sale of the MAHLE Industrial Filtration business. In North America, we employed 15,578 people as at the reference date and thus 1.9 percent more than in the previous year. In South America, however, the headcount decreased by 3.2 percent to 9,338 due to the very difficult economic situation in this region. In the Asia/Pacific region, the headcount rose by 8.7 percent to 16,061 people in total as a result of good order levels. The staffing level in Africa also grew by 15.3 percent to 1,054 owing to increased demand.

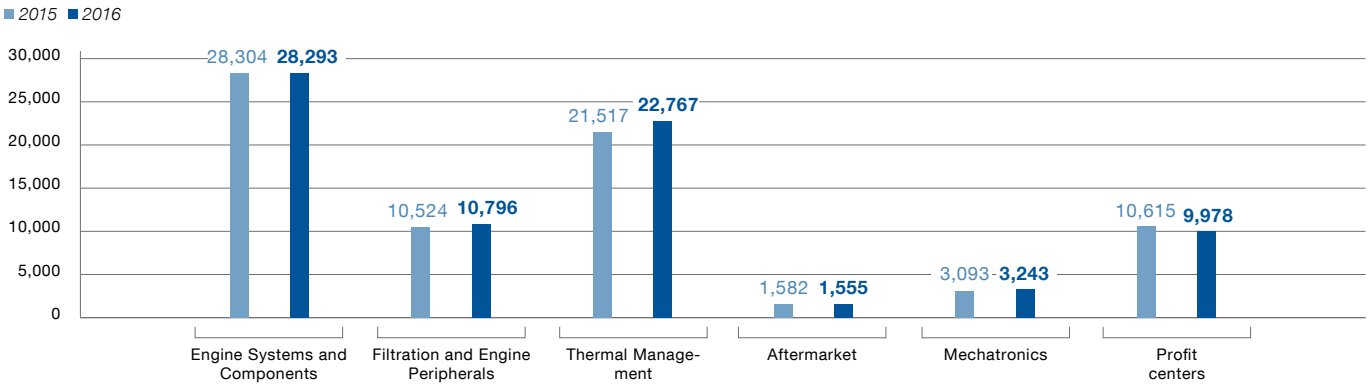
HEADCOUNT BY REGION



HEADCOUNT BY BUSINESS SEGMENT

In the Engine Systems and Components business unit, the number of employees remained constant. As at the reference date of December 31, 2016, it employed a total of 28,293 people at 48 locations. With a 37 percent share of the workforce, this business unit employs the main share of people in the MAHLE Group. 10,796 people were employed at the 36 plants of the Filtration and Engine Peripherals business unit, i.e., 2.6 percent more than in the previous year. This corresponds to 14 percent of the group's total workforce. The Thermal Management business unit headcount increased by 5.8 percent, whereby 22,767 people were employed at 41 locations as at the reference date. This accounts for 30 percent of the group total, following 28 percent in the previous year. With regard to the Aftermarket business unit, the

HEADCOUNT BY BUSINESS SEGMENT



number of employees remained more or less at the same level as in the previous year with 1,555 people. As at the end of the year, the Mechatronics division employed 3,243 people and thus 4.8 percent more than in the previous year. The headcount in the profit centers fell by 637 to 9,978. This was exclusively attributable to the aforementioned changes in the consolidation group.

TECHNOLOGY AND INNOVATION

RESEARCH AND DEVELOPMENT

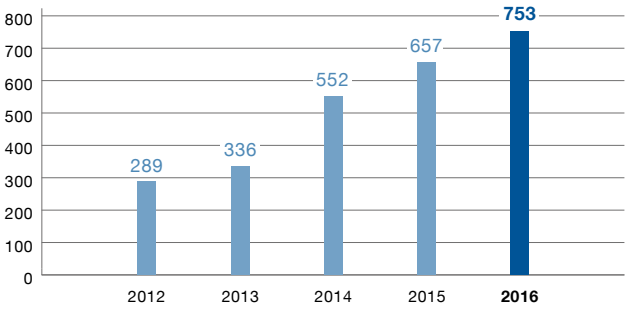
We continued to further expand our group-wide research and development activities in 2016. We have thus invested EUR 753 million in this area—which corresponds to 6.1 percent of sales and therefore an increase of EUR 96 million or 14.7 percent compared with the previous year (EUR 657 million), during which the research and development ratio was still at 5.7 percent. MAHLE has thus achieved a new all-time high. In the period under report, we submitted 350 patents first-filings. By the end of 2016, a total of 5,996 researchers and developers (+1.3 percent) were working for MAHLE at 15 development locations and 12 competence centers.

MAHLE is systematically embracing a dual strategy for research and development. On the one hand, we are working intensively on the further optimization of the combustion engine because this technology still has a great deal of potential that we intend to exploit. At the same time, we are focusing more heavily on the development of alternative drive concepts, such as battery-based e-mobility. In the case of commercial vehicles, we are not limiting ourselves to the ongoing development of the conventional powertrain, as electrification will also increasingly contribute to improving efficiency in this vehicle sector in future. For example, even the partial electrification of light commercial vehicles in urban distribution transport can have a significant impact in terms of fuel savings.

Thanks to our acquisitions over the past few years, we have significantly expanded our expertise in the fields of mechatronics and thermal management in particular. Numerous developments in the field of electric drives are almost ready for series production. We are already offering technologies that are a prerequisite for the breakthrough of e-mobility, such as systems for the thermal management of batteries; we have already received numerous orders from around the world. In all these solutions, we are driven by the desire to make vehicles even more efficient, reliable, and comfortable.

R&D EXPENDITURE 2012–2016

in EUR million



INNOVATIONS 2016

WORLD'S FIRST R744 AIR CONDITIONING SYSTEM

Since January 1, 2017, all newly registered vehicles in the European Union are required to use a refrigerant with a GWP (Global Warming Potential) below 150. GWP is a (relative) measure of the influence of a substance on global warming. In addition to chemical solutions, the natural R744 (carbon dioxide) with a GWP of 1 offers itself as an alternative to the previously used refrigerants. The world's first environmentally friendly R744 air conditioning system was developed for a premium German manufacturer in MAHLE's development departments in Stuttgart. Since the early 1990s, MAHLE has already been working with the environmentally friendly refrigerant. This expertise has made a substantial contribution toward finding solutions to our customers' high requirements for comfort as well as the technical challenges of an R744 system in very short development times. This is because R744 places high technical demands both on the components and the overall system, such as the significantly higher pressures of up to 130 bar, compared with current refrigerants. In the meantime, we are delivering the air conditioning unit and the evaporator in series.

CNG AND DOWNSIZING REDUCE CO_2

As announced, MAHLE has investigated the potential of a downsizing engine designed exclusively for monovalent natural gas operation. With a compression ratio of 13:1, this design can realize mean effective pressures of 30 bar and specific power output of 100 kW/l at a natural gas consumption below 200 g/kWh. A VTG exhaust gas turbocharger can also improve the low-end torque, achieving stoichiometric operation across the operating map. In combination with a stop-start function, up to 31 percent CO_2 can thus be saved with identical driving performance. Many vehicles that use compressed natural gas (CNG) were originally designed to run on conventional gasoline. With such bivalent motors, the fuel substitution only achieves a CO_2 reduction of up to 24 percent while exhibiting reduced nominal power and reduced torque compared with the monovalent design.

POTENTIAL CO_2 REDUCTION FROM SYSTEMIC ENGINE OPTIMIZATION

The valve train and crank mechanism are the mechanical heart and lungs of the combustion engine. Their design and optimization remains a fundamental approach for further increasing fuel efficiency and reducing emissions. The critical aspect of this approach today, however, is not only to implement individual measures for each component, but to ideally tune the complete system of the engine and its peripherals. MAHLE has therefore pushed its systemic developments for commercial vehicles, among others by relieving the oil circuit through improved engine mechanics. In the process, MAHLE is taking two complementary approaches for increasing efficiency and reducing fuel consumption, thus lowering CO_2 emissions: direct reduction of frictional loss within the engine mechanics and reduction of power consumption of auxiliary drives, such as the oil and cooling systems, by designing them to meet demand and applying specific operating point controls. The interaction of several components thus takes center stage. This is how we address the engine and its peripherals in terms of subsystems, such as gas exchange, crank mechanism, as well as oil and cooling systems. The optimization takes places across the engine, especially at the functional interfaces. In doing so, the overall efficiency of the commercial vehicle powertrain increases—in total by up to three percent.

CONTROLLABLE PENDULUM-SLIDER OIL PUMP, ALSO FOR COMMERCIAL VEHICLES

While many auxiliary aggregates are still designed to meet the maximum requirements, these are only required from time to time, which increases consumption unnecessarily. This has also been true of the oil circuit so far. With our world's first controllable pendulum-slider oil pump for commercial vehicles, the pressure and volume flow are generated on demand, reducing the required power consumption to a minimum. Depending on the control strategy, simply supplying oil to meet demand can result in fuel savings of up to 1.5 percent. We have already received numerous orders for our controllable pendulum-slider oil pumps from major European and American vehicle manufacturers—both in the passenger car and the commercial vehicle sector.

WORLD'S FIRST MAP-CONTROLLED THERMOSTAT FOR COMMERCIAL VEHICLES

MAHLE has developed a map-controlled thermostat for commercial vehicle applications, which optimally adapts the coolant temperature to each driving situation for the first time. This increases the efficiency of the engine. Our map-controlled thermostats react very quickly and can already be actuated at low temperatures. They should be ready for series production by 2018. The technology can reduce fuel consumption in long-distance hauling applications by up to 0.5 percent. The power requirements of the cooling system are further optimized when the map-controlled thermostat works in conjunction with the controlled E-Visco® coolant pump and E-Visco® cooler. This lowers consumption and CO_2 emissions can be reduced by up to two percent.

MAHLE ECO A/C SYSTEM FOR COMMERCIAL VEHICLES

Together with the BHTC (Behr-Hella Thermocontrol) joint venture, which is managed as the Control Units profit center, MAHLE developed the ECO A/C system as an air conditioning system for heavy-duty commercial vehicles. Climate comfort in the cabin contributes to a pleasant working environment, helps the driver to concentrate, and improves safety thanks to simple and intuitive operation of the air conditioning system. At the same time, the ECO A/C system requires significantly less energy—a remarkable 83 percent less—than comparable systems. Climate comfort and transport efficiency are thus no longer mutually exclusive.

PURCHASING

MAHLE's most important raw materials include steel, aluminum, nickel, copper, and resins. The prices for these largely remained at a relatively low level over the course of 2016. In the last quarter, however, some, raw materials such as aluminum, nickel, copper, and tin, saw a sharp increase in price, which had a very different regional impact. In Europe, for example, the trend was reinforced by the depreciation of the euro against the U.S. dollar. Nevertheless, most of the raw materials were still significantly cheaper than over the last three years.

The prices for steel and scrap also rose continuously in the second half of the year under review. Oil prices saw a significant trend reversal, with prices increasing by a good 50 percent in 2016. Nonetheless, the averaged prices for crude oil were below the value of 2015. In return, the prices of crude oil derivatives, such as resins, remained largely stable. By contrast, energy prices showed regional variations, with prices tending to fall slightly in most countries. Continuous measures to increase energy efficiency have enabled us to reduce our consumption levels in all regions.

In the year under review, we further developed various areas of our risk management system for purchasing activities. A pilot project was aimed at obtaining information on risks in the supply chain as quickly as possible—be it natural disasters, strikes, or bankruptcies. In order to better identify such risks, a software collects and evaluates real-time data on suppliers in the second and third tier of the supply chain.

We also further scrutinized the basis of supplier relationships in 2016. Our aim, among other things, was to identify risky relationships and dependencies. In such cases, we searched for and validated alternatives in order to limit the consequences of losing a supplier. In 2017, we will be introducing a new audit process to evaluate the quality of the supplier relationship and thereby further refine the frequency and depth of the scrutiny.

The "Global Purchasing Excellence Program" (GPEP) is another central purchasing project, which we started in 2016 in order to identify and implement savings along the supply chain. The program encompasses organizational structures as well as processes and tools used to procure product materials and investment goods. In the course of its introduction, the purchasing organization will be partially realigned across business units and centralized. Last but not least, the organizational integration of the newly acquired business segments was also completed in Purchasing in 2016.

PRODUCTION, QUALITY, AND ENVIRONMENT

GLOBAL PRODUCTION NETWORK

MAHLE produces at about 170 locations worldwide. In 2016, we expanded or modernized the production lines in numerous plants to improve efficiency and product quality. These optimization measures are part of a continuous improvement process, which encompasses all areas of the company. In order to sustainably support this process, we are permanently developing our methods and standards further through a global exchange of best practices. The findings are incorporated into a holistic MAHLE production system; the introduction of the system has already begun.

OPTIMAL PROCUREMENT

In Besigheim near Stuttgart/Germany, a new central warehouse for western and central Europe went into operation in the fall of 2016, taking logistics in the Thermal Management business unit to the next level. With the "Point of Optimal Sourcing" (POS) project, which is unique in the automotive industry, we coordinate the transport from our suppliers to MAHLE via our logistics center in Ostrow/Poland to ensure optimal utilization of the transport vehicles. A shuttle system regularly supplies the connected plants with materials. The result: on the one hand, POS reduces the volume of transport by around a quarter, on the other hand, we need significantly less storage space in the plants, and can also respond flexibly to changes in customer demand.

QUALITY MANAGEMENT

Our quality management system is fully integrated into all of the group's business processes. All processes in the company are thus recorded, evaluated, and scrutinized. The findings provide the basis for further optimization of the processes.

We aim to pursue the zero-defect principle. Potential defect sources are already eliminated during product development. Quality management accompanies and safeguards series production. However, should any defects occur, they are handled using a standardized solution procedure and promptly rectified.

Within the scope of the group-wide quality improvement program, we further optimized the control loops in 2016 to ensure a better and faster information flow. This measure has improved the quality of our components and systems on a sustainable basis. In 2017, we aim to further increase the quality awareness of employees as well as optimize the effectiveness of solutions to problems, the traceability of defect causes, and the quality of suppliers, among other things. In addition, we will introduce preventive measures to improve quality. A control loop, which is directly linked to the MAHLE Management Board, monitors the progress. All activities are aimed at delivering "best-in-class quality" to our customers.

CUSTOMER SATISFACTION

To further improve customer satisfaction, we have introduced a group-wide database in which all customer norms and standards are recorded so that the various customer requirements can be implemented more safely and efficiently. Furthermore, we have expanded our global database for handling customer complaints. As a result, we now have an early warning system that allows us to get even closer to the customer and thus respond more quickly to defects.

In 2016, the number of customer complaints fell group-wide by around ten percent compared with the previous year. We also reduced the number of faulty delivered products in all business units.

ENVIRONMENT AND SAFETY

Comprehensive occupational health, safety, and environmental protection is a basic prerequisite for safe and environmentally friendly development and production processes at MAHLE. A consistent review of the group's internal specifications in all business units is therefore an integral part of the quality assurance process. We have invested in the ongoing development of our production systems in order to keep the emissions of all production locations as low as possible, and we have prescribed group-wide, uniform guidelines. We can thus tap unused energy efficiency potential, lower energy costs, and reduce greenhouse gas emissions such as CO_2. Since 2015, both the respective targets and their implementation have been jointly agreed with representatives from all regions. Energy management is thus making an important contribution to environmental protection. Compliance with MAHLE's defined global uniform safety standards is also reviewed at all locations. As a result, we ensure a safe environment for our employees, smooth production processes, and compliance with legal standards.

OPPORTUNITY AND RISK REPORT

- Forward-looking, target-oriented management system to assess opportunities and risks and thus to secure the long-term success of the company
- Monitoring external influencing factors with impact on the automotive industry for timely identification of trends, specifications, and requirements

We use a management system to evaluate the opportunities and risks associated with our business operations. We draw appropriate conclusions from these findings and purposefully adapt our actions. A globally active internal audit regularly verifies the compliance and efficiency of the processes and control systems by means of an audit plan, which changes on an annual basis. Due to the strong growth of the group, we have continuously expanded our risk management system since 2015. It is characterized by the following main aspects.

MARKET AND TECHNOLOGICAL TRENDS

We identify long-term market and technological trends using a systematic scenario approach. As a framework, it comprises a baseline scenario including market developments in the business segments, regions, products, and markets until 2030. On this basis, and using "extreme scenarios 2030," we implement stress tests for our company on various aspects—including markets, regions, drive types, quantities, and technologies. Taking market and technological trends into account in this systematic way ensures that we identify opportunities and risks at an early stage. The findings from these analyses are used in decisions about future business segments and new production processes; the measures derived are included in the strategic or budget planning. We monitor the implementation of the agreed steps in the management reporting. Opportunities and risks arise from the increasing environmental awareness of markets and new standards to reduce emissions, for example. We therefore include all relevant topics in our international research and development activities at an early stage and rely on a wide range of technologies to increase the efficiency of the combustion engine, the use of alternative drive configurations, as well as a holistic, intelligent thermal management system. Thereby, we offer our customers competitive and innovative products. With our continuously expanding portfolio of electric drives and auxiliary components, we are benefiting from the growing hybridized motor vehicle market. We specifically strengthened these activities through multiple acquisitions, which have meanwhile been integrated into the group. Our mechatronics activities have been combined into a newly created division since the start of 2016—and so has our expertise in this growth market. With a successful major acquisition in 2015, we have decisively expanded our thermal management business and our product portfolio to include air conditioning compressors. We thus have the necessary resources to develop electric air conditioning compressors for the growing plug-in hybrid and electric vehicle market.

Economic fluctuations or changes to the political framework in individual regions or countries can have a significant impact on market developments and subsequently on the business development of the group. Our broad orientation and global presence are important stabilizing factors here. We are therefore suitably placed to spread our market and customer risks in the best possible way. Our highly diversified customer and product portfolio also has a corresponding impact. Possible declines in demand in individual markets or from individual customers can at least be partially offset by local growth potential. In this context, we see a global market slump similar to the economic crisis in 2009, which had a huge adverse effect on profit, as one of the greatest risks for the group. Appropriate early warning systems and action plans limit the repercussions.

We are monitoring the discussions about diesel emissions as a significant uncertainty factor for the whole automotive industry within the scope of our strategic activities and acquisition decisions. We are therefore in a position to mitigate the possible economic effects of possible legislative changes as well as changes in technology, such as the gradual phasing out of the passenger car diesel engine, at an early stage by taking appropriate action.

PROCUREMENT AND PRODUCTION

Our risk management system is also focused on minimizing the negative impacts stemming from the procurement markets. Regular supplier assessments guard against unexpected supply bottlenecks and/or price increases in purchasing. We intensified these

activities in 2016 and are making sure that the independence of our suppliers is being maintained. Appropriate safety stocks and OTC hedging transactions also reduce the procurement risks.

Our production plants all over the world continuously exchange best practices for the ongoing optimization of production processes. The extensive measures to guarantee safety at work, optimized production processes, and high quality standards ensure that operational risks, such as unforeseeable circumstances, unexpected technical faults, accidents, and human error, cause as little hindrance as possible to production operations. Thus far, the increasing amount of extreme weather conditions such as high water, floods, and droughts have only impacted our production locations in isolated cases. MAHLE addresses the resulting risks within the framework of an established environmental management system.

The MAHLE Group is audited and certified in accordance with all major external standards and specifications, and is thus subjected to important external checks aiming at limiting risks. Disruptions of operations resulting from damages, liability risks, and warranty claims are covered by means of insurance policies to an economically prudent degree. We investigate quality and warranty claims in an interdivisional working group in which Sales, Development, Quality, Production, and Purchasing are represented. We identify the causes and determine countermeasures so that similar risks are avoided in the future. Any known profit-related burdens, where legally required, are included as accruals in the consolidated financial statements, or taken into account within the framework of corporate planning.

FINANCE MANAGEMENT

Our systematic and group-wide finance management system ensures the optimized use of financing opportunities from the banking and capital market. The liquidity risk is covered by diversified financing facilities with staggered maturity profiles that considerably exceed the group's foreseeable financial requirements. When designing the financing mix, we take security, flexibility, and cost factors into account. Our aim is to secure the financial independence of the group, limit the financing risks, and ensure that business opportunities can be exploited at all times.

We detect currency risks by means of a group-wide planning and reporting system. These are largely hedged with a horizon of up to 24 months. The hedging is executed on the basis of standardized group-wide hedging principles that include no market forecast or own opinion. As a rule, hedging transactions relate to OTC FX forwards or swaps in the form of portfolio hedges. The use of derivative financial instruments is necessarily linked to the existence of an operational underlying transaction, whereby expected and not yet invoiced currency risks are covered with continuously declining hedging grades. The resulting hedging relationships generate valuation units in accordance with the critical term match method. The interest rate risk is subjected to value-at-risk analyses. Counterparty risks with financial institutions arise from OTC hedging activities and other financial transactions, which are identified and evaluated across the group in a uniform reporting system. If predefined thresholds are exceeded, the counterparty risk is influenced by the targeted spread of risks.

HUMAN RESOURCES, IT, AND ACCOUNTING

First-class employees are a key factor for our sustainable success. That is why it is important for us to attract them, encourage them on a continuous basis, help them gain further qualifications, and retain them in our company over the long term. We have developed a comprehensive personnel marketing concept in order to establish early direct contact with potential candidates and recruit highly qualified employees. We thereby reduce the risk of not filling vacant positions or only with delay. In order to guarantee the group's long-term success and take advantage of the opportunities arising from market and technological changes, our personnel requirement planning is geared toward developments in the relevant markets as well as strategically significant technologies and business segments. Performance-related remuneration systems, modern pension schemes, and advanced training activities counter the risk of losing employees in strategically important positions.

In the IT division, security technologies protect against unauthorized access or misuse of data by internal and external parties. Server and storage systems are set up in such a way that they can be restored at short notice in the event of an emergency and in crisis situations. Defined security standards not only encompass the technical specifications of the hardware and software, but also the functional security structures and organizational provisions. Detailed backup and recovery procedures reduce the risk of severe disruptions, for example, by securing access procedures as well as mirroring and archiving data on a daily basis.

STATEMENT ON CORPORATE MANAGEMENT

With regard to the accounting process, the internal control and risk management system is aimed at ensuring compliance with and effectiveness of accounting and financial reporting. Besides guidelines and principles, the system also includes measures to prevent and uncover reporting errors. The consolidated financial statements are compiled centrally with reporting data transferred from subsidiaries. We ensure compliance with the MAHLE guidelines by means of systemic controls, specialist advice, and manual checks, as well as through the validation of data plausibility by the group accounting department.

REGULATIONS AND LEGISLATION

The introduction and implementation of directives alongside organizational and work instructions ensures that statutory requirements are observed. By integrating internal and external experts into the processes from an early stage, we minimize risks and exploit opportunities that could arise from fiscal, occupational, competition, patent, antitrust, and environmental regulations and legislation, among others. Key elements of our compliance structure include the new MAHLE Business Code, a global compliance organization, a training concept for risk areas relevant to compliance, and preventive measures.

The investigation proceedings for suspected restrictive practices in automotive thermal products that were brought against the Behr Group by the European Commission in May 2012 were concluded in March 2017. A sufficient accounting provision for the risk of the proceedings had already been established in previous years. In addition, in the year under review, an accounting provision in the form of an accrual was established for the investigation proceedings brought against MAHLE Metal Leve in Brazil by local antitrust authorities for suspected restrictive practices in the spare part business.

OVERALL ASSESSMENT

Overall, no risks that could endanger the continued existence of the group are currently observable.

WOMEN IN MANAGERIAL POSITIONS

The Supervisory Board of MAHLE GmbH has set itself the goal of increasing its proportion of women to ten percent. The applicable deadline for this is June 30, 2017. With regard to the Management Board, the Supervisory Board has decided to maintain the status quo—i.e., no female managing director—until June 30, 2017. For the German MAHLE companies, the Management Board of MAHLE GmbH has set the quantitative target for the proportion of women to at least 2.25 percent in the first two management levels below the Management Board. The applicable deadline for achieving this target figure is also June 30, 2017.

By setting this target, both the Supervisory Board and the Management Board would like to do as much justice as possible to the German legislature's intention to increase the number of women in managerial positions; however, they also need to take into account the current proportion of women at MAHLE as well as realistically achievable changes by June 30, 2017. Independently of the legal requirements, MAHLE is pursuing the goal of employing more women in upper and middle management worldwide by means of targeted succession planning, the further development of female junior executives, as well as measures to promote a healthy work-life balance, among others. In Germany, the proportion of women across all management levels at MAHLE lay at almost ten percent as at the end of 2016. We will continue to increase this proportion.

OUTLOOK

- Expectation of a slight organic increase in sales and above-average improvement in profit under the assumption of a moderate development of vehicle markets
- Dedicated continuation of our dual strategy

OVERALL ECONOMIC DEVELOPMENT

Despite a number of latent risks, the overall economic forecasts for the 2017 business year envisage a somewhat better development than that of the period under report. In its January 2017 report, the International Monetary Fund (IMF) anticipates a growth of 3.4 percent—which is 0.3 percentage points more than in the previous year. The announced protectionist measures of the new U.S. government are considered a factor of great uncertainty for the global economic development. If the promised tax cuts and investment programs are implemented, this should lead to growth momentum in the USA.

In Europe, the consequences of the Brexit decision and the smoldering financial crisis in southern Europe could hamper further development. The upcoming election campaigns in major countries of the euro zone and, in light of this, the increasing demands for more separation also represent a factor of uncertainty. The national economies are likely to benefit from continued moderate raw material prices and, additionally, the euro zone from the European Central Bank's (ECB) continued expansionary monetary policy.

In China, a further growth of six percent—slightly below the level of 2016—is expected, although overheated local real estate and uncertain financial markets could dampen this development. Weak impulses and only a slight increase in economic performance are predicted for the Japanese market once again. The prospects are more favorable in India, where growing demand and investment confidence should ensure continued growth.

Provided crude oil prices continue to recover following OPEC's agreement to limit output, this should have a favorable impact on raw material exporting countries—including Russia and Brazil, albeit at a low level. In Latin America, there are signs that the severe recession has finally come to an end. It is currently not possible to predict when the region will return to its former strength.

DEVELOPMENT OF THE VEHICLE MARKETS

MAHLE assumes an inconsistent development of the different regional vehicle markets in 2017. Overall, both the quantity of manufactured passenger cars and light commercial vehicles as well as the number of medium-sized and heavy-duty commercial vehicles produced worldwide will likely exceed the level of 2016.

Further growth in the production of both subsegments is expected for Europe, although the trend may be hampered by political and economic uncertainty, for example in the United Kingdom or Italy.

In North America, we expect passenger car and commercial vehicle production to decrease slightly below the previous year's level. As far as heavy-duty commercial vehicles are concerned, we foresee a further decline, while in all likelihood the slowdown will not be as strong as in 2016. South America is showing the first tentative signs that the economic downturn of the past years—which affected Brazil in particular—is coming to an end. This may lead to a stabilization in the production of all types of vehicles.

In the Asia/Pacific region, the further development of the market for passenger cars and light commercial vehicles essentially depends on the consequences of the anticipatory effects in China. In 2016, the government used tax incentives to encourage the purchase of vehicles with a displacement of up to 1.6 liters, which led to markedly increased production. At the end of the year, it announced this initiative would be prolonged albeit on a reduced scale. We therefore expect that production will remain at around the same high level as in 2016. We anticipate that the production figures for heavy-duty commercial vehicles in Asia/Pacific will slightly exceed those of the previous year, whereas production in China should remain at the level of the previous year, following the significant growth in 2016.

DEVELOPMENT OF THE MARKETS

2017	Overall economy	Passenger cars and light commercial vehicles	Medium-sized and heavy-duty commercial vehicles
	Expectation	Expectation	Expectation
Europe	↗	↗	↗
North America	↗	→	↘
South America	→	→	→
Asia/Pacific	↑	→	↗

DEVELOPMENT OF THE MAHLE GROUP

The MAHLE Group is expecting a slight organic increase in sales (adjusted for changes in the consolidation group as well as exchange rate effects), in line with the development of the automotive markets. With regard to the result from business activities, we are anticipating above-average growth, following the many special effects experienced in 2016.

We continue to consistently pursue our dual strategy, and will work on optimized products relating to the combustion engine as well as new solutions for alternative powertrains. Our goal is to further reinforce our market position in the existing core businesses while developing and expanding new areas. In 2017, for example, we will further strengthen our thermoelectric activities—depending on the application, these can convert heat into electricity or electricity into heat or cold. With these activities, we are expanding our portfolio and offering our customers products and solutions to increase efficiency, for both combustion engines and electric vehicles, as well as in thermal management. This means that we will also maintain a high level of expenditure on research and development in 2017.

We also anticipate growth in our strategic business segment of Mechatronics in 2017—both through its own strength and through acquisitions. With the acquisition of the electronics specialist Nagares, which has already been agreed, we are entering the field of vehicle electronics and sustainably strengthening our competence in electrification and electric drives. Furthermore, some of our developments in this area will soon be ready for series production, enabling us to open up new market segments. Electric auxiliary drives can relieve combustion engines and thus lower consumption and emissions.

We analyze and review the strategic direction and economic performance of the group on an ongoing basis. One of the framework conditions is the agreement concluded in April 2016 to safeguard employment at the German locations, which is valid until the end of 2019. In the course of our portfolio review, we have decided to sell our forging operations at the Plettenberg and Roßwein plants in Germany. A corresponding agreement was concluded in the first quarter of 2017. We are also looking for a buyer for the joint venture Bosch Mahle Turbo Systems (BMTS), because further investments are needed in order to achieve the necessary economies of scale.

We are taking a holistic systems approach to confront the trend in vehicle construction toward increasingly networking components and solutions. We will continue to intensify our interdivisional cooperation, as synergies and thus new innovative solutions emerge from our knowledge in the various areas. In addition, we are also rigorously extending our external networks as this will enable us to tap into new trends that we want to exploit as quickly as possible. For several years now, we have therefore been involved in venture capital funds that address issues such as connected mobility, energy efficiency, and new materials in vehicle construction. We also promote entrepreneurial spirit in our own ranks, for example, through our participation in a start-up platform. Here, interdepartmental teams made up of MAHLE employees and the startup scene work on future projects independently of our daily operations.

Our strategic goal is to evenly distribute sales across the core markets of Europe, North and South America, and Asia/Pacific to ensure we are well protected against individual economic influences. At the same time, this global presence is an important prerequisite for succeeding in a competitive market. In 2016, we therefore expanded various locations in China and Mexico, among others. We will further intensify our activities especially in Asia over the next few years.

A healthy balance sheet structure and moderate net gearing have high priority at MAHLE, because our goal is to ensure the ongoing financial independence of the company. For this reason, a solid equity base and liquidity that is secured over the long term by means of diversified financing sources and instruments are fundamental pillars of our financial policy.

This report contains forward-looking statements that rely on current estimates of future developments and are therefore subject to risks and uncertainties that are beyond our control or precise assessment. As a result, the actual results may differ from the statements made here.

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CONSOLIDATED BALANCE SHEET

CONSOLIDATED BALANCE SHEET AS AT DECEMBER 31, 2016

in EUR '000	Dec. 31, 2016	Dec. 31, 2015
ASSETS		
A. Fixed assets		
I. Intangible assets		
1. Purchased concessions, industrial and similar rights and assets, and licences in such rights and assets	332,085	416,261
2. Goodwill	297,849	354,274
3. Prepayments	774	905
	630,708	**771,440**
II. Property, plant, and equipment		
1. Land, leasehold rights, and buildings including buildings on third-party land	958,430	968,325
2. Technical equipment and machinery	1,496,215	1,402,767
3. Other equipment, fixtures, and furniture	127,359	127,990
4. Prepayments and assets under construction	447,031	389,289
	3,029,035	**2,888,371**
III. Financial assets		
1. Shares in affiliated companies	2,038	10,600
2. Shares in associated companies	42,584	99,619
3. Equity investments	23,459	21,311
4. Loans to companies in which participations are held	1,270	1,486
5. Long-term securities	6,017	5,396
6. Other loans	14,599	13,929
	89,967	**152,341**
	3,749,710	**3,812,152**
B. Current assets		
I. Inventories		
1. Raw materials, consumables, and supplies	513,433	472,999
2. Work in process	204,766	201,208
3. Finished goods and merchandise	614,590	625,001
4. Prepayments	20,123	19,721
5. Prepayments received	–84,073	–76,603
	1,268,839	**1,242,326**
II. Receivables and other assets		
1. Trade receivables	1,956,082	1,806,637
2. Receivables from affiliated companies	762	2,151
3. Receivables from companies in which investments are held	8,706	24,167
4. Other assets	384,795	406,621
	2,350,345	**2,239,576**
III. Securities	403	403
IV. Cash in hand, bank balances, and cheques	372,073	309,625
	3,991,660	**3,791,930**
C. Prepaid expenses	**20,911**	**23,249**
D. Deferred tax assets	**196,183**	**165,935**
E. Excess of plan assets over post-employment benefit liability	**73,613**	**55,525**
	8,032,077	**7,848,791**

in EUR '000		Dec. 31, 2016	Dec. 31, 2015
EQUITY AND LIABILITIES			
A.	**Equity**		
I.	**Subscribed capital**	150,000	150,000
II.	**Capital reserves**	166,430	166,430
III.	**Revenue reserves**	1,872,395	1,811,594
IV.	**Equity impact from currency translation**	–35,496	–60,747
V.	**Consolidated unappropriated retained earnings**	6,109	6,015
VI.	**Non-controlling interests**	562,507	593,998
		2,721,945	**2,667,290**
B.	**Badwill**	**1,478**	**1,877**
C.	**Accruals**		
	1. Accruals for pensions and similar obligations	575,336	543,962
	2. Accruals for taxes	66,736	60,757
	3. Other accruals	1,395,791	1,352,120
		2,037,863	**1,956,839**
D.	**Liabilities**		
	1. Bonds	829,000	829,000
	2. Liabilities to banks	769,332	887,312
	3. Payments received on account of orders	5,942	3,832
	4. Trade payables	1,256,831	1,096,510
	5. Liabilities on bills accepted and drawn	39,125	37,831
	6. Liabilities to affiliated companies	4,712	4,287
	7. Liabilities to companies in which investments are held	17,943	7,101
	8. Other liabilities	267,595	271,628
	thereof from taxes: 95,499 (prev. yr.: 90,724)		
	wthereof relating to social security and similar obligations: 32,483 (prev. yr.: 32,225)		
		3,190,480	**3,137,501**
E.	**Deferred Income**	**80,311**	**85,284**
		8,032,077	**7,848,791**

CONSOLIDATED INCOME STATEMENT

CONSOLIDATED INCOME STATEMENT FROM JANUARY 1 TO DECEMBER 31, 2016

in '000		2016	2015
1.	**Sales**	**12,321,783**	**11,486,133**
2.	Cost of sales	–9,993,960	–9,334,928
3.	**Gross profit on sales**	**2,327,823**	**2,151,205**
4.	Selling expenses	–586,809	–553,321
5.	General administrative expenses	–502,326	–466,801
6.	Research and development expenses	–753,315	–656,953
7.	Other operating income	482,882	414,713
	thereof from currency translation: 184,655 (prev. yr.: 210,426)		
8.	Other operating expenses	–495,451	–377,115
	thereof from currency translation: –235,885 (prev. yr.: –217,963)		
		–1,855,019	–1,639,477
		472,804	**511,728**
9.	Investment income	1,341	240
	thereof from affiliated companies: 914 (prev. yr.: 0)		
10.	Income from other securities and long-term loans	155	49
11.	Result from associated companies	–52,808	–70,663
12.	Other interest and similar income	54,627	18,763
	thereof from affiliated companies: 24 (prev. yr.: 110)		
	thereof income from discounting: 1,074 (prev. yr.: 999)		
13.	Impairment of financial assets and of securities	–92,899	–9,091
14.	Expenses from the transfer of losses	–3,988	–1,905
15.	Interest and similar expenses	–151,162	–140,246
	thereof to affiliated companies: –32 (prev. yr.: –204)		
	thereof expenses from discounting: –58,248 (prev. yr.: –46,931)		
		–244,734	–202,853
	Result from business activities	**228,070**	**308,875**
16.	Taxes on income	–132,189	–155,842
	thereof income from deferred income taxes: 22,900 (prev. yr.: 8,262)		
17.	**Result after taxes**	**95,881**	**153,033**
18.	Other taxes	–32,875	–30,627
19.	**Consolidated net income**	**63,006**	**122,406**
20.	Consolidated unappropriated retained earnings prior year	6,015	8,570
21.	Dividend distribution	–6,000	–8,500
22.	Transfer to revenue reserves	–56,599	–66,394
23.	Profit applicable to non-controlling interests	–96,694	–118,176
24.	Loss applicable to non-controlling interests	96,381	68,109
25.	**Consolidated unappropriated retained earnings**	**6,109**	**6,015**

CONSOLIDATED CASH FLOW STATEMENT

CONSOLIDATED CASH FLOW STATEMENT FROM JANUARY 1 TO DECEMBER 31, 2016

in EUR '000		2016
1.	**Cash flows from operating activities**	
	Profit for the period (consolidated net income including profit and loss applicable to non-controlling interests)	63,006
+/–	Depreciation, amortisation and write-downs of fixed assets/reversals of write-downs of fixed assets	697,592
+/–	Increase/decrease in provisions	–10,755
+/–	Other non-cash expenses/income	–5,450
–/+	Increase/decrease in inventories, trade receivables and other assets not related to investing or financing activities	–190,414
+/–	Increase/decrease in trade payables and other liabilities not related to investing or financing activities	160,085
–/+	Gain/loss on disposal of fixed assets	–13,919
+/–	Interest expense/interest income	97,342
–	Other investment income	51,467
+/–	Interest payments/receipts related to interest other than the provision of capital	9,773
+/–	Income tax expense/income	155,089
–/+	Income taxes paid	–158,130
		855,686
2.	**Cash flows from investing activities**	
+	Proceeds from disposal of intangible fixed assets	–161
–	Payments to acquire intangible fixed assets	–24,392
+	Proceeds from disposal of tangible fixed assets	12,765
–	Payments to acquire tangible fixed assets	–562,927
+	Proceeds from disposal of long-term financial assets	9,214
–	Payments to acquire long-term financial assets	–89,452
+	Proceeds from disposals of entities included in the basis of consolidation	28,569
–	Payments to acquire entities included in the basis of consolidation	–228
+	Cash receipts from the investment of cash funds for short-term cash management	230,770
–	Cash payments for the investment of cash funds for short-term cash management	–191,917
+	Interest received	10,700
+	Dividends received	1,897
		–575,162

	in EUR '000	**2016**
3.	**Cash flows from financing activities**	
+	Proceeds from capital contributions by shareholders of the parent entity	0
+	Proceeds from capital contributions by minority sharesholders	1,523
–	Cash payments to shareholders of the parent entity from the redemption of shares	0
–	Cash payments to minority shareholders from the redemption of shares	0
+	Proceeds from the issuance of bonds and from borrowings	460,527
–	Cash repayments of bonds and borrowings	–609,962
+	Proceeds from grants/subsidies received	1,183
–	Interest payment due to leasing agreements	–2
–	Interest paid	–67,452
–	Dividends paid to shareholders of the parent entity	–6,000
–	Dividends paid to minority shareholders	–45,845
+/–	Profit/loss transfer (to/from parent company)	0
		–266,028
4.	**Cash funds at end of period**	
	Net change in cash funds (subtotals 1—3)	14,496
+/–	Effect on cash funds of exchange rate movements and remeasurements	18,939
+/–	Effect on cash funds of changes in the basis of consolidation	–3,526
+	Cash funds at beginning of period	131,285
		161,194
	Cash-in-hand, bank balances and checks	309,625
–	Bank balances with an initial term of more than 3 months	–10,077
+	Liabilities to banks with an initial term of less than 3 months	–168,263
	Cash funds at beginning of period	**131,285**
	thereof from quota-consolidated entities	21,664
	Cash-in-hand, bank balances and checks	372,073
–	Bank balances with an initial term of more than 3 months	–9,629
+	Liabilities to banks with an initial term of less than 3 months	–201,250
	Cash funds at end of period	**161,194**
	thereof from quota-consolidated entities	38,692

The short term liabilities which were netted against cash balances contained EUR 115,226k (previous year EUR 62,036k) which were related to short term liabilities based on a committed credit line with a remaining tenor of more than one year.

The option to dispense with the prior-year figures was applied in accordance with the regulations of GAS 21.

CONSOLIDATED STATEMENT OF CHANGES IN EQUITY

CONSOLIDATED STATEMENT OF CHANGES IN EQUITY[1] FROM JANUARY 1 TO DECEMBER 31, 2016

	Parent company				
in EUR '000	Subscribed capital	Capital reserves	Revenue reserves	Equity impact from currency translation	
As at January 1, 2015	**150,000**	**166,430**	**1,741,723**	**–92,943**	
Capital increase	0	0	0	0	
Transfer to revenue reserves	0	0	66,394	0	
Dividend distribution	0	0	0	0	
Currency translation	0	0	0	35,988	
Other items	0	0	–222	–93	
Changes in the consolidation group	0	0	3,699	–3,699	
Consolidated net income	0	0	0	0	
As at December 31, 2015	**150,000**	**166,430**	**1,811,594**	**–60,747**	
Adjustment of first consolidation without effect on net income	0	0	–861	0	
As at December 31, 2015 (adjusted)	**150,000**	**166,430**	**1,810,733**	**–60,747**	
Capital increase	0	0	0	0	
Transfer to revenue reserves	0	0	56,599	0	
Dividend distribution	0	0	0	0	
Currency translation	0	0	0	30,751	
Other items	0	0	6,599	–7,036	
Changes in the consolidation group	0	0	–1,536	1,536	
Consolidated net income	0	0	0	0	
As at December 31, 2016	**150,000**	**166,430**	**1,872,395**	**–35,496**	

[1] *The voluntary early adoption of GAS 22 "Group Equity" was exercised.*

	Consolidated unappropriated retained earnings	Total	Non-controlling interests	Consolidated equity
	8,570	**1,973,780**	**581,014**	**2,554,794**
	0	0	2,428	2,428
	–66,394	0	0	0
	–8,500	–8,500	–24,769	–33,269
	0	35,988	–6,609	29,379
	0	–315	–7,902	–8,217
	0	0	–231	–231
	72,339	72,339	50,067	122,406
	6,015	**2,073,292**	**593,998**	**2,667,290**
	0	–861	650	–211
	6,015	**2,072,431**	**594,648**	**2,667,079**
	0	0	1,669	1,669
	–56,599	0	0	0
	–6,000	–6,000	–41,684	–47,684
	0	30,751	10,784	41,535
	0	–437	–47	–484
	0	0	–3,176	–3,176
	62,693	62,693	313	63,006
	6,109	**2,159,438**	**562,507**	**2,721,945**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

CONSOLIDATION GROUP

The consolidated financial statements include MAHLE GmbH (parent company), with registered office and district court in Stuttgart (commercial register number 638), 25 domestic and 134 foreign subsidiaries. Furthermore, 43 companies are proportionately consolidated and nine companies were valued according to the equity method. The consolidated companies are included in the list of shareholdings.

In the 2016 business year, the following company was fully consolidated for the first time. In previous years this company was not included in the consolidated financial statements on account of its immateriality.

- MAHLE Manufacturing Service Japan Corporation, Japan, as of January 1

As of October 31, 2016, the following fully consolidated companies were excluded from the scope of consolidation due to the divestment of the division Industrial Filtration:

- MAHLE Industriefiltration GmbH, Germany
- MAHLE Industrial Filtration (Benelux) B.V., Netherlands
- MAHLE Filtration Industrielle SAS, France
- MAHLE Industrial Filtration (UK) Ltd., Great Britain
- MAHLE Industrial Filtration USA, Inc., USA
- MAHLE Filter Systems s.r.o., Czech Republic
- MAHLE Industrial Filter Systems (Shanghai) Co., Ltd., China
- MAHLE Industrial Filtration Japan Corporation, Japan
- MAHLE Industrial Filtration SRL, Romania

In the business year, four companies were merged with other group companies.

One company was liquidated in the business year 2016.

Two companies previously fully consolidated are now valued according to the equity method.

In the business year, four companies, which were not fully consolidated due to their immateriality, were excluded from the scope of consolidation due to the divestment of the division Industrial Filtration.

In the business year, eleven companies were not included in the consolidated financial statements on account of their immateriality.

Eight companies were not valued according to the equity method due to their immateriality.

KEY CHANGES TO THE CONSOLIDATION GROUP

In the year under report MAHLE divested its division Industrial Filtration. Due to the disposal the assets, liabilities, and deferred income are excluded from the MAHLE Group balance sheet with the following amounts:

Fixed assets	EUR 21,966k
Current assets	EUR 61,495k
Prepaid expenses	EUR 693k
Deferred tax assets	EUR 3,634k
Accruals	EUR 26,765k
Liabilities	EUR 36,126k

Sales decreased due to the disposal by approximately EUR 23,552k. The other items in the income statement have changed accordingly.

According to Sec. 301, Para. 2, Sentence 2 of the German Commercial Code (HGB), subsequent information on the acquisition of the former Delphi Thermal companies was taken into account with no effect on the result within twelve months after the initial consolidation date. This resulted in the following changes in the consolidated balance sheet:

Fixed assets	EUR 2,516k
Current assets	EUR –7,348k
Deferred tax assets	EUR 1,040k
Equity	EUR –350k
Accruals	EUR 1,179k
Liabilities	EUR –4,621k

As the adjustment of the previous year's figures to the new consolidation group would involve a disproportionate effort, the information below is provided to make the consolidated financial statements of the current year comparable with the previous year's statements:

CONSOLIDATED INCOME STATEMENT

	2016	2016	2015
in EUR '000	MAHLE Group	MAHLE Group with 6 months first time consolidated companies	MAHLE Group
Sales	12,321,783	11,778,832	11,486,133
Cost of sales	–9,993,960	–9,508,217	–9,334,928
Selling expenses	–586,809	–573,975	–553,321
General administrative expenses	–502,326	–468,703	–466,801
Research and development expenses	–753,315	–710,399	–656,953
Other operating income and expenses	–12,569	8,141	37,598
Financial result	–244,734	–238,329	–202,853
Result from business activities	**228,070**	**287,350**	**308,875**
Taxes on income	–132,189	–140,833	–155,842
Result after taxes	**95,881**	**146,517**	**153,033**
Other taxes	–32,875	–32,217	–30,627
Consolidated net income	**63,006**	**114,300**	**122,406**

EXEMPTION PROVISIONS FOR DOMESTIC COMPANIES

The following subsidiaries are applying the exemption according to Sec. 264, Para. 3, respectively Sec. 264b of the German Commercial Code (HGB), with regard to the disclosure of their annual financial statements and/or the preparation of the management reports:

MAHLE Aftermarket GmbH, Stuttgart; MAHLE Amovis GmbH, Berlin; MAHLE Beteiligungen GmbH, Stuttgart; MAHLE Filtersysteme GmbH, Stuttgart; MAHLE Immobilien GmbH, Stuttgart; MAHLE Industrial Thermal Systems GmbH & Co. KG, Stuttgart; MAHLE Industriebeteiligungen GmbH, Stuttgart; MAHLE Industriemotoren-Komponenten GmbH, Stuttgart; MAHLE Industry GmbH, Stuttgart; MAHLE International GmbH, Stuttgart; MAHLE Kleinmotoren-Komponenten GmbH & Co. KG, Stuttgart; MAHLE Powertrain GmbH, Stuttgart; MAHLE Brandenburg GmbH, Wustermark; MAHLE Ventiltrieb GmbH, Stuttgart; MAHLE Versicherungsvermittlung GmbH, Stuttgart

METHOD OF CONSOLIDATION

Subsidiaries that were fully consolidated until December 31, 2009, were consolidated using the book value method as in prior years. Thereby, the value of the participation of the parent company at the time of first consolidation, which took place at the time the participation was acquired, is to be offset against the proportionate share of the subsidiary's equity book value. In the case of companies that were consolidated for the first time from 2010 onward, the assets, liabilities, as well as prepaid expenses and deferred income acquired were revalued as part of the purchase price allocation at the time that the company became a subsidiary. Goodwill is amortized over ten years as the markets that are relevant to the MAHLE Group are dominated by a small number of suppliers, have high barriers to market entry, and have historically shown that the average useful life of acquired goodwill is ten years. Goodwill impairments in the business year totaled EUR 400k.

The intra-group supply of goods and services as well as mutual receivables and liabilities were offset and intercompany profits were eliminated.

Deferred taxes resulting from consolidation measures with effect on income were recorded using a tax rate of 24 percent.

ACCOUNTING AND VALUATION PRINCIPLES

The existing methods were retained and were also applied by the associated companies.

Acquired intangible assets and property, plant, and equipment are valued at acquisition costs or manufacturing costs minus depreciation and amortization. Depreciation was performed on a straight-line basis using standard useful lives. If lower valuations were provided, impairments were carried out. Internally developed trademarks and similar rights and assets were not capitalized.

Financial assets were stated at the lower of acquisition cost or fair value, if the impairment is expected to be permanent.

Inventories are capitalized at acquisition costs or manufacturing costs. Unfinished and finished goods are valued taking into account the appropriate share of material and production overheads and depreciation of fixed assets. If the market prices or fair values were lower than the book values, or marketability was limited, devaluations were performed to the extent necessary.

Receivables and other assets are recorded at nominal value. Appropriate write-downs are recorded to account for receivables with recognizable risks of nonpayment; a general valuation allowance is set up to cover the general credit risk.

Prepaid expenses have been recorded for payments made prior to the balance sheet date where they represent expenditures for a specific time after this date.

Accruals for taxes and other accruals adequately cover uncertain liabilities and anticipated losses from pending transactions. Valuation is based on the settlement amount taking into account necessary cost increases. Accruals with a remaining term of more than one year were discounted by using the average market interest rate of the past seven fiscal years provided by the German Central Bank.

Accruals for pensions and similar obligations are calculated group-wide in accordance with actuarial principles (using the projected unit credit method) and discounted to present value. In 2015, the MAHLE Group has opted for the voluntary early adoption of the new regulation of discount rate computation for pension accruals according to Sec. 253 of the German Commercial Code (HGB). In the business year 2016, the calculation is based on the following discount rates: domestic 3.75–4.01 percent; foreign 1.10–5.20 percent. The option to assume a standardized remaining term of 15 years was not utilized. Expected salary increases of 0.00–5.68 percent and anticipated labor turnover rates of 2.03–5.75 percent were taken into consideration. The mortality tables recognized in each country were taken as basis for the calculation.

Assets that serve exclusively to settle pension-related obligations and cannot be utilized to settle claims of any other creditors (plan assets in the form of long-term securities) were offset against the accruals at their fair value. Excess amounts are recorded within the position “Excess of plan assets over post-employment benefit liability”.

Liabilities are stated at their settlement amount.

Receivables, bank balances, and liabilities in foreign currency with a remaining term of less than one year were valued using the mid spot rate applicable at the balance sheet date. If the remaining term was more than one year, the valuation was based on the exchange rate applicable as of the acquisition date or the lower or higher exchange rate at the balance sheet date.

Changes in exchange rates, commodity price variations and interest rates represent a risk to operational business that is very difficult to estimate. To minimize this risk, appropriate hedging transactions such as derivatives are therefore used. These transactions are only concluded with banks that have a prime credit rating. Their use is based on standard guidelines, subject to strict internal controls, and restricted to the hedging of operational business as well as that of related investments and financing activities.

If effective hedging relationships existed between the underlying operating transactions (basically future deliveries of goods and services) or highly probable transactions and the hedging transaction, they were included in hedge accounting evaluation units under the “frozen value method” (“Einfrierungsmethode”).

Deferred income has been recorded for payments received prior to the balance sheet date where they represent income for a specific time after this date.

Deferred tax assets and liabilities are set up to account for all temporary and quasi-permanent differences between the tax and balance sheet values. Furthermore, deferred taxes for tax loss and interest carry forwards and tax credits were capitalized, provided the tax benefit was reasonably recoverable within the next five years. Deferred taxes were determined using tax rates that are expected to apply at the time of recovery and are based on the regulations adopted at the balance sheet date. Deferred tax assets and liabilities are presented as a net value. The tax rates fall within a range of 10.00–36.88 percent.

CURRENCY CONVERSION

The financial statements of foreign companies were—if not prepared in Euro—converted as follows:

Equity:
Exchange rate at date of acquisition (or first consolidation)

Other balance sheet items:
Mid spot rate at the balance sheet date

Income statement items:
Average exchange rate for the year

Exchange rate differences in connection with the use of the closing rate method were shown as "currency translation Jan 01" within the consolidated statement of fixed assets. Differences arising from the conversion of movements during the current year were shown in a separate column.

Any difference arising from the differentiated translation of the balance sheet items into Euro was included under "Equity impact from currency translation" in the consolidated shareholders' equity.

The "thereof" information on currency conversion in the income statement includes both unrealized and realized exchange rate differences.

NOTES TO THE CONSOLIDATED BALANCE SHEET

RECEIVABLES AND OTHER ASSETS

in EUR '000	Carrying amount Dec. 31, 2016	Thereof with a remaining term of more than 1 year
Accounts receivable		
Trade receivables	*1,956,082*	*184*
Receivables from affiliated companies	*762*	*0*
Receivables from companies in which investments are held	*8,706*	*0*
Other assets	384,795	10,466
Total	**2,350,345**	**10,650**

In the previous year, trade receivables (EUR 192k) as well as other assets (EUR 5,627k) had a remaining term of more than one year.

Trade receivables are included in the amount of EUR 40k (previous year: EUR 366k) from affiliated companies and EUR 7,108k (previous year: EUR 10,711k) from companies in which investments are held. Of the receivables from companies in which investments are held results EUR 218k from cash pooling.

Other assets contain receivables from shareholders amounting to EUR 135k (previous year: EUR 64k). Prepaid expenses include, among others, the differences between net loan proceeds and liabilities to banks (debt discounts) amounting to EUR 1,735k (previous year: EUR 2,079k).

EQUITY

The consolidated unappropriated retained earnings equal that of the parent company and contain the amount carried forward from the previous year of EUR 15k.

ACCRUALS FOR PENSIONS AND SIMILAR OBLIGATIONS AS WELL AS OTHER ACCRUALS

Notes for offsetting pursuant to Sec. 246, Para. 2, Sentence 2 of the German Commercial Code (HGB):

in EUR '000	Carrying amount Dec. 31, 2016
Settlement amount of offset liabilities	503,688
Acquistion costs of assets	269,263
Fair value of assets	372,221
Offset income	49,236
Offset expenses	65,833

The difference for discounting with the seven-year average rate according Sec. 253, Para. 6, Sentence 1 of the German Commercial Code (HGB) amounts to EUR 73,597k.

Other accruals primarily relate to anticipated losses from pending transactions, outstanding credit notes and rebates, as well as outstanding purchase invoices. In addition, this item includes obligations arising from employment contracts, risks from antitrust proceedings as well as guarantee and warranty risks.

LIABILITIES

in EUR '000	Carrying amount Dec. 31, 2016	Thereof with a remaining term of up to 1 year	Thereof with a remaining term of more than 1 year	Thereof with a remaining term of more than 5 years
Bonds	829,000	0	829,000	500,000
Liabilities to banks	769,332	285,626	483,706	176,335
Payments received on account of order	5,942	5,934	8	0
Trade payables	1,256,831	1,256,191	640	0
Liabilities on bills accepted and drawn	39,125	39,125	0	0
Liabilities				
to affiliated companies	*4,712*	*4,712*	*0*	*0*
to companies in which investments are held	*17,943*	*17,943*	*0*	*0*
Other liabilities	267,595	232,449	35,146	18,509
Total	**3,190,480**	**1,841,980**	**1,348,500**	**694,844**

In the previous year, liabilities to banks (EUR 353,089k), payments received on account of order (EUR 3,825k), trade payables (EUR 1,095,405k), liabilities on bills accepted and drawn (EUR 37,831k), liabilities to affiliated companies (EUR 4,287k), liabilities to companies in which investments are held (EUR 7,101k) and other liabilities (EUR 230,215k) had a remaining term of less than one year.

The liabilities to affiliated companies contain trade payables EUR 126k (previous year: EUR 1,688k). The liabilities to companies in which investments are held contain trade payables EUR 3,291k (previous year: EUR 1,726k) as well as EUR 3,038k payables related to cash-pooling.

Other liabilities do not contain any payables to shareholders (previous year: EUR 0k).

Of the liabilities to banks, EUR 0k is secured by property liens and EUR 908k by similar rights.

DEFERRED TAXES

Deferred tax assets arise predominantly from differing accounting treatment in intangible assets, property, plant, and equipment, and accruals. The temporary differences in accruals essentially include differing carrying amounts between the tax balance sheet and the consolidated balance sheet for accruals for pensions and similar obligations, as well as accruals that are not tax-deductible, such as accruals for anticipated losses.

The deferred tax liabilities result predominantly from temporary differences relating to tangible fixed assets owing to differing carrying amounts and depreciation methods in the tax and consolidated balance sheets. In addition, the identified fair values disclosed as part of the purchase price allocations of the acquisitions lead to deferred tax liabilities in particular in intangible and tangible fixed assets.

Deferred tax assets of EUR 62,128k were set up on tax loss carry forwards of EUR 323,656k that are recoverable within five years. Deferred tax assets were written off by EUR 137,386k as of December 31, 2016, as their realization is not deemed sufficiently likely.

OFF-BALANCE-SHEET TRANSACTIONS

As of the balance sheet date, off-balance-sheet transactions exist in connection with significant rental and leasing agreements for buildings and land (EUR 148,331k). Moreover, off-balance-sheet transactions are in place in connection with factoring (EUR 125,176k). These off-balance-sheet transactions led to a diversification of financing sources as of the balance sheet date. Through these transactions cash outflows are generally postponed into the future. No material risks are anticipated from these transactions.

CONTINGENT LIABILITIES

in EUR '000	Carrying amount Dec. 31, 2016
Contingents from notes	19,903
Guarantees	371
thereof to associated companies	*171*

To our knowledge, the underlying obligations can be fulfilled in all cases by the companies concerned. We do not expect the contingent liabilities to be claimed. The contingent liabilities include EUR 13,053k from quota-consolidated companies.

The contingent liabilities do not include any obligations concerning retirement benefits.

OTHER FINANCIAL OBLIGATIONS

in EUR '000	Carrying amount Dec. 31, 2016
Purchase commitments from investments	324,505
Financial obligations resulting from rent and lease agreements	55,728
thereof to affiliated companies	*803*
Others	72,574
thereof to affiliated companies	*191*

The other financial obligations include EUR 12,247k from quota-consolidated companies.

The other financial obligations do not include any obligations concerning retirement benefits.

CONTRIBUTION OF QUOTA-CONSOLIDATED COMPANIES

The balance sheet includes short-term assets of EUR 393,150k and long-term assets of EUR 169,042k belonging to quota-consolidated companies. Current liabilities of EUR 302,483k as well as long-term debt of EUR 42,613k are recognized by quota-consolidated companies.

NOTES TO THE CONSOLIDATED INCOME STATEMENT

The income statement of the MAHLE Group has been prepared according to the cost of sales method. Sales are thus set against the expenses incurred in their realization, which are allocated in principle to the functions production, sales, general administration, and research and development.

The cost of sales comprises the material and production costs incurred in the realization of sales, the landed costs of the trade business, and the costs of the allocation to accruals for warranties. Furthermore, this item also contains depreciation and amortization on the hidden reserves disclosed as part of the purchase price allocations of the acquisitions. These include technologies, technical equipment, and machinery as well as land and buildings.

The selling expenses include, in particular, personnel and non-personnel expenses, depreciation allocated to the sales function, as well as logistics, market research, sales promotion, shipping and handling, and advertising costs. Furthermore, they also contain amortization on the hidden reserves disclosed as part of the purchase price allocations of the acquisitions. These include trademark rights and customer relationships.

The general administration expenses include personnel and non-personnel expenses as well as depreciation allocated to the administrative function.

The personnel and non-personnel expenses and depreciation allocated to the research and development function are substantial to the MAHLE Group. In order to present the economic situation of the group more clearly, they have been included as separate item in the breakdown.

Other operating income contains EUR 177,252k income relating to other periods. This income is mainly related to the reversal of accruals.

Other operating expenses contain EUR 5,353k expenses relating to other periods. This expense is mainly related to disposals of depreciable fixed assets.

SALES AFTER CHANGES DUE TO BILRUG

Due to a revised regulation of Sec. 277, Para. 1 of the German Commercial Code (HGB) the sales figures of the previous year are not comparable to the figures reported in the current business year since previous year's sales figures were not adjusted accordingly. Applying Sec. 277, Para. 1 of the German Commercial Code (HGB) in the revised version the sales figures of prior reporting period would amount to EUR 11,512,837k. In particular charges to suppliers, atypical services and sales of energy and other utilities, income from canteens and letting or leasing as well as from sales to employees are disclosed within sales instead of other operating income from the business year 2016 onwards.

SALES BY AREA OF OPERATION

in EUR '000	**2016**
Engine Systems and Components business unit	2,683,399
Filtration and Engine Peripherals business unit	2,190,469
Thermal Management business unit	4,293,275
Aftermarket business unit	898,898
Profit centers, division and services	2,255,742
Total	**12,321,783**

SALES BY GEOGRAPHICAL MARKET (TARGET AREA)

in EUR '000	**2016**
Europe	5,960,149
North America	3,349,821
South America	504,824
Asia/Pacific	2,421,330
Africa	85,659
Total	**12,321,783**

PERSONNEL EXPENSES

in EUR '000	2016
Wages and salaries	2,270,371
Social security costs and other benefits	545,524
Old age pension costs	46,755
Total	**2,862,650**

DEPRECIATION, AMORTIZATION, AND IMPAIRMENTS OF INTANGIBLE AND TANGIBLE FIXED ASSETS

in EUR '000	2016
Total	**606,540**
thereof impairments	*6,040*

SUBSEQUENT VALUATION OF THE PURCHASE PRICE ALLOCATION FOR THE ACQUISITIONS[1)]

in EUR '000	2016
Depreciation and amortization within cost of sales	78,226
Amortization within selling expenses	29,860
Release of subsidies within other operating income	15,537

[1)] relating to MAHLE Behr, MAHLE Letrika, former Delphi Thermal entities and MAHLE Electric Drives Japan

CONTRIBUTION OF QUOTA-CONSOLIDATED COMPANIES

The income statement includes income of EUR 1,291,945k and expense of EUR 1,240,247k of quota-consolidated companies.

OTHER NOTES

AVERAGE ANNUAL NUMBER OF EMPLOYEES[1)]

	2016
Direct employees	40,940
Indirect employees	34,665
Total	**75,605**

[1)] excluding apprentices

The total average annual number of employees includes a pro rata figure of 2,552 employees from quota-consolidated companies.

DERIVATIVES

Derivatives in accordance with Secs. 285, 314 of the German Commercial Code (HGB) not yet settled as of the balance sheet date can be broken down as follows:

in EUR '000	Nominal amounts Dec. 31, 2016	Fair value[1)] Dec. 31, 2016
Transactions relating to interest	19,258	–1,715
Transactions relating to currency	1,981,173	–16,434
Transactions relating to currency and interest	6,721	280
Transactions relating to commodities	16,519	848

[1)] The fair value of currency- and commodities-related transactions corresponds to the market value of the derivatives as of the balance sheet date, which is identified in accordance with the net present value method. All interest-related transactions are based on recognized financial/mathematical models.

The derivative contracts as of December 31, 2016, are placed in relation to third parties exclusively with banks. Evaluation units were established for hedging transactions with an effective relationship to the underlying transaction. Accruals of EUR 681k were set up for all other hedging transactions that have resulted in anticipated losses.

EVALUATION UNITS

The following evaluation units were created from derivatives:

in EUR '000	Type of evaluation unit	Amount of hedged transaction 2016	Balance sheet item
Currency exposure			
Recorded values	Portfolio hedge	57,623	Trade receivables
	Portfolio hedge	12,371	Bank balances
	Portfolio hedge	–1,876	Liabilities to banks
	Portfolio hedge	–34,025	Trade payables
Remaining currency exposure from eliminated transactions with affiliated companies	Portfolio hedge	431,351	
Future transactions	Portfolio hedge	67,272	
Currency and interest exposure (cross currency swap)			
Recorded values	Micro hedge	–6,721	Liabilities to banks
Remaining currency exposure from eliminated transactions with affiliated companies	Micro hedge	9,708	
Interest exposure			
Recorded values	Micro hedge	–4,939	Liabilities to banks
Remaining currency exposure from eliminated transactions with affiliated companies	Micro hedge	0	
Commodity exposure			
Future transactions	Portfolio hedge	14,997	

	Volume of hedged exposure 2016
Currency exposure in transaction currency	*in '000*
CAD	19,424
CNY	300
CZK	–78,622
EUR	64,607
GBP	6,908
HUF	–3,550,000
JPY	9,672,980
MXN	1,236,036
PHP	82,798
RON	14,574
RUB	–913,102
THB	–161,440
TRY	26,868
USD	–773,541
Currency and interest exposure in transaction currency	*in '000*
CNY	–79,680
Interest fixed CNY/variable 3-month-Euribor	
USD	1,238
Interest fixed USD/fixed THB	
USD	5,847
Interest fixed USD/variable CDI	
Interest exposure in transaction currency	*in '000*
IDR	70,000,000
Interest fixed IDR/variable 3-month-IDR Jibor	
Commodity exposure in reporting currency	*in '000*
Aluminum	8,167
Copper	3,088
Nickel	3,319
Tin	423

The changes in value in the underlying and hedging transactions are offset during the hedging horizon, since risk positions (underlying transactions recognized on the balance sheet) are immediately hedged by means of forward exchange transactions of the same amount, in the same currency, and with the same maturity period in accordance with the guidelines of the group risk management.

The risk of potential future changes in cash flows arising from highly probable underlying transactions, basically future deliveries of goods and services, is offset by using hedging transactions. The hedge ratio of such future transactions is reduced over time, the further such transactions are in the future. The hedging horizon for currency- and commodities-related hedging transactions which are included in hedge accounting relationships is generally two years and, in exceptional cases, can be extended up to three years for commodities hedging transactions. Past experience has shown that this strategy has led to an effective hedging of cash flows in forecast evaluation units.

The hedging quota of a planned exposure increases over its lifetime. When the planned exposure finally turns into a booked exposure it will have been hedged fully via consecutive individual hedging steps. At this stage the exposure is hedged via a portfolio of individual hedges which have been added gradually over time. At any given point in time a number of individual booked exposures can mature, each with their own portfolio of hedges covering the exposure. The entirety of several booked exposures with their respective hedges create a portfolio hedge.

Currency and interest rate hedging transactions (cross currency swaps) are entered into with the same maturity profile as the respective underlying contracts and form a micro hedge with the corresponding financial liability.

The “critical term match method” is used to measure the effectiveness of the hedging relationship.

REPORT ON POST-BALANCE SHEET DATE EVENTS

In December 2016, MAHLE Holding Espana S.L. signed a contract for the acquisition of the Spanish electronics specialist Nagares SA. The transaction is still subject to approval by antitrust authorities.

In January 2017, MAHLE GmbH signed a contract for the disposal of its forging activities—MAHLE Motorkomponenten GmbH—to the Austrian Frauenthal Group.

In February 2017, MAHLE GmbH is expanding its expertise in the field of thermoelectrics by taking over the start-up company O-Flexx Technologies GmbH based in Duisburg/Germany.

APPROPRIATION OF EARNINGS

UNAPPROPRIATED RETAINED EARNINGS

in EUR '000	**2016**
Net income MAHLE GmbH	12,894
Transfer to revenue reserves	–6,800
Amount carried forward from prior year	15
Unappropriated retained earnings MAHLE GmbH	**6,109**

PROPOSED UTILIZATION OF RETAINED EARNINGS

in EUR '000	**2016**
Unappropriated retained earnings	6,109
Dividend distribution to MAHLE-Stiftung GmbH	–6,000
Carry forward to new account	**109**

REMUNERATION OF THE MEMBERS OF THE MANAGEMENT BOARD OF MAHLE GMBH[1)]

in EUR '000	**2016**
Supervisory Board	300
Management Board	11,109

[1)] parent company

The total remuneration of the Management Board comprises fixed and variable components. The fixed portions for the 2016 business year amounted to EUR 3,117k and the variable compensation for 2016 to EUR 8,178k. The remuneration shown also includes an adjustment for the previous year. The fixed portions include benefits in kind, which consist primarily of the noncash benefits of having company cars.

Remunerations paid to former members of the Management Board and their descendants totaled EUR 1,830k.

An amount of EUR 22,725k is set aside for this group of persons in the pension accruals as of December 31, 2016.

AUDITOR'S FEE

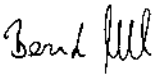
The total fee for the business year charged by PricewaterhouseCoopers GmbH, the group auditor, pursuant to Sec. 314, Para. 1, No. 9 of the German Commercial Code (HGB), consists of the following:

in EUR '000	**2016**
Services for audit of financial statements	855
Other assurance services	321
Tax advisory services	718
Other services	1,098
Total	**2,992**

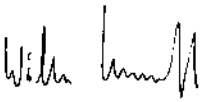
Stuttgart/Germany, March 17, 2017

The Management Board of MAHLE GmbH

Wolf-Henning Scheider



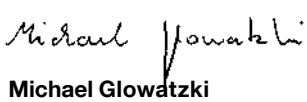
Bernd Eckl



Wilhelm Emperhoff

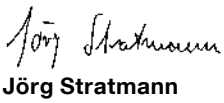
Arnd Franz

Michael Frick



Michael Glowatzki

Rudolf Paulik



Jörg Stratmann

CONSOLIDATED STATEMENT OF FIXED ASSETS

CONSOLIDATED STATEMENT OF FIXED ASSETS FROM JANUARY 1 TO DECEMBER 31, 2016

		Acquisition/manufacturing costs								
				Business year 2016						
in EUR '000		Acquisition/ manufac- turing costs Jan 1, 2016	Currency translation Jan 01, 2016	Changes at the Group	Additions	Disposals	Reclassi- fications	Currency translation of current year	Acquisition/ manufac- turing costs Dec 31, 2016	
I.	**Intangible assets**									
	1. Purchased concessions, industrial and similar rights and assets, and licences in such rights and assets	752,392	4,121	–4,786	23,822	2,478	3,230	58	776,359	
	2. Goodwill	711,881	0	–58,855	17	85,112	0	–1	567,930	
	3. Prepayments	905	–309	0	570	56	–334	–2	774	
		1,465,178	**3,812**	**–63,641**	**24,409**	**87,646**	**2,896**	**55**	**1,345,063**	
II.	**Property, plant, and equipment**									
	1. Land, leasehold rights, and buildings including buildings on third-party land	1,599,841	26,898	–25,851	18,608	5,639	16,821	245	1,630,923	
	2. Technical equipment and machinery	4,882,121	120,956	–97,518	130,084	59,879	292,753	7,519	5,276,036	
	3. Other equipment, fixtures, and furniture	410,636	7,735	–14,595	32,945	12,409	4,656	264	429,232	
	4. Prepayments and assets under construction	391,578	1,653	–749	381,290	3,576	–317,126	–108	452,962	
		7,284,176	**157,242**	**–138,713**	**562,927**	**81,503**	**–2,896**	**7,920**	**7,789,153**	
III.	**Financial assets**									
	1. Shares in affiliated companies	29,713	2,918	–239	2,793	5,560	4	441	30,070	
	2. Shares in associated companies	108,571	–1	6,753	78,991	53,668 [1]	–4	99	140,741	
	3. Equity investments	21,311	1,465	0	1,324	584	0	51	23,567	
	4. Loans to companies in which participations are held	1,486	0	0	0	216	0	0	1,270	
	5. Long-term securities	7,670	2	–1,278	13	0	0	0	6,407	
	6. Other loans	13,931	404	–44	6,331	6,010	0	19	14,631	
		182,682	**4,788**	**5,192**	**89,452**	**66,038**	**0**	**610**	**216,686**	
		8,932,036	**165,842**	**–197,162**	**676,788**	**235,187**	**0**	**8,585**	**9,350,902**	

[1] Includes results from continuation of equity approach as well as disposal due to dividend payments.
[2] Thereof shares in affiliated companies measured according to the equity method: EUR 602k.

	Accumulated depreciation/amortization									Net book values	
			Business year 2016								
	Accumulated depreciation/ amortization Jan 1, 2016	Currency translation Jan 01, 2016	Changes at the Group	Depreciation/ amortization of the business year	Write-ups of the business year	Disposals	Reclassi- fications	Currency translation of current year	Accumulated depreciation/ amortization Dec 31, 2016	Net book values Dec 31, 2016	Net book values Dec 31, 2015
	336,131	2,371	–4,635	112,083	0	1,640	–270	234	444,274	332,085	416,261
	357,607	0	–58,872	56,458	0	85,112	0	0	270,081	297,849	354,274
	0	0	0	0	0	0	0	0	0	774	905
	693,738	**2,371**	**–63,507**	**168,541**	**0**	**86,752**	**–270**	**234**	**714,355**	**630,708**	**771,440**
	631,516	12,893	–19,360	57,627	42	2,605	–8,371	835	672,493	958,430	968,325
	3,479,354	93,450	–95,498	337,383	9	53,245	12,179	6,207	3,779,821	1,496,215	1,402,767
	282,646	5,762	–10,828	40,845	0	11,243	–5,680	371	301,873	127,359	127,990
	2,289	–43	0	2,144	0	589	2,142	–12	5,931	447,031	389,289
	4,395,805	**112,062**	**–125,686**	**437,999**	**51**	**67,682**	**270**	**7,401**	**4,760,118**	**3,029,035**	**2,888,371**
	19,113	2,488	–90	6,193	0	0	0	328	28,032	2,038	10,600
	8,952	0	2,648	86,557	0	0	0	0	98,157	42,584[2)]	99,619
	0	0	0	103	0	0	0	5	108	23,459	21,311
	0	0	0	0	0	0	0	0	0	1,270	1,486
	2,274	0	–143	5	1,746	0	0	0	390	6,017	5,396
	2	133	0	41	50	97	0	3	32	14,599	13,929
	30,341	**2,621**	**2,415**	**92,899**	**1,796**	**97**	**0**	**336**	**126,719**	**89,967**	**152,341**
	5,119,884	**117,054**	**–186,778**	**699,439**	**1,847**	**154,531**	**0**	**7,971**	**5,601,192**	**3,749,710**	**3,812,152**

SHAREHOLDINGS
AS AT DECEMBER 31, 2016

Shareholdings in companies included in consolidation, associated companies, companies included in consolidation on a pro-rata basis and other companies which serve the permanent business operations

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
Parent company			
MAHLE GmbH, Stuttgart/Germany			
1. Fully consolidated subsidiaries			
a) Fully consolidated subsidiaries of MAHLE GmbH with direct shareholding quota			
Conso, LLC, Wilmington, Delaware/USA	100.00		
Kokusan MAHLE Siam Co., Ltd., Samut Prakan/Thailand	99.999		
Letrika do Brasil Ltda., Jaguariúna/Brazil	99.9996		
MAHLE Aftermarket France SAS, Décines/France	100.00		
MAHLE Aftermarket GmbH, Stuttgart/Germany	100.00		
MAHLE Aftermarket Inc., Farmington Hills, Michigan/USA	100.00		
MAHLE Aftermarket Ltd., Bilston/Great Britain	100.00		
MAHLE Aftermarket Pte. Ltd., Singapore/Singapore	100.00		
MAHLE Aftermarket S. de R.L. de C.V., Lerma/Mexico	100.00		
MAHLE Aftermarket S.L., Alcalá de Henares/Spain	100.00		
MAHLE Aftermarket SAS, Poissy Cedex/France	100.00		
MAHLE Aftermarket, ULC, Burlington/Canada	100.00		
MAHLE Amovis GmbH, Berlin/Germany	100.00		
MAHLE Anéis Participações Ltda., Mogi Guaçu/Brazil	100.00		
MAHLE Behr GmbH & Co. KG, Stuttgart/Germany	50.71		
MAHLE Beteiligungen GmbH, Stuttgart/Germany	100.00		
MAHLE Componente de Motor SRL, Timisoara/Romania	100.00		
MAHLE Componentes de Motor de México, S. de R.L. de C.V., Ramos Arizpe/Mexico	100.00		
MAHLE Componentes de Motor España, S.L., Vilanova i la Geltrú/Spain	100.00		
MAHLE Componentes de Motores S.A., Murtede/Portugal	100.00		
MAHLE Componenti Motori Italia S.p.A., La Loggia/Italy	100.00		
MAHLE Composants Moteur France SAS, Chavanod/France	100.00		
MAHLE Compressores do Brasil Ltda., Jaguariúna/Brazil	100.00		
MAHLE Compressors Hungary Kft., Balassagyarmat/Hungary	100.00		
MAHLE Compresores, S. de R.L. de C.V., Juarez Chihuahua/Mexico	100.00		
MAHLE Compressors (Suzhou) Co., Ltd., Suzhou/China	100.00		
MAHLE de México S. de R.L. de C.V., Ramos Arizpe/Mexico	100.00		
MAHLE Donghyun Filter Systems (Tianjin) Co., Ltd., Tianjin/China	100.00		
MAHLE Donghyun Filter Systems Co., Ltd., Hwaseong/South Korea	100.00		
MAHLE Electric Drives Japan Corporation, Numazu-shi, Shizuoka/Japan	100.00		
MAHLE Engine Components (Chongqing) Co., Ltd., Chongqing/China	100.00		
MAHLE Engine Components (Nanjing) Co., Ltd., Nanjing/China	100.00		
MAHLE Engine Components (Thailand) Co., Ltd., Bangkok/Thailand	99.75		
MAHLE Engine Components (Yingkou) Co., Ltd., Yingkou/China	100.00		
MAHLE Engine Components India Private Limited, Pithampur/India	100.00		
MAHLE Engine Components Japan Corporation, Okegawa-shi/Japan	100.00		
MAHLE Engine Components Slovakia s.r.o., Dolný Kubín/Slovakia	100.00		
MAHLE Engine Components USA, Inc., Morristown, Tennessee/USA	100.00		
MAHLE Engine Peripherals and Tooling (Shanghai) Co., Ltd., Shanghai/China	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
MAHLE Engine Systems UK Ltd., Kilmarnock/Great Britain	100.00		
MAHLE Filter Systems (India) Private Limited, Gurgaon/India	50.00[1)]		
MAHLE Filter Systems Canada, ULC, Tilbury/Canada	100.00		
MAHLE Filter Systems Japan Corporation, Tokyo/Japan	100.00		
MAHLE Filter Systems Land Corporation, Cavite/Philippines	66.67		
MAHLE Filter Systems North America, Inc., Troy, Michigan/USA	100.00		
MAHLE Filter Systems Philippines Corporation, Cavite/Philippines	100.00		
MAHLE Filter Systems UK Ltd., Telford/Great Britain	100.00		
MAHLE Filtersysteme Austria GmbH, St. Michael ob Bleiburg/Austria	100.00		
MAHLE Filtersysteme France SAS, Seboncourt/France	100.00		
MAHLE Filtersysteme GmbH, Stuttgart/Germany	100.00		
MAHLE Filtration Systems (Hubei) Co., Ltd., Wuhan City/China	100.00		
MAHLE Filtre Sistemleri A.S., Gebze, Kocaeli/Turkey	100.00		
MAHLE France SAS, Rouffach/France	100.00		
MAHLE Guangzhou Filter Systems Co., Ltd., Guangzhou/China	100.00		
MAHLE Holding (India) Private Limited, Gurgaon/India	100.00		
MAHLE Holding Austria GmbH, St. Michael ob Bleiburg/Austria	100.00		
MAHLE Holding España S.L., Montblanc/Spain	100.00		
MAHLE Immobilien GmbH, Stuttgart/Germany	100.00		
MAHLE Immobilien Schweiz AG, Grenchen/Switzerland	100.00		
MAHLE Indústria e Comércio Ltda., Mogi Guaçu/Brazil	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
MAHLE Industrial Thermal Systems GmbH & Co. KG, Stuttgart/Germany	60.00[6)]		
MAHLE Industriebeteiligungen GmbH, Stuttgart/Germany	100.00		
MAHLE Industriemotoren-Komponenten GmbH, Stuttgart/Germany	100.00		
MAHLE Industries UK Ltd., Rugby/Great Britain	100.00		
MAHLE Industries, Incorporated, Farmington Hills, Michigan/USA	100.00		
MAHLE Industry GmbH, Stuttgart/Germany	100.00		
MAHLE International GmbH, Stuttgart/Germany	100.00		
MAHLE Japan Ltd., Tokyo/Japan	100.00		
MAHLE Kleinmotoren-Komponenten GmbH & Co. KG, Stuttgart/Germany	100.00		
MAHLE Konya Motor Parçalari San. ve Tic. A.Ş., Konya/Turkey	100.00		
MAHLE Letrika Bel OOO, Grodno/Belarus	100.00		
MAHLE Letrika Bovec d.o.o., Bovec/Slovenia	100.00		
MAHLE Letrika d.o.o., Šempeter pri Gorici/Slovenia	100.00		
MAHLE Letrika Italia, S.r.l., Reggio Emilia/Italy	100.00		
MAHLE Letrika Komen d.o.o., Komen/Slovenia	100.00		
MAHLE Letrika Laktaši d.o.o., Laktaši/Bosnia and Herzegovina	100.00		
MAHLE Letrika (Suzhou) Automotive Electrics Co., Ltd., Taicang City/China	98.45		
MAHLE Luxembourg Sàrl, Luxembourg/Luxembourg	100.00		
MAHLE Manufacturing Management, Inc., Farmington Hills, Michigan/USA	100.00		
MAHLE Manufacturing Service Japan Corporation,Tokyo/Japan	100.00		
MAHLE Maquiladora LLC, Farmington Hills, Michigan/USA	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
MAHLE Metal Leve S.A., Mogi Guaçu/Brazil	70.00		
MAHLE Motor Parçalari San. ve Tic. A.Ş., Izmir/Turkey	100.00		
MAHLE Motorkomponenten GmbH, Plettenberg/Germany	100.00		
MAHLE Polska Spółka z o.o., Krotoszyn/Poland	100.00		
MAHLE Powertrain GmbH, Stuttgart/Germany	100.00		
MAHLE Powertrain Ltd., Northampton/Great Britain	100.00		
MAHLE Powertrain, LLC, Farmington Hills, Michigan/USA	100.00		
MAHLE RUS, OOO, Village Dobrino/Russia	100.00		
MAHLE S.A., Vilanova i la Geltrú/Spain	100.00		
MAHLE Services (Thailand) Ltd., Samut Prakan/Thailand	100.00		
MAHLE Shanghai Filter Systems Co., Ltd., Shanghai/China	95.00		
MAHLE Siam Filter Systems Co., Ltd., Samut Prakan/Thailand	74.90		
MAHLE Sistemas de Filtración de México S.A. de C.V., Santa Catarina, Monterrey/Mexico	100.00		
MAHLE Technologies Holding (China) Co., Ltd., Shanghai/China	100.00		
MAHLE Trading (Shanghai) Co., Ltd., Shanghai/China	100.00		
MAHLE Trading Japan Co., Ltd., Tokyo/Japan	100.00		
MAHLE Tri-Ring Valve Train (Hubei) Co., Ltd., Macheng/China	65.00		
MAHLE Brandenburg GmbH, Wustermark/Germany	100.00		
MAHLE Ventiltrieb GmbH, Stuttgart/Germany	100.00		
MAHLE Versicherungsvermittlung GmbH, Stuttgart/Germany	100.00		
MAHLE Vöcklabruck GmbH, Vöcklabruck/Austria	100.00		
OSCON, LLC, Wilmington, Delaware/USA	100.00		
OSNOC, LLC, Wilmington, Delaware/USA	100.00		
PT. MAHLE Filter Systems Indonesia, Jawa Barat/Indonesia	100.00		
PT. MAHLE Indonesia, Bekasi/Indonesia	100.00		
S.C.I. Daudet, Décines/France	100.00		

b) Fully consolidated subsidiaries of MAHLE Behr GmbH & Co. KG with direct shareholding quota

Behr Asia Pacific Management (Shanghai) Co. Ltd., Shanghai/China	100.00		
Behr RUS o.o.o., St. Petersburg/Russia	99.90		
MAHLE Behr Berga GmbH, Berga/Germany	100.00		
MAHLE Behr Charleston Inc., Charleston, South Carolina/USA	100.00		
MAHLE Behr Components Spain S.L., L'Espluga de Francolí/Spain	100.00		
MAHLE Behr Dayton L.L.C., Dayton, Ohio/USA	100.00		
MAHLE Behr France Hambach S.A.S., Hambach/France	100.00		
MAHLE Behr France Rouffach S.A.S., Rouffach/France	99.995		
MAHLE Behr Gerenciamento Térmico Brasil Ltda., Arujá/Brazil	99.994		
MAHLE Behr Holding Deutschland GmbH, Stuttgart/Germany	100.00		
MAHLE Behr Holding GmbH, Stuttgart/Germany	100.00		
MAHLE Behr Holýsov s.r.o., Holýsov/Czech Republic	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
MAHLE Behr India Private Limited, Pune/India	60.00		
MAHLE Behr Italy s.r.l., Grugliasco/Italy	98.00		
MAHLE Behr Japan K.K., Tokyo/Japan	100.00		
MAHLE Behr Kirchberg GmbH, Kirchberg/Germany	100.00		
MAHLE Behr Korea Inc., Busan/South Korea	100.00		
MAHLE Behr Kornwestheim GmbH, Kornwestheim/Germany	100.00		
MAHLE Behr Luxembourg Sàrl, Luxembourg/Luxembourg	100.00		
MAHLE Behr Manufacturing Management, Inc., Troy, Michigan/USA	100.00		
MAHLE Behr Maquiladora LLC, Wilmington, Delaware/USA	100.00		
MAHLE Behr Mexico S. de R.L. de C.V., Ramos Arizpe/Mexico	100.00		
MAHLE Behr Mnichovo Hradiště s.r.o., Mnichovo Hradiště/Czech Republic	100.00		
MAHLE Behr Námestovo s.r.o., Námestovo/Slovakia	100.00		
MAHLE Behr Ostrava s.r.o., Mošnov/Czech Republic	99.98		
MAHLE Behr Ostrov s.r.o., Mnichovo Hradiště/Czech Republic	100.00		
MAHLE Behr Ostrów Wielkopolski Sp. z o.o., Ostrów Wielkopolski/Poland	100.00		
MAHLE Behr Ostrów Wielkopolski Park Technologiczny Sp. z o.o., Ostrów Wielkopolski/Poland	100.00		
MAHLE Behr Ostrów Wielkopolski Park Technologiczny Sp. z o.o. Sp. K., Ostrów Wielkopolski/Poland	100.00		
MAHLE Behr Properties Management LLC, Wilmington, Delaware/USA	100.00		
MAHLE Behr Rio Bravo, S. de R.L. de C.V., Ramos Arizpe/Mexico	100.00		
MAHLE Behr Senica s.r.o., Senica/Slovenia	100.00		
MAHLE Behr Service America L.L.C., Troy, Michigan/USA	100.00		
MAHLE Behr Service Asia Co., Ltd., Shanghai/China	100.00		
MAHLE Behr Service GmbH, Schwäbisch Hall/Germany	100.00		
MAHLE Behr Service Mexico, S. de R.L. de C.V., Ramos Arizpe/Mexico	100.00		
MAHLE Behr South Africa (Pty) Ltd., Durban/South Africa	100.00		
MAHLE Behr Spain S.A., Montblanc/Spain	100.00		
MAHLE Behr Thermal Systems (Jinan) Co., Ltd., Jinan/China	100.00		
MAHLE Behr Thermal Systems (Qingdao) Co., Ltd., Qingdao/China	100.00		
MAHLE Behr Troy Inc., Troy, Michigan/USA	100.00		
MAHLE Behr USA Inc., Troy, Michigan/USA	100.00		
MAHLE Behr Versicherungsdienst GmbH, Stuttgart/Germany	100.00		
MAHLE Industrial Thermal Systems GmbH & Co. KG, Stuttgart/Germany	40.00[6)]		

c) Fully consolidated subsidiaries of MAHLE Metal Leve S.A. with direct shareholding quota

MAHLE Argentina S.A., Rafaela/Argentina	100.00		
MAHLE Filtroil Indústria e Comércio de Filtros Ltda., Mogi Guaçu/Brazil	60.00		
MAHLE Hirschvogel Forjas S.A., Queimados/Brazil	51.00		
MAHLE Industry do Brasil Ltda., Mogi Guaçu/Brazil	100.00		
MAHLE Metal Leve GmbH, St. Michael ob Bleiburg/Austria	100.00		
MAHLE Metal Leve Miba Sinterizados Ltda., Indaiatuba/Brazil	60.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
d) Fully consolidated subsidiaries of MAHLE Industrial Thermal Systems GmbH & Co. KG with direct shareholding quota			
MAHLE Industrial Thermal Systems (Tianjin) Co., Ltd., Tianjin/China	100.00		
MAHLE Industrial Thermal Systems America, L.P., Belmont, Michigan/USA	99.00		
MAHLE Industrial Thermal Systems Reichenbach GmbH, Heinsdorfergrund/Germany	100.00		
2. Affiliated companies, not consolidated on account of its immateriality for the presentation of the net assets, financial position and results of operations			
a) Affiliated companies of MAHLE Behr GmbH & Co. KG with direct shareholding quota			
MAHLE Behr Sweden AB, Askim, Göteborg/Schweden	100.00[3)5)]	42	7
MAHLE Behr Thermal Noida Private Limited, Gurgaon/India	100.00[3)]	145	6
b) Other affiliated companies with direct shareholding quota			
Compañía Rosarina S.A., Rosario/Argentinia	100.00[3)]	970	–2,114
Eito Denki Co. Ltd., Gojome-machi, Minamiakita-gun, Akita/Japan	66.80[3)]	215	11
Letrika Lab, d.o.o., Šempeter pri Gorici/Slovenia	100.00[3)]	118	1
MAHLE Engine Components Australia Pty Ltd., Port Melbourne/Australia	100.00[4)]	602	211
MAHLE Industrial Thermal Systems America, Inc., Belmont, Michigan/USA	100.00[3)]	66	0
MAHLE Industrial Thermal Systems Verwaltung GmbH, Stuttgart/Germany	100.00	436	10
MAHLE InnoWa GmbH, Stuttgart/Germany	100.00	2,543	0
MAHLE Kleinmotoren-Komponenten Verwaltungs GmbH, Stuttgart/Germany	100.00	27	0
MG Immobilienentwicklungs- und Ansiedlungsgesellschaft mbH, Wolfsberg/Austria	74.00[3)]	1	0
Ueno Industry Co. Ltd., Tokyo/Japan	100.00[3)]	1	0

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
3. Proportionately consolidated companies			
a) Subgroup HBPO that is managed by MAHLE Behr GmbH & Co. KG and two more companies			
Parent company			
HBPO Beteiligungsgesellschaft mbH, Lippstadt/Germany	33.33		
Companies included in subgroup accounts of HBPO Beteiligungsgesellschaft mbH with direct shareholding quota			
HBPO Asia Ltd., Seoul/South Korea	100.00		
HBPO Automotive Hungária Kft., Györ/Hungary	100.00		
HBPO Automotive Spain S.L., Martorell/Spain	100.00		
HBPO Beijing Ltd., Beijing/China	100.00		
HBPO Brasil Automotive Servicos Ltda., Arujá/Brazil	100.00		
HBPO Canada Inc., Windsor/Canada	100.00		
HBPO China Ltd., Shanghai/China	100.00		
HBPO Czech s.r.o., Mnichovo Hradiště/Czech Republic	100.00		
HBPO Germany GmbH, Meerane/Germany	100.00		
HBPO GmbH, Lippstadt/Germany	100.00		
HBPO Ingolstadt GmbH, Ingolstadt/Germany	100.00		
HBPO Japan K.K., Tokyo/Japan	100.00		
HBPO Korea Ltd., Busan/South Korea	100.00		
HBPO Management Services Mexico S.A. de C.V., Puebla/Mexico	100.00		
HBPO Manufacturing Hungary Kft., Kecskemét/Hungary	100.00		
HBPO Mexico S.A. de C.V., Puebla/Mexico	100.00		
HBPO North America Inc., Troy, Michigan/USA	100.00		
HBPO Pyeongtaek Ltd., Pyeongtaek/ South Korea	100.00		
HBPO Rastatt GmbH, Rastatt/Germany	100.00		
HBPO Regensburg GmbH, Regensburg/Germany	100.00		
HBPO Services Mexico S.A. de C.V., Puebla/Mexico	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
HBPO Slovakia s.r.o., Lozorno/Slovakia	100.00		
HBPO UK Ltd., Banbury/Great Britain	100.00		
SHB Automotive Modules Company Ltd., Hwaseong/South Korea	50.00		
b) Subgroup Behr-Hella Thermocontrol that is managed by MAHLE Behr GmbH & Co. KG and another company			
Parent company			
Behr-Hella Thermocontrol GmbH, Stuttgart/Germany	50.00		
Companies included in subgroup accounts of Behr-Hella Thermocontrol GmbH with direct shareholding quota			
Behr-Hella Thermocontrol (Shanghai) Co., Ltd., Shanghai/China	100.00		
Behr-Hella Thermocontrol EOOD, Sofia/Bulgaria	100.00		
Behr-Hella Thermocontrol Inc., Wixom, Michigan/USA	100.00		
Behr-Hella Thermocontrol India Private Limited, Pune/India	100.00		
Behr-Hella Thermocontrol Japan K.K., Kanagawa/Japan	100.00		
BHTC Mexico S.A. de C.V., Queretaro/Mexico	100.00		
c) Subgroup Behr Hella Service that is managed by MAHLE Behr GmbH & Co. KG and another company			
Parent company			
Behr Hella Service GmbH, Schwäbisch Hall/Germany	50.00		
Companies included in subgroup accounts of Behr Hella Service GmbH with direct shareholding quota			
Behr Hella Comércio de Pecas Automotivas S.A., Arujá/Brazil	100.00		
Behr Hella Service North America L.L.C., Peachtree City, Georgia/USA	100.00		
Behr Hella Service South Africa (Pty) Ltd., Johannesburg/South Africa	100.00		
Behr Service IAM USA Inc., Troy, Michigan/USA	100.00		

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
d) Proportionately consolidated group of companies that is managed by MAHLE Behr GmbH & Co. KG and another company			
Parent company			
Shanghai Behr Thermal Systems Co. Ltd., Shanghai/China	50.00		
Subsidiaries with direct shareholding quota			
Chengdu Behr Automotive Thermal Systems Co., Ltd., Chengdu/China	100.00		
Shenyang Behr Automotive Thermal Systems Co., Ltd., Shenyang/China	100.00		
e) Other proportionately consolidated companies with direct shareholding quota that are managed by MAHLE Behr GmbH & Co. KG and another company			
Behr Thermot-tronik Italia S.p.A., Grugliasco/Italy	50.00		
Dongfeng Behr Thermal Systems Co. Ltd., Wuhan/China	50.00		
f) Other proportionately consolidated companies that are managed by MAHLE GmbH and another company			
Allied Ring Corporation, St. Johns, Michigan/USA	50.00		
4. Associated companies, consolidated using the equity method			
a) Associated companies of MAHLE Behr GmbH & Co. KG with direct shareholding quota			
Dongfeng-Paninco Automobile Aluminium Heat Exchanger Co. Ltd., Shiyan/China	50.00		
HICOM HBPO SDN BHD, Shah Alam/Malaysia	40.00		
b) Associated companies of MAHLE Metal Leve S.A. with direct shareholding quota			
Innoferm Tecnologia Ltda., Mogi Guaçu/Brazil	33.33[2)3)]	3,892	–116

Name and Location	*Share in equity in %*	*Equity in EUR '000*	*Result of the last business year in EUR '000*
c) Other associated companies with direct shareholding quota			
Bosch Mahle Turbo Systems GmbH & Co. KG, Stuttgart/Germany	50.00		
Bosch Mahle Turbo Systems Verwaltungs GmbH, Stuttgart/Germany	50.00[2)]	28	3
Cofap Companhia Fabricadora de Peças Ltda., São Paulo/Brazil	31.65		
India Nippon Electricals Ltd., Tamil Nadu/India	20.50[2)3)]	22,799	2,642
INPRIME d.o.o., Tolmin/Slovenia	20.84[2)3)]	–267	4
LangFang Kokusan Electric Co., Ltd., Hebei/China	40.00		
Letrika SOL d.o.o., Šempeter pri Gorici/Slovenia	41.57[2)3)]	729	–202
MAHLE Behr Verwaltung GmbH, Stuttgart/Germany	23.08[2)5)]	17,005	–667
MAHLE König GmbH, Rankweil/Austria	50.00		
MAHLE König Kommanditgesellschaft GmbH & Co. KG, Rankweil/Austria	50.00		
MAHLE Letrika Roots India Private Limited, Coimbatore/India	50.00[2)3)5)]	596	–191
Pt Federal Izumi Manufacturing, Bogor/Indonesia	36.94		
SiEVA d.o.o., Šempeter pri Gorici/Slovenia	20.00[2)3)]	7,045	43

[1)] Shareholding 50% + 1 share
[2)] The company was not measured using the equity method on account of its immateriality for the presentation of the net assets, financial position and results of operations
[3)] Local financial statements
[4)] Affiliated company, consolidated using the equity method
[5)] Previous years figures according to last available financial statement
[6)] From the Group's perspective, company is included by 100%

AUDITOR'S REPORT

This audit report is issued on financial statements prepared in German language.

We have audited the consolidated financial statements prepared by MAHLE GmbH, Stuttgart/Germany, comprising the balance sheet, the income statement, the cash flow statement, the statement of changes in equity, and the notes to the consolidated financial statements, together with the group management report for the business year from January 1 to December 31, 2016. The preparation of the consolidated financial statements and the group management report in accordance with German commercial law is the responsibility of the parent company's Management Board members. Our responsibility is to express an opinion on the consolidated financial statements and the group management report based on our audit.

We conducted our audit of the consolidated financial statements in accordance with § (Article) 317 HGB ("Handelsgesetzbuch": "German Commercial Code") and German generally accepted standards for the audit of financial statements promulgated by the Institut der Wirtschaftsprüfer (Institute of Public Auditors in Germany) (IDW). Those standards require that we plan and perform the audit such that misstatements materially affecting the presentation of the net assets, financial position, and results of operations in the consolidated financial statements in accordance with (German) principles of proper accounting and in the group management report are detected with reasonable assurance. Knowledge of the business activities and the economic and legal environment of the group and expectations as to possible misstatements are taken into account in the determination of audit procedures. The effectiveness of the accounting-related internal control system and the evidence supporting the disclosures in the consolidated financial statements and the group management report are examined primarily on a test basis within the framework of the audit. The audit includes assessing the annual financial statements of the companies included in consolidation, the determination of the companies to be included in consolidation, the accounting and consolidation principles used and significant estimates made by the company's Management Board members, as well as evaluating the overall presentation of the consolidated financial statements and the group management report. We believe that our audit provides a reasonable basis for our opinion.

Our audit has not led to any reservations.

In our opinion based on the findings of our audit, the consolidated financial statements comply with the legal requirements and give a true and fair view of the net assets, financial position, and results of operations of the group in accordance with (German) principles of proper accounting. The group management report is consistent with the consolidated financial statements, complies with legal requirements, as a whole provides a suitable view of the group's position and suitably presents the opportunities and risks of future development.

Stuttgart, March 17, 2017

PricewaterhouseCoopers GmbH
Wirtschaftsprüfungsgesellschaft

sgd. Dieter Wißfeld
Wirtschaftsprüfer
(German Public Auditor)

sgd. ppa. Renate Berghoff
Wirtschaftsprüferin
(German Public Auditor)

MEMBERS OF THE SUPERVISORY BOARD

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Former Chairman of the Management Board and CEO of MAHLE GmbH, Stuttgart/Germany

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effective January 1, 2016
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Executive Director of IG Metall, administrative office Stuttgart/Germany

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Chairman of the Management Board of Bertrandt AG, Ehningen/Germany

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Executive Secretary of the Central Works Council of MAHLE Group Germany

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KARIN HIMMELREICH
Managing Director MP Transaction, Frankfurt/Germany

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DIETER KIESLING
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effective March 19, 2016
Trade Union Secretary of IG Metall, administrative office Stuttgart/Germany

PATRYK KRAUSE
until March 18, 2016
Trade Union Secretary of IG Metall

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effective July 1, 2016
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THOMAS R. LETSCH
Former Vice President Sales and Application Engineering Commercial Vehicles of MAHLE Group

DR. UWE MOHR
Vice President Corporate Research and Advanced Engineering of MAHLE Group, effective September 1, 2016 Vice President R&D Services

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Head of Institute, Institute for Combustion Engines, University RWTH Aachen/Germany

PROF. DR.-ING. DR.-ING. E. H. HANS-JOACHIM SCHÖPF
until June 30, 2016
Former Executive Vice President R&D of Mercedes Car Group of Daimler AG, Stuttgart/Germany

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GEORG WEIBERG
Former Head of Global Truck Engineering, Daimler AG, Stuttgart/Germany

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WOLF-HENNING SCHEIDER
CHAIRMAN AND CEO

Research and Advanced Engineering, Corporate Planning, Corporate Communications, Corporate External Affairs, Engineering Services, Motorsports, and Special Applications profit center

BERND ECKL
January 1, 2017: joining

effective April 1, 2017
Corporate Executive Vice President and General Manager Engine Systems and Components business unit, Corporate Quality Management, Large and Small Engine Components profit center

WILHELM EMPERHOFF
Corporate Executive Vice President and General Manager Filtration and Engine Peripherals business unit, Mechatronics division, until October 31, 2016: Industrial Filtration profit center

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Corporate Executive Vice President and Chief Financial Officer Finance, Controlling, Taxes, IT Services, Insurances, Internal Audit

MICHAEL GLOWATZKI
Corporate Executive Vice President Human Resources, Legal

DR. RUDOLF PAULIK
until March 31, 2017
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