ESSENTIAL

FREUDENBERG SEALING TECHNOLOGIES

THE MAGAZINE – **ISSUE #2 2015**

QUALITY! QUALITY?

A story spanning 3,500 years – from Babylonian commandment tablets to modern management methods.

QUALITY AS A FACTOR OF SUCCESS

Matthias Wissmann, President of the German Association of the Automotive Industry (VDA) on hidden champions and technology trends.

"IT STILL HAS A LONG LIFE AHEAD"

Engine guru Prof. Dr. Ing. Fritz Indra on the potential of the internal combustion engine.

PARTNER FOR THREE LIFE CYCLES

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LEATHER – SYNONYM FOR QUALITY

Leather is still considered a symbol of special quality, perhaps because we experience leather via several channels of perception. Whether the products are shoes, purses, furniture or car interiors, grained leather surfaces appeal to our aesthetic sense. But it is not just leather's look that is unique. Its scent is singular as well (Tip: rub your finger over the surface of the cover page of this edition of ESSENTIAL). And not least of all, leather surfaces cater to our sense of touch more than most materials or synthetic substitutes. But leather doesn't merely score points for the quality of its look and feel. Though it was one of the first materials that human beings actually processed and used many thousands of years ago, it is also a model of durability and robustness today and often unmatched in that respect. If they are well maintained, leather products last a long time – a superb testimony to the material's sustainability.

As the market and technology leader in the sealing field and a company that emerged from what was once Europe's largest tannery, we still feel closely connected to leather, even if leather's importance as a material for seals ended long ago. (Leather seals actually date back to ancient times when Romans used them to seal their expertly engineered irrigation systems). Today leather remains a synonym for quality – just as it has always been.

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A DIFFERENT TAKE ON SEALS

At Germany's biggest poetry slam, poets fight for the audience's favor – and sealing rings take on a whole new role.

JUST BEAUTIFUL

#1

Quality is much more than the absence of defects. It is divided into many facets. It is often measurable – and sometimes not, as is the case with perceived quality. This refers to the effect of an object on an observer via one or several channels of awareness. It is not only influenced by its quality. The socialization of the observer and the environment of the object also have an impact on it.

#2

We usually make the decision at first glance as to whether we find an object beautiful, be it a work of art, a building or a car. And we are thus passing judgment on its perceived quality. There is often agreement within a specific cultural group on aesthetic appraisals of objects. A technology fan can hardly escape the fascination for the captivating form of a sports car, and is undeterred by uneven gap measurements.

#3

Testing, tinkering and continual optimization have a great deal to do with quality. But at the beginning, quality often requires one thing in particular: an idea as daring as it is unusual. What emerges as creativity often must be implemented with the painstaking detail work that makes it possible to see and experience quality. But one thing is certain: Visionaries and tinkerers are an unbeatable combination.

IDEA AND SOLUTION

#4

In the beginning, there was the idea: use the Hoover Dam as a projection surface for the world premiere of the first autonomously driven truck with official road approval. The project required the brilliant illumination of 39,000 square meters of gray concrete with a total output of 1.7 million lumens. Video projection mapping synchronized the individual images of 60 large projectors into an overall picture on the concave surface of the concrete dam – which was made possible by the division of the 221-meter-high and 380-meter-wide structure into individual segments. In the end, the most brightly-lit projection of all time even made its way into the Guinness Book of Records.

ETERNAL LIGHT

#5

Longevity is commonly understood to be a main characteristic of quality. But people are not always interested in a long life span. After all, the measurement of quality is based on the users' requirements. Who wants to deal with an ever so robust 20-year-old mobile telephone? Nonetheless, devices or machines that do their duty for decades in some cases command our respect. And with their long-lasting quality, they aren't merely monuments to their architects. They are symbols of sustainability as well.

#6

In 1901, Dennis Bernal, the owner of a local electric plant, the Livermore Power and Light Co., had an idea that could have set the standard for a business model for mobile wireless providers 100 years later. On June 8, he gave the Livermore, Calif. fire department a light bulb so that the men would not have to laboriously light a kerosene lamp when an alarm went off at night. Since the last relocation of the fire department in March 1976, the world's oldest light bulb has burned continuously – for a total of 114 years. The lamp, with its mouth-blown glass body, was produced at the Shelby Electric Company of Ohio – just 22 years after Thomas Edison invented the light bulb.

4 QUESTIONS for

LUDGER NEUWINGER-HEIMES

Chief Financial Officer (CFO)
Freudenberg Sealing Technologies

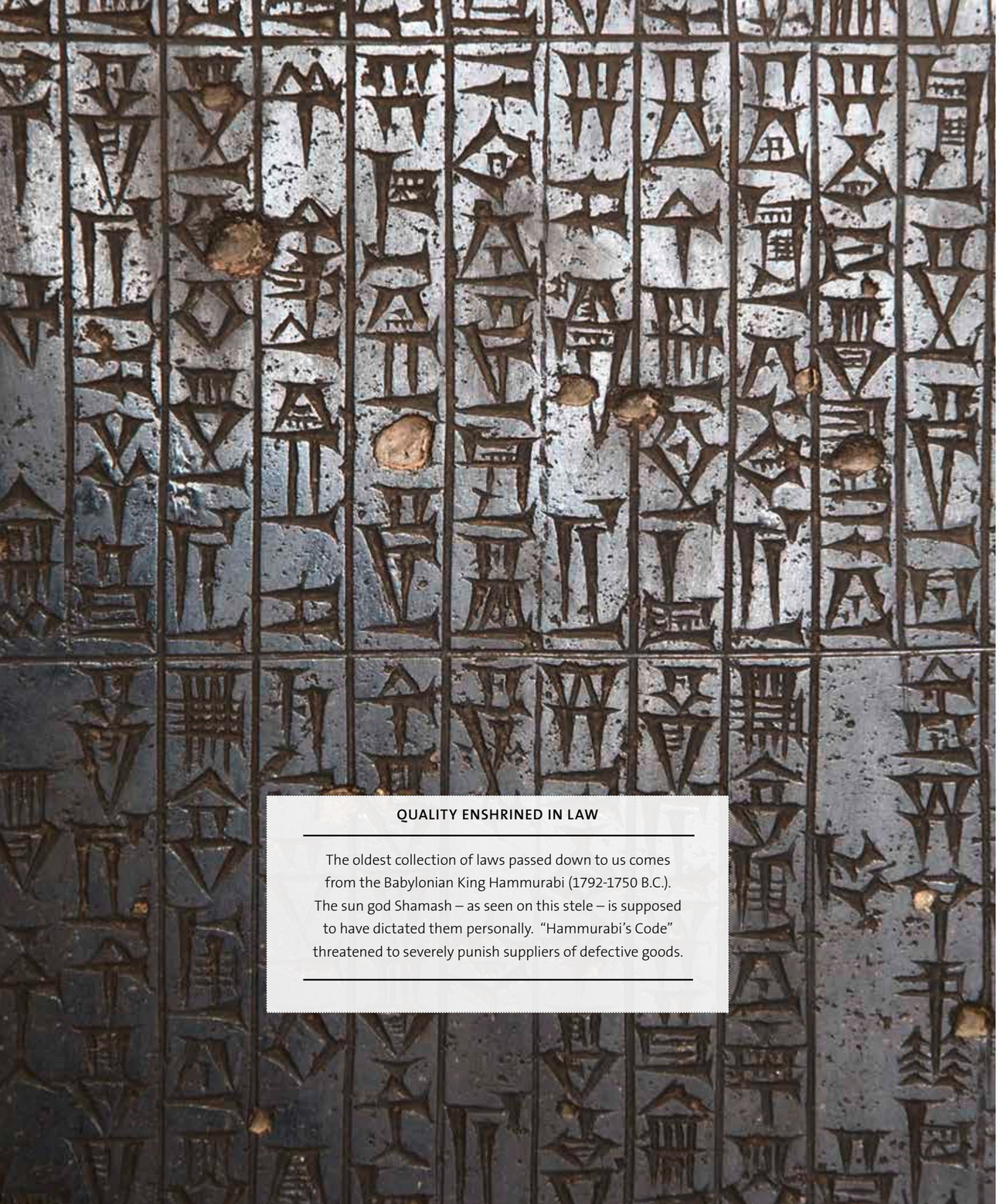
1 MR. NEUWINGER-HEIMES, AS CHIEF FINANCIAL OFFICER (CFO) OF FREUDENBERG SEALING TECHNOLOGIES, HOW OFTEN DO YOU FIND YOURSELF IN A CONFLICT BETWEEN COST PRESSURES AND QUALITY? That question doesn't actually arise. The level of quality is specified by the markets or our customers and is not negotiable. Our challenge is to achieve this level of quality at the lowest possible cost. This is perhaps one of the clearest differences between us, with a tradition dating back more than 160 years, and other companies who pursue short-term success instead. We know perfectly well that we will only secure long-term and sustained success with the absolutely highest levels of quality. Our products may represent a relatively small share of added value in our customers' complex systems – but a crucial share of their functional reliability. Our claim is zero-defect quality. We can make no compromises on this. That would be irresponsible from a business perspective. Not just with the threat of product liability claims in mind but also from the standpoint of our image as a supplier. Many manufacturers have learned from painful experience that purely price-driven sourcing decisions do not pay off and that recalls do immense damage to a company's reputation.

"OUR ASPIRATION: ZERO-DEFECT QUALITY"

2 FREUDENBERG SEALING TECHNOLOGIES UNDERTAKES SOPHISTICATED AND EXPENSIVE FUNDAMENTAL RESEARCH. IN YOUR VIEW, IS THIS NECESSARY TO ENSURE QUALITY? Absolutely. As a technology company, the term quality must be conceived very broadly. To secure our position in the market, it is not enough to control processes to the point that you can manufacture practically error-free. It is just as important to stay a crucial step ahead of the competition in the quality of our innovations. For example, in 2013, we developed a completely new generation of polyurethane that significantly broadens the application options for the material, which has been known since the 1950s. The new generation has meanwhile been successfully established. To be sure, not every new research project leads to commercial results from the outset. But it is important for us to keep developing new technologies and materials that ensure our edge in the quality of our innovations.

3 MANUFACTURING IN WESTERN EUROPE IS UNDER ENORMOUS COST PRESSURES. AT THE SAME TIME, GROWTH IS TAKING PLACE ALMOST EXCLUSIVELY IN ASIAN MARKETS. HOW ARE YOU DEALING WITH THIS TREND – AND HOW ARE YOU ENSURING QUALITY? We are very well positioned globally and are responding appropriately to the challenge that the world's regions are developing in different ways. Back in the early 1960s, Freudenberg was one of the first Western European companies to enter into a cooperation agreement with a Japanese company. Today NOK is our partner in most of our activities in China. We are currently expanding our capacity in China, in the accumulator and liquid silicone areas, for example – the importance of these two technologies is increasing. This is absolutely essential if we are to participate in global growth. In the process, we are making sure that we are producing the same quality everywhere at our more than 45 facilities worldwide. We have also begun activities to strengthen our European facilities as well. Here the key factors are the flexibility and distinct know-how that allow us to handle the most difficult challenges that our customers bring us.

4 WHAT PERSONAL EXPERIENCES DO YOU ASSOCIATE WITH THE TERM QUALITY? ARE THERE AREAS THAT HAVE ESPECIALLY IMPRESSED YOU – OR SENSITIZED YOU TO QUALITY? Everyone has surely had the experience that any compromise on the quality of durable consumer goods will cost you dearly – either due to early repair expense or limited joy of use. I am an avid runner, so I pay close attention to the durability, comfort and materials of my running shoes. Unfortunately, price is not a good indicator of quality. Here you must delve more deeply and take a closer look at the factors that ultimately determine quality. If you compare the quality of shoes today with that of when I first started my hobby 30 years ago, the advances in quality are impressive in every area. Intensive materials research, the joy of innovation and expertise in materials and applications thus also pay off when it comes to running shoes. ◎



QUALITY ENSHRINED IN LAW

The oldest collection of laws passed down to us comes from the Babylonian King Hammurabi (1792-1750 B.C.). The sun god Shamash – as seen on this stele – is supposed to have dictated them personally. "Hammurabi's Code" threatened to severely punish suppliers of defective goods.

QUALITY – WHAT IS IT?

IT IS A TERM THAT HAS BECOME FIRMLY ENTRENCHED IN OUR PROFESSIONAL AND EVERYDAY LIVES. AND THE IDEA RESONATES AS SOMETHING OBJECTIVE AND MEASURABLE. BUT UPON CLOSER EXAMINATION, IT TURNS OUT THAT WE OFTEN MEAN SOMETHING DIFFERENT WHEN WE TALK ABOUT "QUALITY". AND WHEN WE GET TO THE BOTTOM OF THE IDEA, WE QUICKLY FIND IT IS NOT VERY EASY TO DEFINE. QUALITY: ESSENTIAL ADDRESSES A COMPLEX PHENOMENON.

Suppliers to Babylonia's royal court knew that Hammurabi – the sixth king of the first dynasty, reigning from 1792 to 1750 B.C. – was a tough customer. The ancient ruler has secured his place in history with the "Code of Hammurabi", the world's oldest fully preserved collection of laws. A total of 282 paragraphs were recorded on a 2.25-meter-high stele made of diorite. An unmistakable message can be read there: "Anyone delivering bad goods will be beheaded." But what Hammurabi meant by "bad" is not conveyed. Aristotle was the first to try to come up with a standard for quality nearly 1,400 years later. The Greek philosopher defined "10 categories" with whose help all objects, phenomena and beings should be described. The third category – after substance and quantity – is quality. In this category, Aristotle's question was: What is a subject's nature? He described quality as "a system of characteristics that make something what it is and differentiate it from other things". A key attribute of good or bad quality is how well something fits the purpose for which it was intended. According to Aristotle, assessing the quality of a donkey using the criteria for a horse would make it impossible to differentiate a good donkey from a bad one.

TRADE GUILDS: THE FIRST QUALITY MANAGEMENT

The beginnings of quality management date back 500 years. It was identified early on that quality – particularly in artisanal products – was not measurable simply in terms of fixed parameters, but also had to be the result of a process and the skills of the producer. The first laws governing techniques and training coincided with the emergence of trade guilds at the start of the 16th century. Their craftsmen ensured quality by standardizing procedures and providing the corresponding training for each profession. The first standards emerged. The best known is the purity law for Bavarian beer. Duke Wilhelm IV signed a decree on April 23, 1516 that regulated both the prices and the ingredients of beer.

During their long periods as apprentices and journeymen, the workers' focus was on quality. Even based on today's standards, the term "quality" during this period can be described as integral and enduring. This was mainly due to the fact that one craftsman was responsible for the entire process chain, from planning to quality control. For example, the choice of the wood for a new barrel was a crucial criterion for a cooper, allowing him to ultimately deliver a high-quality, leak-tight barrel on time. Artisanal knowledge and techniques were passed down and refined over generations.

Guilds provided the first binding quality regulations for skilled trades. The best example is still valid today - the purity law for German beer, dating back to 1516.

A rupture came with industrialization. Division of labor took hold with the emergence of the first factories. The unskilled factory worker was only responsible for small sub-steps of value creation – it was impossible for him to perform quality control. Other people had to handle it. The American engineer Frederick Taylor, who developed scientific plant management relying on an extensive division of labor, envisioned the "inspector" as an independent function. His task was primarily to sort out non-functioning products so they could be repaired. Planning and production were now de-coupled from quality assurance. It was especially important to make it through quality control – and less important whether the result was a "good" product in the end. "We have the quality department to handle quality" can still be heard today at many companies.

With the industrial division of labor, individual awareness of the quality of an end product was initially lost.

During the 1930s, however, some large American firms had already recognized that it was cheaper to design quality into products instead of looking for and repairing defects afterwards. As early as 1931, Walter A. Shewart, an engineer at Bell Telephone Laboratories, developed quality control methods such as the quality control chart (a tool for the graphic representation of statistical samples). But it was not until the Second World War that such methods found broader application. The American military was plagued with defective equipment. In one investigation, it turned out that just one third of the U.S. Navy's electrical devices worked reliably – and that only one out of every nine electronic tubes that were ordered worked. To reduce the already out-of-control wartime costs at least to some extent, the U.S. government required suppliers to the military to apply modern methods of quality control systematically from that point on. Engineer and statistician W. Edwards Deming introduced statistical process control, which formed the basis for development of the MIL Q-9858 standard adopted in 1959.

With the end of the war, interest in quality issues waned – the pent-up demand was too great. The result was that people bought whatever came off the assembly lines.

BIG IN JAPAN

W. Edwards Deming was disappointed. The message about his quality control processes was falling on deaf ears. The situation was different for America's former wartime enemy. The economy in post-war Japan slowly began to recover. In view of producers' and consumers' tight resources, the Asian country could not afford poor quality. So the Japanese Union of Scientists and Engineers invited Deming to a lecture series on statistical process control in Tokyo and Hakone. Hundreds of Japanese engineers and future top executives became familiar with the optimization of production and manufacturing processes developed by Deming. The Deming Prize reflects the importance of the American's ideas for the Japanese economy. Established in 1951 and regularly awarded since then, it remains the highest honor for Japanese engineers to this very day.

Deming's quality control loop, in particular, was systematically implemented in Japan (if there are deviations, they are analyzed and the causes found and remedied).

Deming focused on two aspects:

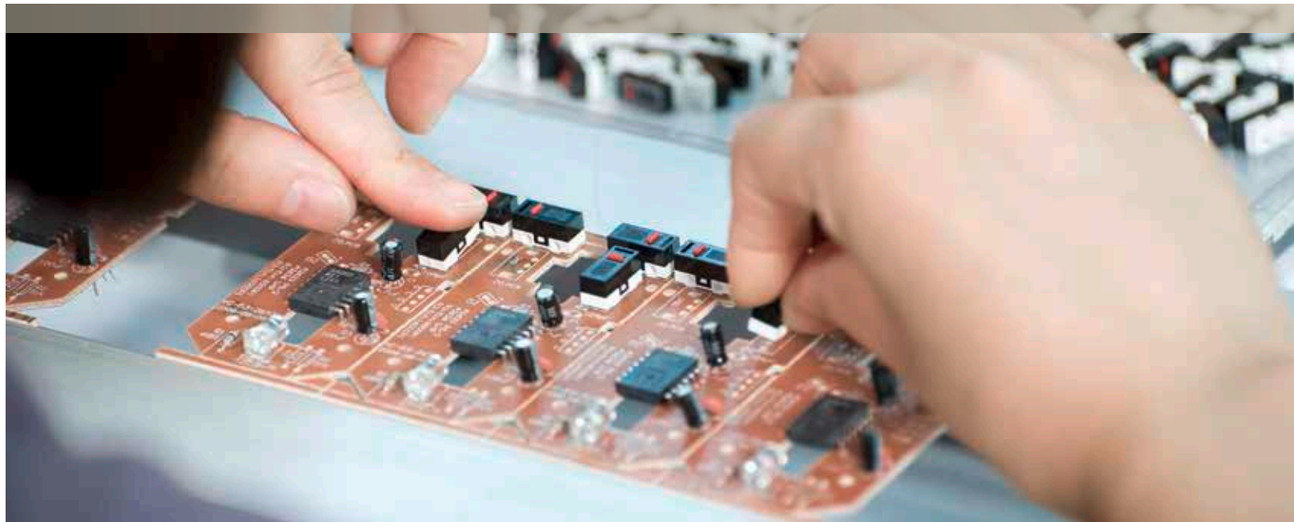
1. Given that quality cannot be checked on the basis of results, he placed the emphasis on the process and, accordingly, statistical methods of process control and regulation (statistical quality control).

2. Deming placed great importance on employee behavior with regard to cooperation, communication, the free expression of opinion and an open climate. Deming's concept therefore rejects the determination of the cost of quality.

In 1952, another American scientist, industrial engineer Joseph M. Juran, was invited to Japan. A year earlier, he had published a quality control handbook. Juran's quality triad was based on quality planning, quality control and quality improvement. The core of his instruction was that quality has to be a management philosophy centered on the customer. His customer-supplier concept was also applied within companies. In this way, one employee could be the "customer" of another.

Deming and Juran were the initial sparks for numerous processes that Japanese engineers developed further and that led to highly visible successes nearly 25 years later. In the interim, an unsaturated producers' market marked by shortages had turned into a saturated buyers' market where customers' quality requirements had become much more important. Many Western companies were not prepared for this. Japanese companies dominated entire sectors, such as the electronics, optical and motorcycle industries. In 1972, "Made in Japan" was not just the title of a critically acclaimed Deep Purple album, it was also the trademark of a strong, export-oriented, self-confident country. And in the mid-1970s, the Japanese auto industry was a growing threat to American and European companies.

W. Edwards Deming finally achieved belated fame in his own country. In 1980, an NBC documentary entitled "If Japan can ... Why can't we?" presented the 80-year-old scientist to the general public. From that point on, his seminars were all booked up despite their rapidly rising admission fees. Suddenly, quality again became an important issue in the U.S., and Deming developed his quality control loop into the PDCA cycle (plan, do, check, act). Kaoru Ishikawa's company-wide quality control (CWQC) was further developed into total quality management (TQM) and zero-defect programs into Six Sigma. Zero-defect programs had been developed in the 1960s for the manufacture of rockets for the American space program.



THE DIFFERENT WAYS OF VIEWING QUALITY

After the success of Japanese industry created an understanding of quality, the awareness grew that quality is more than the elimination of errors. Harvard Professor David A. Garvin revolutionized the definition of quality in the early 1980s by expanding the term to five perspectives. The perspectives illustrate that – as Aristotle once put it – the meaning of quality all comes down to context. Garvin simultaneously defined eight dimensions that can be used to describe the quality of a product:

1. The **transcendent perspective** describes quality as absolutely and universally identifiable, not precisely definable and only perceptible through experience. Quality in the sense of immeasurable perfection is best applied to fashion and design. But a product with special engineering artistry – such as a high-performance sports car – can also represent transcendent quality. From this perspective, a product's aesthetics are especially important as a dimension of quality.

2. The **product-related perspective** assumes that quality can be precisely measured and that differences can be expressed quantitatively. For example, in a carpet, the number of knots per square centimeter is a clear quality criterion. For this perspective, performance, product features, durability and ease of repair are especially important as dimensions of quality.

3. The **user-related perspective** involves the question of how well a product can meet an individual need. For example, there is just one reason for the existence of convertibles: because there are people who enjoy driving with the top down. Aesthetics and perceived quality – including image and reputation – are crucial in this case.

4. The **process-related perspective** describes quality as the adherence to predetermined specifications. From this perspective, an affordable small car can represent high quality just as easily as a high-end luxury car – if the stipulated requirements are precisely followed. Conformity and reliability are particularly important as quality dimensions.

5. The **value-related perspective** is closely tied to the two previous perspectives. It describes quality as performance at an acceptable cost. Excellence is considered in relation to value. The result is a hybrid whose boundaries are hard to define in practice. Investigations have shown, however, that growing numbers of customers are adopting this perspective. A typical example: If you are buying sunscreen at a discounter for 1 euro/100 ml to protect yourself from UV radiation, you are hardly ready to spend 5 euro/ml if the added value is in the design of its packaging or its scent.

Differing perspectives on quality are often the cause of acrimonious battles within companies. Sales and marketing experts feel attached to the product- or user-related perspective – and take quality to mean higher performance, more equipment and other upgrades that often lead to higher costs. By contrast, managers responsible for production tend to define quality from a process perspective. To them, more process-related quality mainly means lower costs. As Garvin sees it, it is important to be aware of the rationale for different quality perspectives. In his view, companies are most successful when they:

- Emphasize user-related quality in the **planning** of a new product ("What does the customer want?")

- Adopt the product-related perspective in the **design** of the product ("What differentiates my product from others?")

- Place the emphasis on the process-related perspective in the product's **implementation**

Successful companies do not necessarily have to take all the perspectives or dimensions of quality into consideration. For example, the success of the Japanese auto industry in the 1970s was above all the result of product-related quality – with an emphasis on reliability and a reduced need for repairs. American manufacturers had a serious deficit here and could not meet many customers' needs for an affordable car that was simply supposed to function well. American buyers of Japanese cars during the 1970s considered other forms of quality, such as aesthetic features and durability, to be less important.

But in recent years, it was precisely the Japanese auto industry that was frequently accused of putting its focus exclusively on product-related quality – an area where American, European and Korean manufacturers had reached the level of Japanese companies. At the same level of product quality, elements of user-related, perceived quality become increasingly important. As a result, Toyota established a special department of "perceived quality" for the development of the Auris compact car introduced in Europe in 2015. Its employees exclusively address the occupants' visual, haptic and auditory experience.

In Germany as well, serious thought is being given to the future concept of quality. The German Society for Quality (DGQ) is promoting a definition of the term that "goes beyond just precision work and high-value processing". It wants to counter obstacles to innovative approaches resulting from restrictive processes. Its thinking is that quality cannot dispense with innovation since only innovation can ensure the quality appropriate to the market and its needs. The DGQ suggests that companies adopt the following orientation:

- Show a readiness to take risks and anticipate changes instead of merely reacting to them.

- See structures, methods and processes as a means to an end. They are important in the production of high-quality products and services. At the same time, they must demonstrate a certain flexibility to avoid barriers to innovation.

- Employees are the main source of potential innovation within a company. Their ideas should be received openly. Only managers who cultivate a culture of openness and tolerance will maximize their company's innovative potential.

So what is quality? It is more than the elimination of defects. It defies simple judgments and it is impossible to evaluate outside of a specific context. Quality ultimately expresses an attitude that managers, in particular, have to model within the company. Quality is thus one thing above all else: a management philosophy. ◎

IMPROVED QUALITY –> IMPROVED PRODUCTIVITY –>
FALLING COSTS –> COMPETITIVE PRICES –>
SECURE MARKET SHARES –> STABILIZATION OF THE COMPANY –>
SECURE JOBS –>
SECURE COMPANY

THE DEMING CHAIN REACTION

Based on the scientist's 14 points, the Deming Chain Reaction traces job security and the survival of the company back to the existence and continual improvement of quality. The individual components of the chain are:

IMPROVED QUALITY ▸ IMPROVED PRODUCTIVITY ▸ FALLING COSTS ▸ COMPETITIVE PRICES ▸ SECURE MARKET SHARES ▸ STABILIZATION OF THE COMPANY ▸ SECURE JOBS ▸ SECURE COMPANY.

According to Deming, there are no shortcuts for this chain reaction.

Deming calls violations of these 14 points the **seven deadly diseases,** which can bring especially negative consequences in their wake and ultimately lead to the failure of an entire management program.

THE SEVEN DEADLY DISEASES OF A MANAGEMENT SYSTEM (W. EDWARDS DEMING)

1. The lack of a clear-cut organizational purpose
2. A focus on short-term profits
3. Annual evaluation, performance assessment, personal assessment systems
4. High turnover in the organization's leadership, jumping from company to company
5. The use of statistics by management – without consideration of values that are unknown or unquantifiable
6. Excessive social costs
7. Excessive costs due to product liability judgments

QUALITY – VARIOUS DEFINITIONS

JOSEPH M. JURAN'S CONCEPT:

Juran, one of the leading quality experts in the United States, defines quality as "fitness for use". Based on this definition, quality refers to a product or service's suitability for use of in the eyes of a company's customers. The assessment of quality is derived from customers' individual needs. Management's task is the initiation and implementation of a process to improve quality within the company. According to Juran, an exclusively production-oriented definition of quality runs the risk of identifying changes in the behavior of customers too late and potentially neglecting the impact of competition. To achieve "fitness for use", a company must introduce a series of quality-related activities, which Juran explains with the help of the quality spiral (the cycle of market research to product development, production and sales, and then back to market research). A special importance is attached to comprehensive training programs on quality improvement at all management levels. Furthermore, he holds the view that quality can be raised continually and in the long run with improvement programs implemented annually.

ISO (DIN) 9000 - 9004 (ISO):

In Germany, the Frankfurt-based German Society for Quality (DGQ) has participated in the design of DIN standards and defines quality as the totality of characteristics and features of a product or an activity that relate to their suitability for satisfying specified requirements (DIN 55350 Section 11: Quality Assurance and Statistical Terms, Basic Terms, Berlin). The series of standards holds that quality should be evaluated and assessed in relation to the requirements, which may encompass a large number of characteristics and features. A quality assurance system should meet quality requirements cost-effectively and strengthen the company's competitive position. The literature discusses the evaluation of the ISO series of standards in very different ways. Nevertheless, its growing importance to the domestic European market and the intensification of international, global interdependencies is undisputed.

THE 14 POINT MANAGEMENT PROGRAM OF W. EDWARDS DEMING

1. Create a resolute company goal targeting the continuous improvement of products and services.
2. Apply a new philosophy to ensure business stability.
3. End the need for and dependence on 100-percent inspection to achieve quality.
4. End the practice of doing business based on the lowest price.
5. Constantly look for the causes of problems in order to continuously and repeatedly improve all systems in manufacturing and services, as well as other activities within the company (continuous improvement).
6. Institute modern methods of regular and follow-up training directly in the workplace and for the particular job.
7. Use modern methods of leadership that focus on helping people (and equipment) do their work better.
8. Eliminate the atmosphere of fear.
9. Eliminate boundaries between individual departments.
10. Eliminate the use of appeals, posters and admonitions.
11. Eliminate performance specifications that set quotas (standards) and goals for employees.
12. Eliminate all obstacles that remove the right of employees and supervisors to be proud of their work.
13. Create a radical training program and encourage the self-improvement of each individual.
14. Clearly define senior management's lasting obligation to continually improve quality and productivity.

FACTS & FIGURES

WHERE DO PEOPLE LIVE THE BEST?

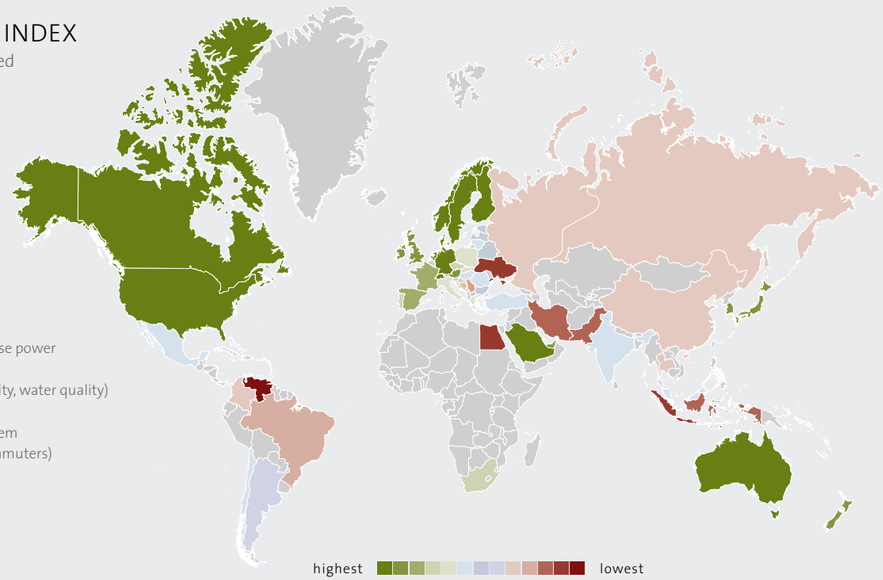
Quality of life is a multilayered term. The operators of Numbeo.com are trying to create an index for it based on data that users can generate and transmit themselves. Of the nine factors that flow into the "Quality of Life" index, the environmental situation and security are given the greatest weight. Data from 57 countries and 97 cities are currently available. Only European, North American and Australian cities have made it into the top 10 ranking.

WHAT IS IMPORTANT FOR QUALITY OF LIFE?

The Scandinavian countries above all achieve high scores for quality of life due to their clean air and water. In Egypt, China and Iran, this aspect is a substantial detriment. The citizens of South Korea feel the safest, while the fear of criminality or internal unrest most disturbs Venezuelans, South Africans and Brazilians. Denmark is far ahead with its health system – Venezuela, the Ukraine and Iran score the worst. Commuters incidentally have the easiest time in Bosnia-Herzegovina, Slovenia and Switzerland – in contrast to Egypt, Japan and Turkey.

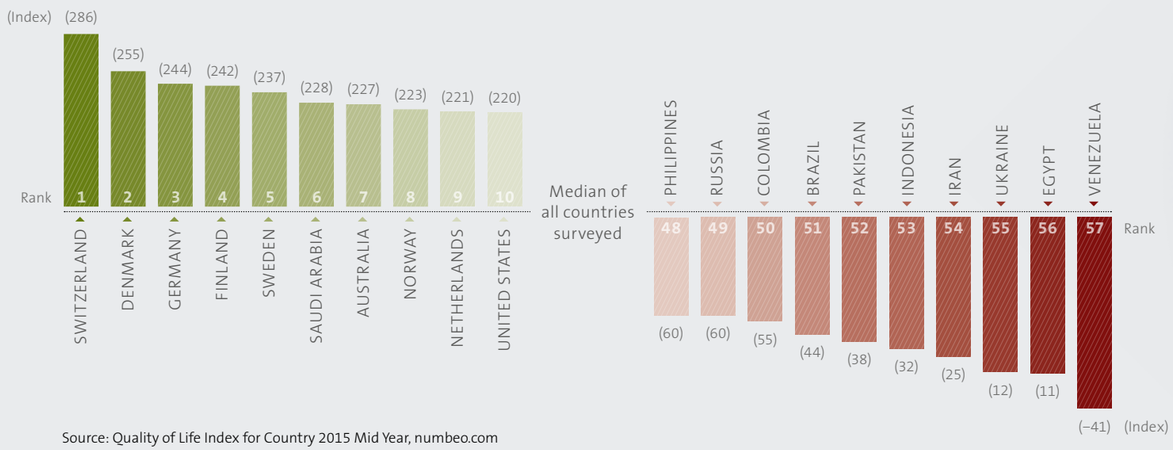
QUALITY OF LIFE INDEX

57 countries were surveyed



Calculated from the factors:

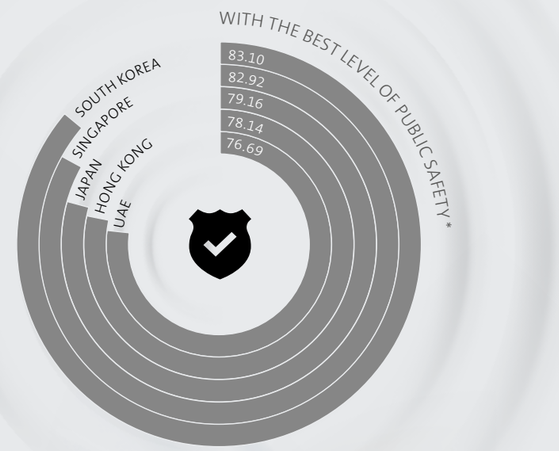
- Cost of living and local purchase power
- Property and rental charges
- Environmental quality (air purity, water quality)
- Crime rate
- Quality of the health care system
- Traffic situation (times for commuters)

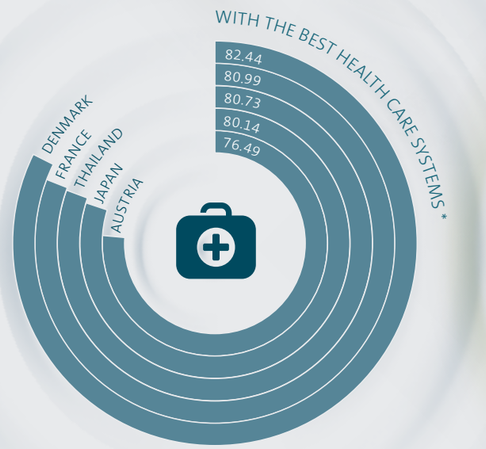


Source: Quality of Life Index for Country 2015 Mid Year, numbeo.com

THE TOP 5 COUNTRIES

* Evaluation based on a 100-point scale





Source: Quality of Life Index for Country 2015 Mid Year, numbeo.com

FACTS & FIGURES

CERTIFIED QUALITY

Designations of origin, manufacturer trademarks and signets have been known since Greek antiquity. Their job is to guarantee a certain level of quality. In 1887, Great Britain introduced the requirement to attach the label “Made in Germany” on the country’s goods – to protect British consumers from competing German products deemed to be inferior. Due to the value and workmanship of German goods, however, the “Made in Germany” label has become a certification of quality. Today bestowing quality seals is mainly the job of independent institutions and helps to orient customers of all kinds.

QUALITY MARKS

OSPITALITÀ ITALIANA

JORDAN QUALITY MARK

OFFICIAL QUALITY SEAL OF THE SOVIET UNION

FAIR TRADE CERTIFIED MARK

FSC

RAL SEAL OF QUALITY

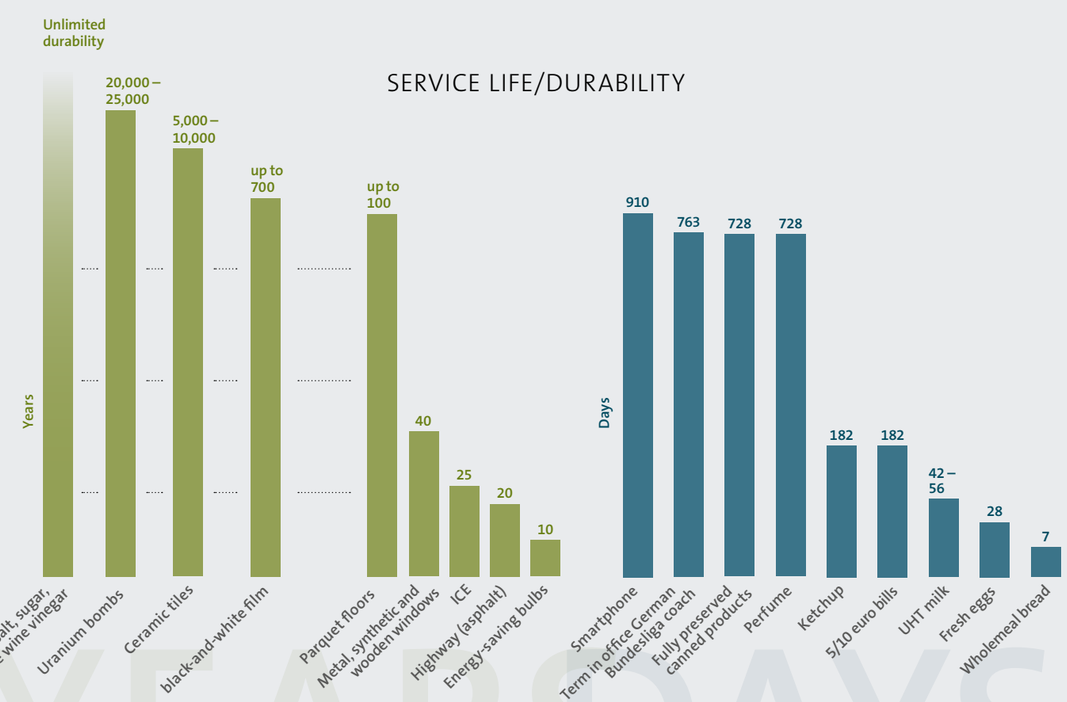
STAINLESS STEEL

TÜV CERTIFICATION ISO 9001

JAPANESE INDUSTRIAL STANDARDS

LONG LIFE

Longevity is often a crucial quality factor. At the same time, individual longevity depends heavily on the reference value. The standard for consumer goods is different from those for machines or construction projects. This variable definition of longevity also applies to nature. Still, we marvel at the outliers: Johann Wolfgang von Goethe could have released the world’s oldest koi into a pond. Napoleon Bonaparte as a child could have gotten excited about the oldest tortoise alive today. Incidentally, the best prerequisites for a ripe old age found in nature are a strong genetic constitution, an energy-conserving metabolism, vegetarian nutrition and a peaceful life. Attributes that hardly apply to the Scottish King Macbeth. But he could have celebrated his coronation in 1040 with beer from the Weihenstephan brewery in Freising, Bavaria – the world’s oldest brewery.



KARL-HEINZ WESTHOFF

FREUDENBERG'S PRINCIPLES FORM THE FOUNDATION FOR ITS QUALITY PHILOSOPHY.

Our actions are determined by the need to proactively identify, understand and satisfy the needs and expectations of our customers. As a conscientious supplier with a distinct passion for detail, we make indispensable contributions to the success of our customers. We create the greatest possible benefits for them with our global presence and commitment to quality, service and reliability.

ZERO-DEFECT TOLERANCE

IT IS THE GREAT DIVERSITY OF INDUSTRIES AND PRODUCTS THAT CHALLENGE KARL-HEINZ WESTHOFF THE MOST. TO MASTER THE COMPLEXITY, THE HEAD OF QUALITY MANAGEMENT AT FREUDENBERG SEALING TECHNOLOGIES RELIES ON ONE FACTOR IN PARTICULAR – PEOPLE.

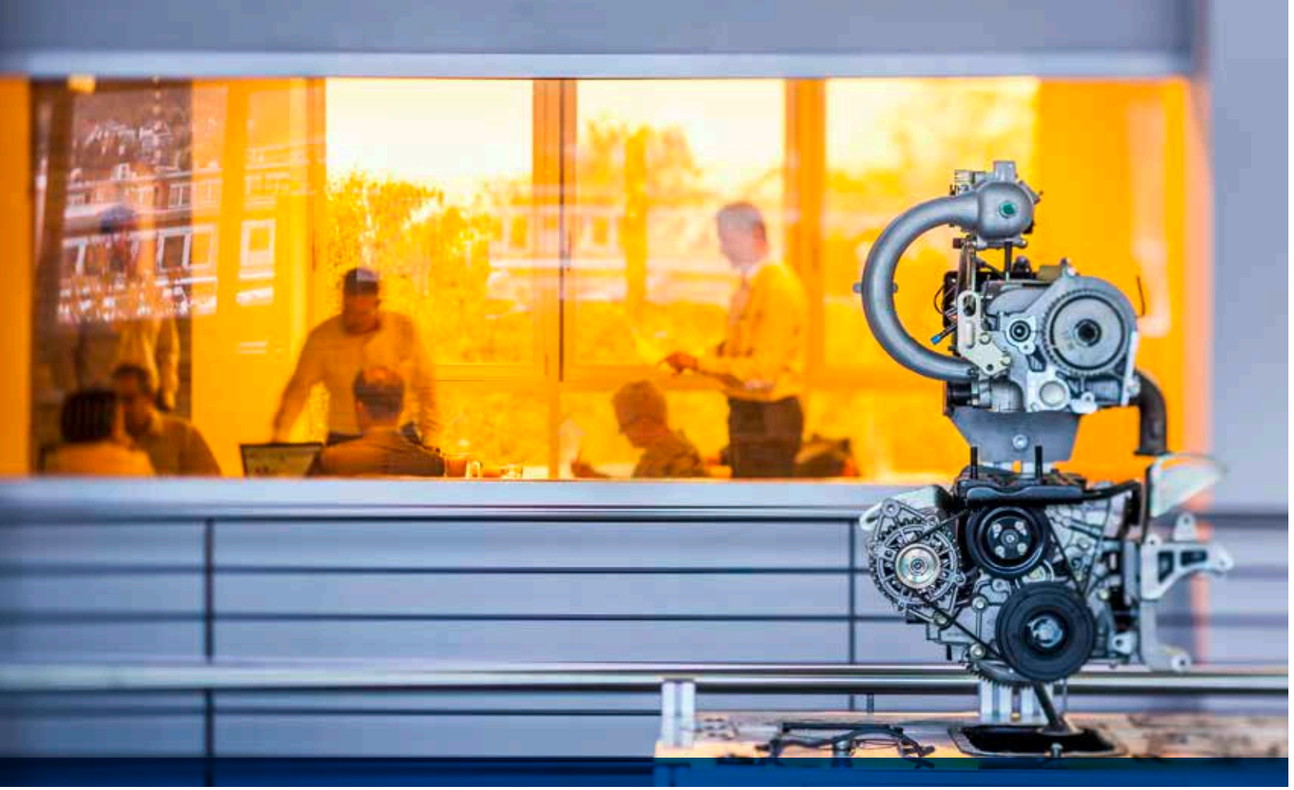
From O-rings for ABS systems or injection nozzles produced in the hundreds of thousands, to the diaphragm for a computer tomography system, all the way to made-to-order seals for a tunnel boring machine, the requirement to precisely meet customer expectations and deliver high quality is always the same. But the industries and the development and production methods differ substantially. Karl-Heinz Westhoff always finds it exciting to manage this diversity and provide stable processes for it.

Today, Westhoff can look back on a 32-year career in quality management and other leadership positions, including 23 years spent in the auto industry. For the past nine years, he has been responsible for quality management as well as occupational health and safety and environmental protection. He describes the switch to a conglomerate as enriching. "I simply wanted to see something different, and the variety of requirements and different industries could hardly be greater than here at Freudenberg."

The 56 year-old is proud of the fact that he has made a substantial contribution to the systems used by Freudenberg to manage quality – with successes that are not merely reflected in error rates but above all in extremely positive customer evaluations. "For 250,000 different items, 400 million seals manufactured per month and more than 40 manufacturing locations in 15 countries, we need a highly effective quality management system to ensure that the goods arriving at the customer meet expectations, despite the immense complexity."

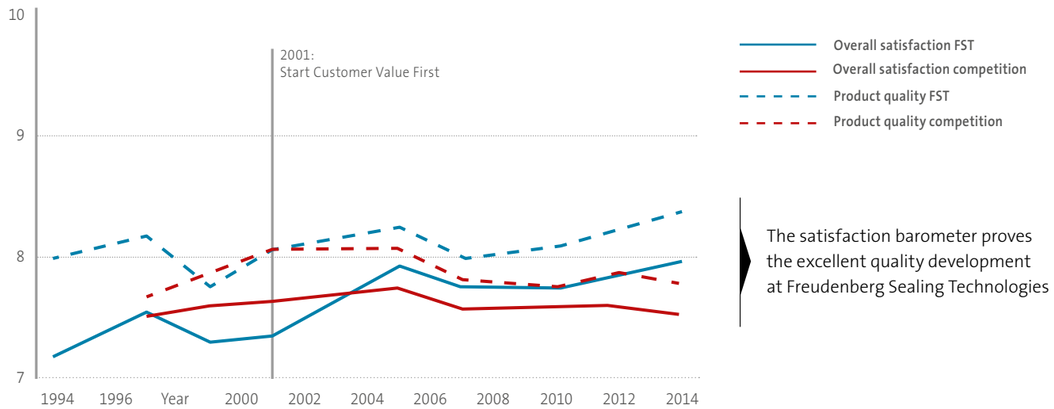
The secret – as Westhoff sees it – consists of two dimensions. The first is the radical uniformity of quality management as an over-arching process into which all areas of the company are integrated. And the second is the awareness of all employees that they are the bearers and executors of a comprehensive quality philosophy in their jobs at all times.

Accordingly, the quality manager sees above all the consistency of training for each employee as a differentiating characteristic of the Freudenberg Sealing Technologies quality philosophy. "Anyone coming into the company attends an induction seminar at which quality is one of the main themes. This is of crucial significance even for our managers. As a result, we regularly offer training with 'leadership in production' as its theme, and hold problem-solving workshops. We do everything we can to ensure our employees understand that they make a major contribution to the attainment of the highest quality."



EVALUATION OF THE PERFORMANCE ON A SCALE FROM 1 TO 10

Best competitor from the customers' perspective



The satisfaction barometer proves the excellent quality development at Freudenberg Sealing Technologies

Westhoff is convinced that a system is only as good as the employees who practice it. So he considers experience and knowledge to be crucial components. "We value technical expertise highly – whether it is from training or education." Employees with the right qualifications occupy every area of activity.

But this is not merely a matter of expertise. Identification with the company and its products is also a decisive building block in achieving quality. This begins with ergonomically optimized, safe work processes and measures to assure employee health – because occupational safety, concentration and fitness are also components of quality. Some great examples are the "We all take care" projects submitted by individual employees or departments companywide and honored with awards by a jury. "For us, this lets people experience the fact that occupational safety, health and environmental protection are firmly anchored in our company as a value-oriented enterprise," Westhoff explains. And this carries over into how the company appears in the public eye. "The question 'What does our company do for society?' is also a quality issue because, for many employees, the social responsibility of their employer is a characteristic to identify with." For example, Freudenberg Sealing Technologies chose the inclusion of people with disabilities into its Schwalmstadt facility in 2014 as a model project in the "We all take care" program.

The importance of employees to quality is shown in the talent management process. It is increasingly becoming a key strategic function to open things up, highlight career paths and support employees so that they can work in the areas best suited to them.

But outstanding results in the world's "key currency of the quality manager" – PPMs (parts per million, which are used to indicate the number of defects in a million manufactured parts) – cannot be achieved solely with expertise and an identification with the company. Successes are only possible with stable processes – the second dimension of the quality secret. Westhoff can illustrate this with justified pride. "Our PPMs have been going down for years and are currently in the single digit range. In some production areas, we now even expect PPBs – parts per billion."

The foundation is always the quality management process, which can be shown in simplified form in three stages at Freudenberg Sealing Technologies: development, industrialization and series production. So it doesn't matter whether the part is a valve stem seal produced in the millions or the customized production of the main shaft of a wind turbine gearbox. At the start, there is a customer requirement for which a technical solution is developed and a production plan is worked out – until series-production parts can ultimately be produced and delivered.

Westhoff explains the philosophy: "The core question is always, 'How do I limit risks?' To get an answer, the methods are adapted to the specific project. For single-item production, I might choose over-specification to be on the safe side. For a series-production product, on the other hand, statistical process control comes into play. But we always have to provide evidence that we can mass produce a product that precisely meets the specifications." It is even part of the Freudenberg Sealing Technologies quality philosophy to turn down a project if this cannot be guaranteed.

DEVELOPMENT

So it is very important to communicate clearly as early as the first phase, which is development. A precise definition of the specifications is the first cornerstone of good quality. "Our key account managers are also continually trained in quality," says Westhoff. "Particularly in the early phase of the project, it is important to

"WE ARE FIRMLY CONVINCED THAT THE LONG-TERM ORIENTATION ENABLED BY THIS IS A SPECIAL STRENGTH BENEFITING OUR CUSTOMERS AND PARTNERS. FOR THIS REASON, OUR READINESS TO TAKE RISKS AND THE SCOPE AND SPEED OF OUR STRATEGIC DEVELOPMENT WILL BE MARKED BY PRUDENT ENTREPRENEURSHIP AND FINANCIAL SOLIDITY IN THE FUTURE AS WELL."

ask the right questions and to obtain as precise a picture of the requirements as possible. Otherwise, we cannot assess whether a particular request is even feasible." In doing so, the company's wide-ranging basic research is helpful. Experience from other applications and industries often makes it possible to identify critical aspects of the development early on – before the customer is aware of them. Each new development must make it through six "quality gates" before production can begin.

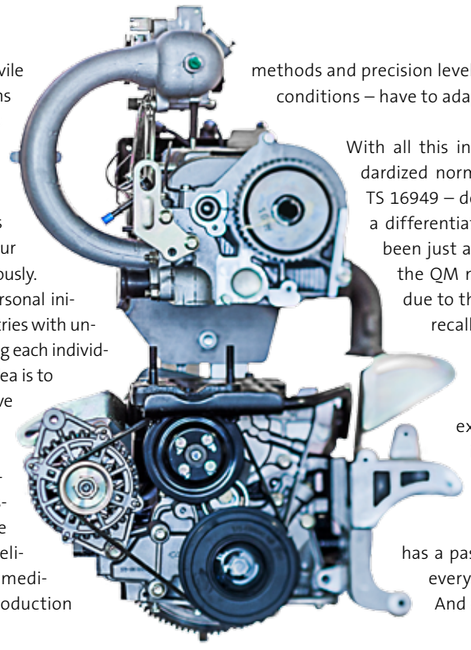
Westhoff notes with concern that nearly as many attorneys as engineers are involved when new projects are launched. "In shaping the contract, it is extremely important for us to precisely define what we are promising the customer – and what we are not promising. In this way, we can avoid the possibility that malfunctions running into thousands of euros per vehicle will occur because of a seal costing just a few cents." At the same time, the financial risks are rising steadily because the production of one systematic error can now affect an enormous number of vehicles due to global platform strategies.

INDUSTRIALIZATION

The second phase, industrialization, involves primarily the development of stable production processes to guarantee uniformly high quality. This phase is characterized by comprehensive process analyses with test runs up to maximum capacity. Risk mitigation is the overriding priority here as well, and stable processes have to be developed to achieve two goals: volume and quality.

SERIES PRODUCTION

The quality process in no way comes to an end at the series-production stage. Over the entire lifecycle, processes are constantly checked and – where needed – warranty cases analyzed. This includes the formation of a "rapid reaction force" to handle problems as well as the option of tracing the path of each individual component from the field back to production – to identify the causes of failures as quickly as possible.



Westhoff does not think much of a servile adherence to pan-regional specifications and instructions. "Cultural differences necessitate a certain level of process adjustment," he says. "In Germany, it is generally the case that a highly trained employee can read designs and knows what to do. If we are too restrictive in our specifications, we are not taking him seriously. Then we can no longer count on his personal initiative. On the other hand, in other countries with unskilled workforces, instructions describing each individual hand movement make sense." The idea is to move closer to human beings and achieve quality outcomes through flexibility.

Quality standards have risen constantly in recent years. For example, increasingly high injection-pump pressures are leading to components that are so delicate that residual contamination immediately leads to a system malfunction. Production methods and precision levels – for example under clean-room conditions – have to adapt to these requirements.

With all this in mind – in view of globally standardized norms such as ISO 9001, ISO 9100 or TS 16949 – does Westhoff still consider quality a differentiating characteristic? Or has it long been just an entry ticket? This is not hard for the QM manager to answer – and not just due to the steadily rising number of global recalls. "There is a growing problem with quality in the automotive industry. But customer surveys show that satisfaction with our quality is extremely high. The processes are important – something like a cooking recipe. But a decisive factor in whether food tastes good or great is whether or not the cook has a passion for cooking. At our company, every employee has a passion for quality. And our customers realize this." ◎

QUALITY: EIGHT COUNTRIES – EIGHT PERSPECTIVES

WITH QUALITY DEFINED IN SUCH A MULTILAYERED WAY, INDIVIDUAL PERCEPTIONS OF THE CONCEPT ARE SURE TO VARY WIDELY. ESSENTIAL WANTED TO KNOW WHETHER THERE ARE ALSO NATIONAL DIFFERENCES AND ASKED EIGHT PEOPLE FROM DIFFERENT COUNTRIES ABOUT THEIR EXPERIENCES AND THEIR UNDERSTANDING OF QUALITY. THEIR ANSWERS ARE IN NO WAY REPRESENTATIVE, BUT THEY OFFER INTERESTING INSIGHTS. AND IF QUALITY MEANS SOMETHING ENTIRELY DIFFERENT TO YOU, PARTICIPATE IN THE EXPERIMENT YOURSELF AND FILL IN THE ONLINE QUESTIONNAIRE WITH ITS NINE QUESTIONS ON QUALITY.

1 WHAT DO YOU PERSONALLY UNDERSTAND QUALITY TO MEAN?

GER: Quality can be found in anything. If you want to achieve high quality, you have to start with the design. For example, there can be no compromise when it comes to the quality of clinical data.

CHN: To me, quality is something like a standard that guarantees safety, durability and performance.

USA: I understand the term quality to mean that a product meets a certain standard and that it must be better than average in comparison with similar items.

JPN: Quality is reflected in how developed and well-thought-out something is, how close to perfection – and also how intensively it was cultivated and tested before it was released.

IND: I associate certain perceptions with it – such as excellent product experiences, well-thought-out functionality and absolute reliability. But, beyond a certain level, it must also be tied to a pleasant surprise for me as a user.

ITA: To me, quality above all means durability and reliability. The fact that something functions over a long period and is designed in a well-thought-out way – but especially that it fulfills its intended purpose and is tailored to particular needs. When it comes to services, I think the issues are precision and a consistency between what is promised and what is delivered.

FRA: I mainly see it as a correspondence of the product's characteristics and functioning during its use with what was promised in the sales process. But quality also relates to safety: the idea that no product should endanger the consumer in anyway. As I see it, products or services are high quality if they meet expectations that may not even have occurred to me. A quality product must also fulfill its environmental responsibilities and be ecologically acceptable. Durability is also a component of sustainability. Quality means something different to companies: being in a position to sell products at precisely optimized costs and times so they fully meet the customer's requirements.

SWE: Quality exists when you have bought a product and you realize all the promises made to you earlier have been kept and that you are completely satisfied with your choice.

2 WHAT OBJECT DO YOU PERSONALLY OWN THAT YOU ESPECIALLY ASSOCIATE WITH QUALITY? TO WHAT ASPECT DO YOU ATTACH THE QUALITY OF THIS OBJECT?

GER: My audiophile music system. Its design and haptics and, above all, the music it produces, are outstanding.

CHN: My leather purse. Its material is genuine leather, which lasts a long time and keeps its shape and elasticity even after years and years. In addition, the zipper and the clip on the strap have still not worn out or rusted after years of use.

USA: My Echo speaker system. Its capacity to learn and thus its capacity to continually develop technically.

JPN: My digital system camera, along with camera lenses and digital watches. The camera – not an SLR camera – and the lenses, due to the quality of their design and the photographic results; the watches due to their precision and robustness.

IND: My iPhone, because of its design, technical features and reliability.

ITA: I have a Yamaha piano that, of all my possessions, is the best example of a quality product. I like its discreet and elegant design and, once you understand the technical details of "sound production", you really appreciate the fact that everything is precisely designed and configured to do its job in a very complex and well-orchestrated system.

FRA: My old winter coat. The coat has not just fulfilled my expectations and requirements – it has exceeded them. I didn't expect this. I didn't notice many of its features, such as its breathability or the vents in the arms, when I bought it. I still like it. It offers outstanding wind protection and is even waterproof – at the zippers, too. It also has a large hood and numerous pockets. It is just very functional – even after frequent use. The coat is also very robust. I have had it for seven years. So it's a coat that is intelligent and long-lasting.

SWE: My washing machine, my car and the clothes I buy. They all cost a bit more at the time of purchase, but it pays off over time. I save money because they hold up better.

GER: GERMANY / CHN: CHINA / USA / JPN: JAPAN / IND: INDIA / ITA: ITALY / FRA: FRANCE / SWE: SWEDEN

3 HAVE YOU EVER HAD A PERSONAL EXPERIENCE WITH AN ITEM WHOSE QUALITY REALLY DISAPPOINTED YOU?

GER: Yes, with the quality of the red paint on a midrange automobile.

CHN: Yes, a bracelet that I bought new and began to rust within three months.

USA: Yes. A grocery store in our area had products in its meat and sausage department that were labeled with a certain seal of approval. But the meat's quality left much to be desired and I will never buy it again – at any price.

JPN: During a trip to a developing country, my AC transformer broke down due to an unreliable power supply –in an inexpensive guesthouse.

IND: Less so with a particular item. But I've had a great many disappointing experiences with quality of service.

ITA: Very often, especially with regard to services. City administration and public servants I have dealt with are very disappointing in this regard. Their attitude doesn't necessarily give you the feeling they are being helpful. The employees are not really trained either. They often know too little about things they should really know and cannot handle complicated issues very well. I consider this to be a classic example of bad quality: when there is no consistency between the actual purpose of a service – to help me solve a problem – and the potential or organizational requirement to actually do so.

FRA: The family van we bought new. The sliding roof was never properly sealed. And the ventilation system broke down after just six months – and that was with normal use.

SWE: Yes, you actually expect quality from brand names – but I had a quite expensive pair of brand-name jeans rip the second time I put them on.

4 HOW IMPORTANT IS "QUALITY" IN YOUR LEISURE TIME?

GER: In my free time, I expect high-quality products above all to increase my enjoyment of life.

CHN: First and foremost, for my food to have fresh ingredients. Furthermore, I associate quality in my leisure time with good, unpolluted air. It also includes consumer goods and furnishings of all types that have an ergonomic design and are not too expensive.

USA: Mainly enjoyment, whether I am busy or doing nothing.

JPN: Good food.

IND: It mainly means not being ruled by the clock and enjoying every moment.

ITA: In my free time, quality is mainly expressed in "aha" experiences, wonders or surprises. I perceive things as high quality if they produce thoughts, new mental connections, ideas or feelings in me. It could be a film or – in foods – a new dish. The quality does not necessarily reside in the item or its ingredients, but rather in how everything was newly assembled or arranged to create something new and distinct that people didn't know before.

FRA: Quality is an important factor – even in leisure activities. In the end, free time should be fun. But when you take advantage of a recreational opportunity and it doesn't match the experience you wanted, it isn't fun anymore. And then you can't enjoy your free time.

SWE: Travel; provided the organizer offers special arrangements for families, and provides babysitters or really good options for play.

5 DOES THE TERM "QUALITY" HAVE A DIFFERENT MEANING IN YOUR PROFESSIONAL AND PERSONAL LIFE – AND IF YES, WHERE YOU SEE THE KEY DIFFERENCES?

GER: No, even if quality is mainly associated with safety in my profession.

CHN: I have worked in the auto industry for years. When it comes to quality, I think first about materials that have been tested and highly developed according to specifications – and technical solutions that carry out their functions reliably and for as long as possible.

USA: I separate my professional and private lives – for a variety of reasons. I work a lot and deal with high expectations for quality. But when I'm done with work, life is there to be enjoyed. That's when you should relax – otherwise you will quickly be stressed out.

JPN: No.

IND: Not really. Whatever I associate with quality in my professional life, I relate to it in the same way in my personal life.

ITA: Yes. I see a difference in each context. In my profession, quality tends to mean functionality and respect for the specifications that are provided. When a service adheres to the required specifications or a product does its job, I would call that quality. In my personal life, I expect a little more. Here, I connect quality with more than the completion of the job; I expect a certain something extra – a special feeling.

FRA: To me, quality has the same meaning in my professional and personal life.

SWE: In my professional life, the main issue is the balance between work and leisure – and the fact that the office offers the best possible conditions to do the job well. In my personal life, the issue is having "quality time" with family and being able to buy products for the family that enable a worry-free life.

6 IS THERE SUCH A THING AS TOO MUCH QUALITY?

GER: No.

CHN: I cannot imagine that.

USA: That depends on what the market wants. I think the Concorde was a good example of "too much".

JPN: I am embarrassed when people overdo service – to ostensibly offer me more quality.

IND: As a consumer, I would say no. In my professional life, on the other hand, my decisions involving quality are often determined by factors such as deadline or cost pressures. But I am aware of the times when we were unable to deliver the best possible quality due to situational factors.

ITA: I believe there cannot be an excess of quality without reference to the customer or user. There may be such a thing as "inappropriate" quality – in relation to the particular context. For example, one meal can meet the quality standard for food in a school cafeteria, but be inappropriate for a wedding reception. In the same way, the catering service at such a celebration would be an example of "wasted quality" for a picnic.

FRA: Probably not for the customer, as long as the relation between quality and price is right. If you handle this relationship especially well, you have a clear competitive advantage. But from the company's standpoint, there can in fact be an excess of quality. In complex organizations, this can easily happen if departments or employees are not working toward the defined goals or target groups and thus are not properly allied.

SWE: When quality involves costs, there can certainly be limits to what I am ready to pay for. I would like a feeling of quality – which to me does not necessarily have anything to do with luxury.

7 IN YOUR VIEW, WHAT ARE THE INDUSTRIES WHERE A HIGH LEVEL OF QUALITY IS ESPECIALLY IMPORTANT?

GER: In all the life sciences, the food industry and in the automotive and aviation industries.

CHN: In aviation, the auto industry, in buildings and food processing.

USA: In all fields, because there is extremely tough competition everywhere.

JPN: In cameras, jewelry, food and the medical field.

IND: Education, health care and food.

ITA: Quality is definitely important for durable goods such as vehicles, buildings and infrastructure. Also, anything directly involving people is vitally important – such as health, education or the judicial system.

FRA: In the energy industry, mainly with regard to nuclear energy. But quality also plays a crucial role in agriculture and the food industry. The same applies to the environmental industry. And, of course, for the automotive and aviation industries.

SWE: In the auto industry, it is important to trust the brand that you buy and be able to rely on the fact that it has kept its promises regarding safety and quality.

8 IS THE AWARENESS OF QUALITY A QUESTION OF MENTALITY OR CAN YOU LEARN IT?

GER: Every person learns it from experience

CHN: I am convinced that a quality orientation can be learned.

USA: The awareness of quality is acquired by making comparisons. There is always a line that you want to reach or surpass.

JPN: I think you can learn it.

IND: It is an awareness that you certainly can learn.

ITA: In my view, you can learn quality. Appreciating quality has something to do with how well you are educated in shaping the characteristics of a product or service. And how you basically choose from various possibilities and options. A number of people have an inborn interest in details, but a quality consciousness can be awakened in any individual – also through the right messages and effective communication.

FRA: I believe that a person's quality consciousness is inborn. At the same time, it naturally comes in very different forms – everyone defines quality differently. But I think that you have to have a certain awareness of quality when you are involved with the production of a high-quality item. This consciousness bears the stamp of the person's upbringing. It can also be developed and nurtured later – best of all when management sets the example.

SWE: I believe it can be learned.

9 WHAT COUNTRIES DO YOU ASSOCIATE MOST WITH QUALITY?

GER: Germany, Japan, Switzerland.

CHN: Germany for cars, Japan for electric household appliances – and France for outstanding wines.

USA: I would generally tend to choose the USA – due to the multitude and variety of products. But I believe there are plenty of quality products from other countries.

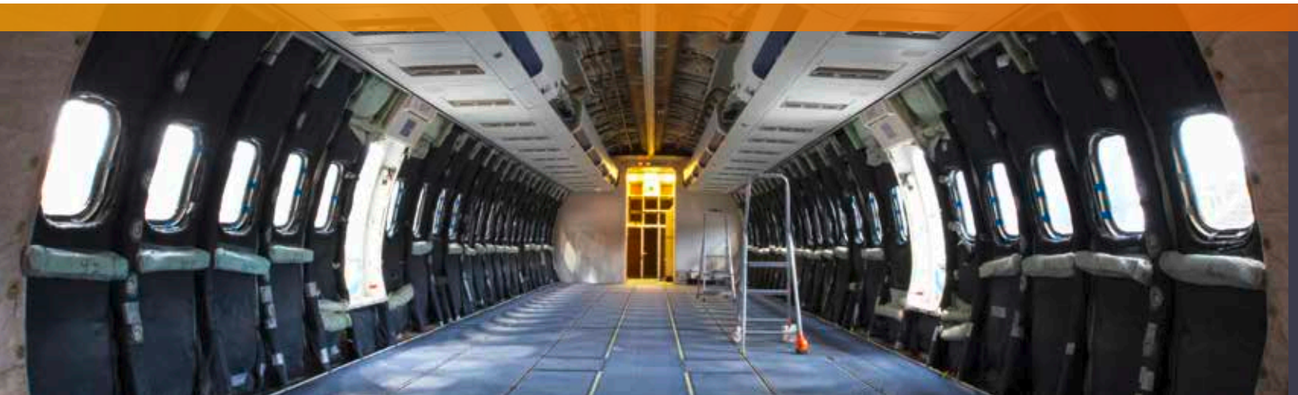
JPN: That's hard to answer, but I would most associate quality with Japan – even though everything isn't perfect here right now.

IND: Germany, Japan, Switzerland and Italy (for certain lifestyle accessories such as shoes, gourmet foods, purses or fashion).

ITA: Switzerland, Germany and Denmark– the U.S. as well in a number of aspects, for example the service in restaurants. In other areas, I include Italy, for good food, for example. Sometimes quality relates to the alternatives that are available to you. I have installed water lines in Tajikistan, and lines from Iran were considered good until we received lines from Russia, which were substantially better. So in many cases, quality should not be seen as an absolute but rather as a relative concept.

FRA: France, Germany, Switzerland, the Netherlands, the U.S., Canada.

SWE: Germany for cars, Sweden for design and Volvo cars, and France for wine and good food. ©



INFORMATION ON INTERVIEWEES:

GER:	Dirk (director, Global Program Data Management)	**IND:**	Jain (manager, Program Office)
CHN:	Na (senior manager, Service Marketing)	**ITA:**	Luca (environmental engineer)
USA:	Brad (sales manager)	**FRA:**	Clara (project leader, SAP PLM)
JPN:	Nakata (jewelry designer)	**SWE:**	Susanne (communications manager, Product & Service)

MATTHIAS WISSMANN

Born April 15, 1949 in Ludwigsburg

1973–1983 Federal Chairman of the "Junge Union"

1993 Federal Minister for Research and Technology

1993-1998 Federal Minister, Transportation

Since 2007 VDA President

INTERVIEW

ESSENTIAL ASKED THE PRESIDENT OF THE GERMAN ASSOCIATION OF THE AUTOMOTIVE INDUSTRY (VDA) ABOUT THE QUALITY DEMANDS ON AUTOMAKERS AND SUPPLIERS.

MR. WISSMANN, WHAT CONSTITUTES QUALITY FOR YOU PERSONALLY AS A DRIVER?

WISSMANN: To me, quality means the highest possible intrinsic value, efficient engines, the highest safety standards, outstanding comfort and a fascinating design. In my view, "fascination with the automobile" does not just involve a rational process of getting from point A to point B as quickly as possible – but considerable emotion as well. For many people, their cars continue to be expressions of their personality. This applies to their external appearance and their interior equipment. Furthermore, cars today have to do more than just drive and look good; they have to be a "mobile communication platform" with continual and secure access to the Internet and attractive assistance systems that make driving both easier and safer.

IN CUSTOMER SATISFACTION STUDIES LIKE THE J.D. POWER REPORT, GERMAN CARS ARE CERTAINLY WELL REPRESENTED – BUT ARE RATED NO BETTER THAN, SAY, KOREAN CARS. NONETHELESS, GERMAN CARS ARE SEEN WORLDWIDE AS PREMIUM PRODUCTS AND INSPIRE A SPECIAL LEVEL OF DESIRABILITY. WHAT IS THE QUALITY PROMISE THAT GERMAN CARS ARE MAKING WORLDWIDE?

WISSMANN: The quality successes of German automobiles are the result of systematic, sustained efforts by company managers and employees to continually improve the quality of their products and processes across the entire value chain. "Made in Germany" is a quality seal of approval to which we are always committed. Incidentally, this high quality standard applies to all the production facilities of our manufacturers and suppliers worldwide.

WHAT IS THE IMPORTANCE OF THE GERMAN SUPPLIER INDUSTRY IN THIS CONTEXT? ARE GERMAN AUTO SUPPLIERS "PREMIUM" AND IS THE END-CUSTOMER INTERESTED IN THAT FACT? WHY AREN'T GERMAN SUPPLIERS PERCEIVED AS GUARANTORS OF QUALITY TO THE SAME DEGREE?

WISSMANN: Suppliers generate 75 percent of the added value of an automobile and bear a substantial share of the development costs. With their technological innovations, small- and medium-sized suppliers directly underscore the strong reputation of Germany as a center of automotive manufacturing. Many of them are "hidden champions" because they – often unnoticed by the public – are the global market leaders in their technological field. Their know-how is indispensable to the development of driver assistance systems, such as lane departure warning and emergency braking systems, the optimization of conventional powertrains and the further development of alternative drive technologies. They provide a wide variety of ideas and inventions that customers later find in their cars and that make driving safer, more environmentally friendly and more comfortable.

QUALITY CONSISTS OF SEVERAL DIMENSIONS – SUCH AS DURABILITY, FUNCTIONAL RELIABILITY AND EVEN INNOVATION. IN YOUR VIEW, WHICH OF THESE DIMENSIONS ARE CRUCIAL TODAY?

WISSMANN: In the race to produce the best and highest-quality products, our companies' capacity to innovate plays a crucial role. Every year, our manufacturers and suppliers invest more than 30 billion euros in research and development. The largest share of this sum continues to fall to Germany. The German auto industry provides one third of Germany's total industrial investment in research. Nearly 93,000 employees are active in research and development at manufacturers and suppliers. Companies must maintain their capacity to innovate – this is the precondition for international success. To guarantee it, we need a smart policy for Germany as an economic center that does not weaken industry or small and medium-sized companies.

IN THE FUTURE, QUALITY MAY NOT HAVE VERY MUCH TO DO WITH THE HARDWARE IN THE AUTOMOBILE BUT RATHER WITH THE SOFTWARE'S INTELLIGENCE AND THE ABSENCE OF DEFECTS – ESPECIALLY WHEN YOU THINK ABOUT THE NETWORKED AUTOMOBILE OR AUTONOMOUS DRIVING. WHAT CHALLENGES ARE EMERGING FROM THIS?

WISSMANN: The technical innovations for networked and automated driving – which the German auto industry is tackling diligently – will bring more progress on safety, the environment and comfort. The direction is clear: We want to come closer and closer to the vision of accident-free driving. The new technologies require massive increases in our know-how in all the IT fields. The classic expertise in powertrain, body and production technology is no longer enough. We want to attract the best people, so Germany remains attractive as a center of technology.

RECALLS HAVE RECENTLY SHAKEN THE AUTO INDUSTRY WORLDWIDE. IT IS STRIKING THAT THE NUMBER OF AFFECTED VEHICLES KEEPS RISING. TO WHAT DO YOU ATTRIBUTE THIS TREND AND WHAT CAN THE VDA DO TO COUNTER IT?

WISSMANN: Recalls reflect the high sense of responsibility that the auto industry has for its customers even when it comes to increasingly complicated vehicle technologies. In many cases, the recalls involve improvements to the vehicle's series-production status. Vehicles produced by the German auto industry have never been more reliable. Manufacturers and suppliers have succeeded in extending the life span of nearly every assembly that is subject to wear. The cost of maintaining and repairing a car has been greatly reduced, in part due to significantly longer maintenance intervals. The number of wear-related repairs per car and year has been trending steadily downward for 10 years, even though the average age of the passenger car fleet – now nine years – is quite high.

THE PRICE PRESSURES ON SUPPLIERS CONTINUE TO RISE. DO YOU SEE A LONG-TERM DANGER TO PRODUCT QUALITY HERE? FOR ALL THE ENTHUSIASM FOR INNOVATION, MIGHT AN ELEMENT OF BASIC QUALITY BE LOST?

WISSMANN: Everyone is feeling the harsh wind of international competition – manufacturers and suppliers alike. If you want to stay in the lead in the Champions League, you can't lean back. You have to stay wide awake and keep training. Our companies stand out for this "fitness". It is the nature of things that relations between manufacturers and suppliers are not always completely harmonious. This is a matter of supply and demand, customer and supplier. But they both know they're in the same boat. The success of the German auto industry is only possible because maximum customer benefit and the best product quality are what counts.

INTERNATIONALIZATION HAS ALWAYS BEEN ONE OF THE STRENGTHS OF THE GERMAN AUTO INDUSTRY. ARE THE VDA'S QMC BRANCHES IN MOSCOW, SHANGHAI AND BEIJING A TRANSFER OF KNOW-HOW OR DO THEY HAVE ANOTHER PURPOSE?

WISSMANN: The QMC (Quality Management Center) is active in key foreign markets with its own branches. The QMC's involvement in China is particularly important since it is the largest car market and has high potential. The QMC will continue to maintain its involvement in Russia. A great deal has already been achieved here with the dissemination of European quality standards. The QMC is above all an important source of support for our member companies due to its strategy of systematic internationalization. In its role as an IATF member, the QMC has not only established key quality standards, such as ISO/TS 16949, but has further developed them as benchmarks under QM system standards. ◎

© VDA

OPENING OF IAA 2015 – the auto show of superlatives attracted more than 930,000 visitors to the River Main in Frankfurt.

CLAUS MÖHLENKAMP

CHAIRMAN OF THE EXECUTIVE BOARD AT FREUDENBERG SEALING TECHNOLOGIES

INNOVATION MOTIVATORS

MR. MÖHLENKAMP, GERMAN AUTOMAKERS ARE CONSIDERED LEADERS IN INNOVATION IN THE GLOBAL MARKET. DOES THIS ALSO APPLY TO GERMAN AUTO SUPPLIERS?

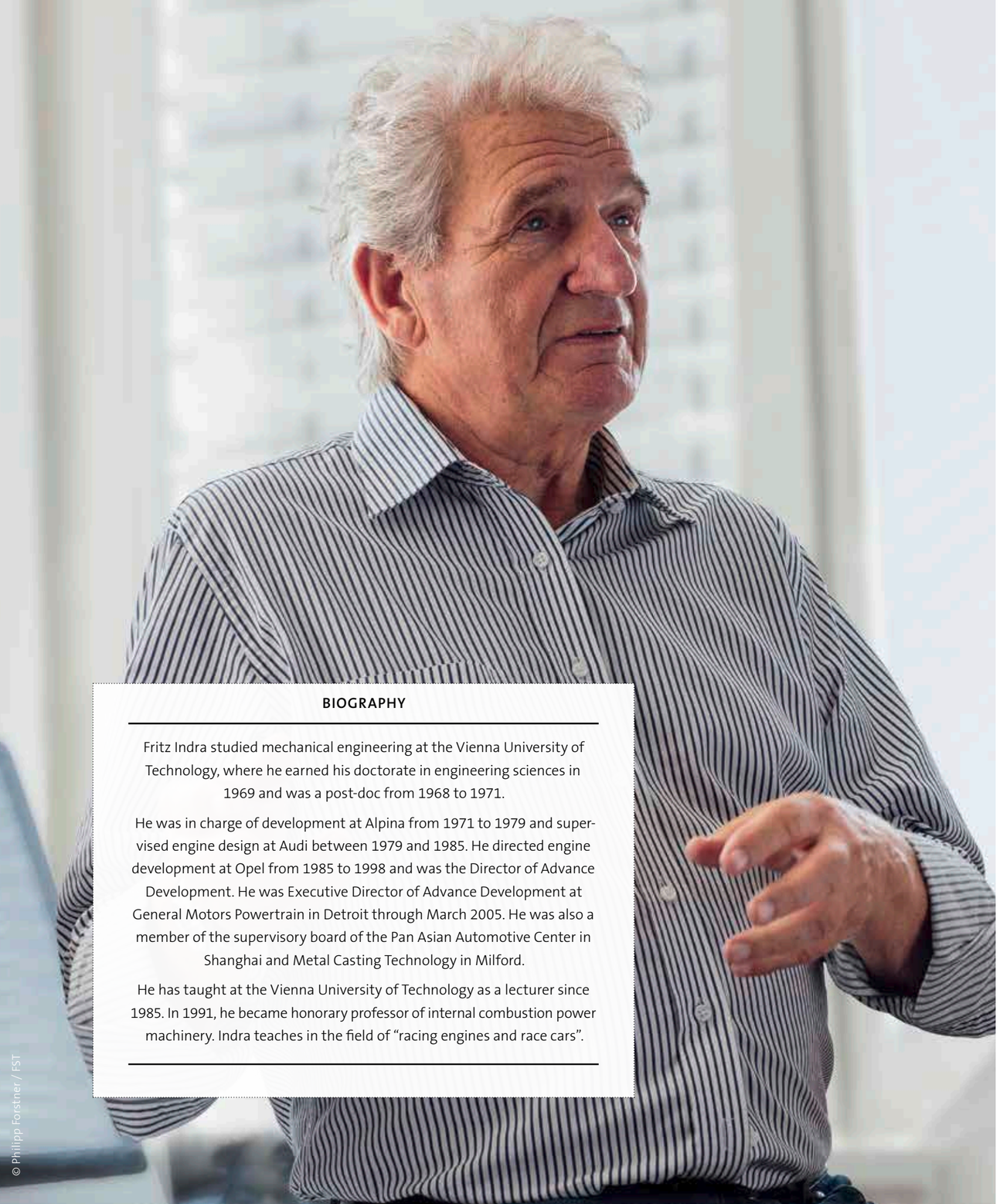
MÖHLENKAMP: There are numerous companies in the German supplier industry that are global market leaders in their field. We make this claim in the sealing field. Not just because our products can be found at nearly all the well-known automakers, but also because we are mostly a step ahead of our competitors due to our capacity to innovate – while providing the impetus to help our customers meet their goals.

CAN YOU GIVE US AN EXAMPLE?

MÖHLENKAMP: A few weeks ago, we were able to complete negotiations on the first series use of our gas lubricated mechanical face seal LEVITEX®, which functions practically without contact. The sole remaining source of frictional resistance is the cushion of air created by the seal itself. In this way, we reduce friction by more than 90 percent and even improve its durability. This leads to a situation where our customers can reduce the CO_2 emissions of their vehicles by up to one gram per kilometer if they use LEVITEX for crankshaft sealing. In view of the increasingly tight limits on greenhouse gas emissions worldwide, this is an attractive solution for many automakers and supports their efforts to achieve energy efficiency in all the automobile's systems. We look forward to taking this innovation into series production in 2018 in cooperation with a German automaker.

DON'T RECALLS DIMINISH TRUST IN THE QUALITY PROMISES GIVEN BY AUTOMAKERS AND SUPPLIERS?

MÖHLENKAMP: We see recalls as part and parcel of an effective quality management process, in that problems are also being closely monitored in the field. This ensures immediate response – where necessary, in the form of rectification or replacement. But we are obviously happy that our products have so far never been the subject of a recall. And we are doing everything to make sure it stays that way. ◎



BIOGRAPHY

Fritz Indra studied mechanical engineering at the Vienna University of Technology, where he earned his doctorate in engineering sciences in 1969 and was a post-doc from 1968 to 1971.

He was in charge of development at Alpina from 1971 to 1979 and supervised engine design at Audi between 1979 and 1985. He directed engine development at Opel from 1985 to 1998 and was the Director of Advance Development. He was Executive Director of Advance Development at General Motors Powertrain in Detroit through March 2005. He was also a member of the supervisory board of the Pan Asian Automotive Center in Shanghai and Metal Casting Technology in Milford.

He has taught at the Vienna University of Technology as a lecturer since 1985. In 1991, he became honorary professor of internal combustion power machinery. Indra teaches in the field of “racing engines and race cars”.

ENGINES FOR THE FUTURE

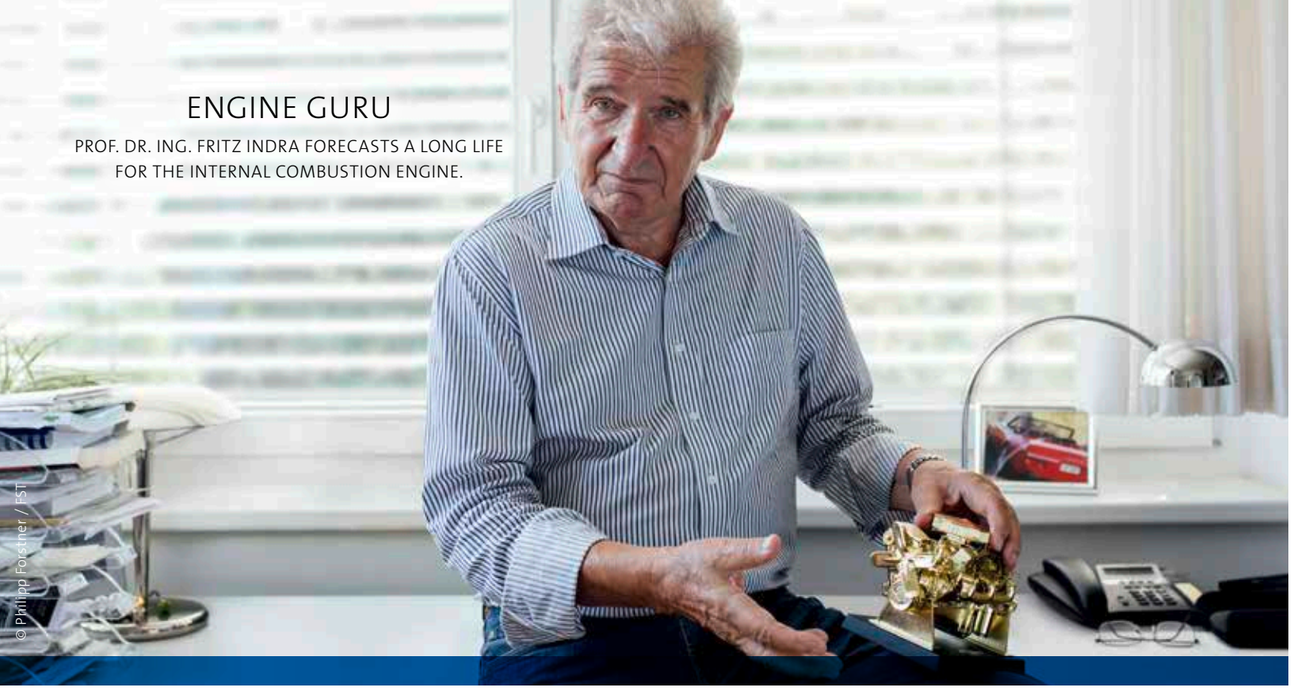
OFTEN DECLARED DEAD – YET ALIVE AND WELL. GASOLINE AND DIESEL ENGINES HAVE MORE THAN 100 YEARS OF HISTORY BEHIND THEM AND STILL DOMINATE THE MARKET AS A POWER SOURCE FOR CARS AND COMMERCIAL VEHICLES. ESSENTIAL SPOKE WITH PROF. DR. ING. FRITZ INDRA, WHO GUIDED AND INFLUENCED THE LAST 40 YEARS OF ENGINE DEVELOPMENT. WHAT CAN WE STILL EXPECT FROM THE INTERNAL COMBUSTION ENGINE?

PROFESSOR INDRA, AUTOMAKERS LIKE STUDEBAKER, FORD AND SIMCA PRESENTED PROTOTYPES AT THE END OF THE 1950s THAT – EQUIPPED WITH BUILT-IN ATOMIC REACTORS – WERE SUPPOSED TO BECOME ROUTINE SIGHTS ON THE ROAD BY 2000 AT THE LATEST AND REPLACE THE INTERNAL COMBUSTION ENGINE. AS AN ENGINE DEVELOPER, HOW DO YOU EXPLAIN THE FACT THAT A TECHNOLOGY THAT HAS BEEN WRITTEN OFF AGAIN AND AGAIN IS MORE ALIVE THAN EVER?

PROF. DR. ING. FRITZ INDRA: It is actually amazing that, more than 120 years ago, Mr. Diesel and Mr. Otto invented an engine whose pistons are still going up and down today. And many find it hard to imagine that it is still the most effective way to put something in motion. At the start of the 20th century, the electric car seemed to be winning. But when the electric starter motor was invented and you no longer had to start the internal combustion engine with a crank, there was no more holding it back. Seen in this light, the internal combustion engine has actually been a hybrid right from the start. It prevailed because it offered huge advantages compared to all the alternatives: long range, easy to refuel and low weight. And it has been developed since then. It is quite unlikely that someone will wake up tomorrow with a way to do it all better. Millions of engineers like Felix Wankel or scientists, physicists and dreamers have already wracked their brains over ways to do it differently or better. Today there are more internal combustion engines being developed than ever before. Capacities are being expanded. The application of new technologies – of which there are many – is bringing continual advances and the engine is naturally getting better and better all the time. And the better something gets, the harder it is for alternatives to win out.

IN YOUR VIEW, WHAT HAVE BEEN THE MOST IMPORTANT STEPS TAKEN BY THE INTERNAL COMBUSTION ENGINE IN ITS YEARS OF DEVELOPMENT?

INDRA: I like to think back to my father’s VW Beetle. A family of five, we drove it from Vienna to the Attersee, about 200 kilometers. The Beetle had 30 horsepower and never consumed less than 11 liters over 100 kilometers. Today I drive the same stretch in a car that is twice as heavy, with air-conditioning, comfort features and a full safety package – at an average of 4.5 liters. I think there



ENGINE GURU

PROF. DR. ING. FRITZ INDRA FORECASTS A LONG LIFE FOR THE INTERNAL COMBUSTION ENGINE.

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A DIFFERENT TAKE ON DOWNSIZING:
In the U.S., Indra was honored with a model of a“Big Block V8.”

YOU HAVE ALWAYS BEEN CONSIDERED AN ADVOCATE FOR TURBO TECHNOLOGY. TODAY FORCED-INDUCTION ENGINES HAVE ESTABLISHED THEMSELVES ACROSS A BROAD FRONT – FIRST IN DIESELS AND NOW IN GASOLINE ENGINES. HAVE WE REACHED THE END OF TURBO TECHNOLOGY OR IS THERE STILL POTENTIAL FOR FURTHER DEVELOPMENT?
INDRA: We are still a long way from the end. New techniques such as cylinder deactivation have been established across the board and harmonize very well with turbocharging. A few years ago, no one would have thought it possible to build a three-cylinder engine with cylinder deactivation. Last spring, Ford presented an engine of this type at the Vienna Motor Symposium. A quite simple, small engine that doesn’t even need a balancer were two key advances: electronic gasoline injection and electronic ignition. Carburetors were never capable of maintaining exhaust limits over a relatively long operating life, while ensuring the best possible fuel mixture. When the injection systems went into large-scale production, they were not only better than the much more complicated carburetors – they were less expensive. The same thing happened with ignition systems. When I was the project manager for the B7 Turbo in the Alpina at the end of the 1970s, we installed the first electronic-map ignition system in a car – that is, computer-controlled ignition that selected the optimal ignition timing for every operating point. It was an unbelievably important step, and it is now the industry standard.

LEVITEX® SEAL. WHAT POTENTIAL DO YOU SEE IN THE REDUCTION OF INTERNAL FRICTION IN ENGINES?
INDRA: Internal friction is significant because it is the basic condition for an economical engine. An engine family that has too much internal friction carries this disadvantage around in all its versions, whatever the output. The reduction of internal friction is a very demanding task for engineers and begins with an extremely important issue: the right material for the engine block. Over the past 20 years, people have increasingly turned to aluminum. As I see it, that’s definitely a mistake. For a good reason, highly efficient engines are not made from aluminum but rather from gray cast iron – or even from compacted graphite cast iron (CGI). All Audi V6 diesel engines are made of this high-strength, highly stable material. I know it quite well because we at Opel were the first to introduce the material in the 1990s, in racing engines for the DTM Calibra.

Engine dimensions were specified by the rules back then. But we wanted to implement a larger bore to reduce frictional losses. With CGI, we were able to bore to the point that there were only three millimeters between the cylinders. In addition, gray cast iron provides a much more stable mounting for the crankshaft, a more stable cylinder bore and piston rings with less tension. The engine is smaller and more stable. With an aluminum block and aluminum crankshaft covers, the housing and the crankshaft warm up at different rates and increasingly large gaps form at the bearing points. So you need a large oil pump, which in turn has greater power losses and reduces engine output. And it is much better for the crankshaft seal if the crankshaft runs centrally. So internal friction begins with the choice of the material and the dimensioning. Sealing solutions such as the LEVITEX seal presented at the Motor Symposium can further improve an existing concept.

SO THE RIGHT CHOICE OF MATERIAL IS A PRIMARY DESIGN ISSUE?
INDRA: It is inconceivable but true that people have only begun to design with the right materials in the last few years. Nobody would have considered steel pistons to be possible 10 years ago. A steel piston that is cast exactly like an aluminum piston is, indeed, much too heavy. But with the right design, a steel piston is lighter than an aluminum piston. All the Le Mans diesel race cars have been using steel pistons for the past five years. The trend can also be found in bodyshell construction, where panels with different thicknesses are used. Materials and design must fit with one another, and basic questions have to be asked: Why should an engine block have walls that are just as thick at its rear as they are at its front, even though the stresses are less there? And why do you need all these ribs and buttons that some designer thought up 100 years ago? Meanwhile, the Fritz Winter iron foundry, in cooperation with AVL, has managed to make gray cast iron engines just as light as those of their aluminum counterparts.

ARE THERE STILL ASPECTS OF THE FUNDAMENTAL PRINCIPLE OF THE INTERNAL COMBUSTION ENGINE THAT CAN BE IMPROVED?
INDRA: Yes, as a matter of fact. It has always been clear that power output per liter of displacement has been rising. That’s reasonable because efficiency improves as I get more performance from an existing engine – since the bearings, crankshaft and weight stay the same. That’s why manufacturers such as Opel bored out engine families that originally had 1.6 liters – with a cylinder spacing of 93 millimeters – first to 1.8 liters, then to 2.0 liters and later even to 2.4 liters. In spring, however, Audi introduced an engine at the Vienna Motor Symposium based on the Miller cycle that has less output per liter of displacement. The Miller cycle has an extended first stroke, the valves open differently, and switchover valves are needed. The turbocharged two-liter gasoline engine delivers 35 fewer horsepower. However, it is systematically geared to fuel economy – and is allegedly so much better than its predecessor with maximum performance that the technology will likely go into very high-volume production, and the differential in fuel consumption compared to diesels is likely to be equalized.

IS THERE THE POTENTIAL FOR EFFICIENCY IMPROVEMENTS IN ENGINE PERIPHERALS?
INDRA: Great things are also happening in engine peripherals. In thermal management, for example. My father had a small chain on the dashboard of his Steyr 100 that you used to pull blinds in front of the radiator during wintertime. It improved drag and the engine warmed up faster. The same thing is happening today – but completely electronically of course and without the driver even noticing it. Start-stop systems have gained acceptance very quickly, primarily because the NEDC includes so much idling. But in practice, many of the systems

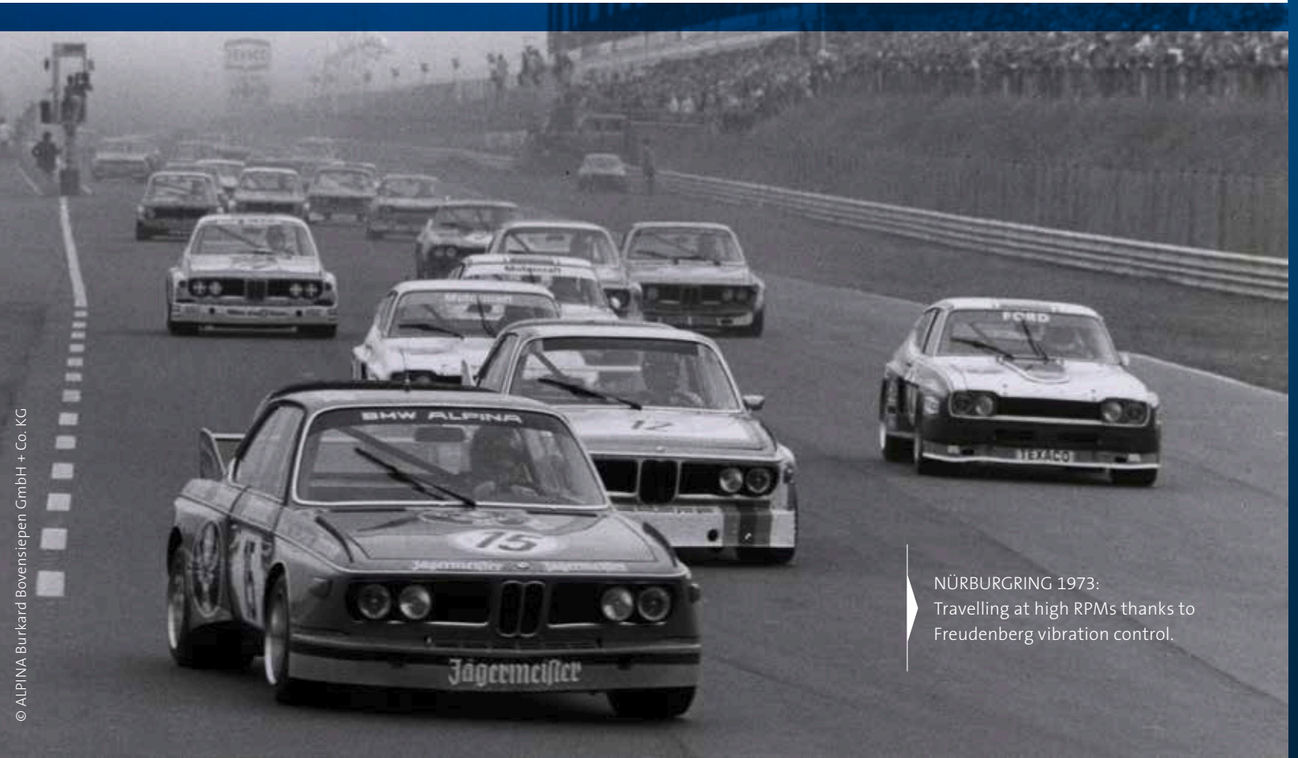
Boosting acceleration with an electric charger offers still more potential. This involves the use of an electric motor to blow in compressed air during the first few seconds. This is of huge help to a turbo, as the engine otherwise has to wait until it produces enough hot exhaust gases and the turbocharger speeds up. You can then lay out the engine differently and drive much more efficiently in the high performance range. Audi has just introduced this on a diesel, making the famous turbo lag a thing of the past.

FREUDENBERG SEALING TECHNOLOGIES HAS PRESENTED AN APPROACH TO REDUCE EMISSIONS: THE NEARLY FRICTION-FREE

are a pain and a huge lurch occurs each time the engine starts. A 48-volt starter generator would work much better. Instead of the alternator, a belt-driven starter generator with 10 to 15 kilowatts sits on the crankshaft. This improves the packaging of the engine compartment and brings about a completely noiseless engine startup. The huge advantage of the technology is that you can also use the generator to help accelerate the vehicle. And this facilitates an entirely different layout for the turbocharger and an improvement in its efficiency. I am of the opinion that a starter generator offers 80 percent of all the advantages of a full hybrid – at a fraction of its costs. It works even better if you put the starter generator right on or inside the transmission. Then you can even manage a small degree of electric drive at minimal cost.

YOU ARE NOT EXACTLY A FAN OF ELECTRIC MOBILITY.
INDRA: I always say that the best thing about electric mobility is the unintentional shove it gave to developers of internal combustion engines: Many new features – coasting as well as stop-start systems – were accelerated or dug up again with the thinking: What can we learn from electric drives and apply to normal technology? You can always rely on an internal combustion engine – in the summer, winter, day and night, with five people and their luggage – or head quickly over to grandma's place because she's had an accident. That's what people appreciate about their cars. And it is not enough to bring a technology to market that's equally good. It has to be better. It is nonsense to speculate whether a range of 100 or 200 kilometers is enough, as long as "normal cars" are driving 1,000 kilometers.

PROFESSOR INDRA, IN YOUR LONG CAREER, HAVE YOU EVER HAD A TECHNICAL PROBLEM THAT WAS HELPED BY A SEALING OR VIBRATION CONTROL SOLUTION FROM FREUDENBERG?
INDRA: Very early on, in fact. In the early 1970s, I was responsible for racing engines at Alpina and we ran BMW 3.0 CSL touring cars with Niki Lauda. But an increase in the speed of the inline six-cylinder always failed because the extremely long crankshaft built up rotational vibrations and threw off the front vibration damper. It could only handle up to 7,000 rpm. I got to know Dr. Klaus Kurr, the rotational vibration expert at Freudenberg. We solved the problem together. In 1973, BMW won the European Touring Car Championship, and Niki Lauda set an absolute touring car record in the six-hour race at the Nürburgring. ◎



NÜRBURGRING 1973:
Travelling at high RPMs thanks to Freudenberg vibration control.

COASTING

In "coasting," the internal combustion engine is shut off and uncoupled from the drivetrain. In this way, the available kinetic energy can be used for forward movement instead of being lost to engine drag. Safety-related functions such as power steering or brake servos remain active. The benefit of the coasting function depends on the driving profile for a particular route. In the NEDC now in force, the fuel savings from coasting are as high as 7 percent, and even up to 10 percent in real-life traffic. "Coasting on idle" comes into use at higher speeds. Here the drivetrain is uncoupled as soon as the driver takes his foot off the accelerator and does not brake; the internal combustion engine continues to run on idle.
Two-stroke engines from Saab and DKW in the 1950s already had a similar albeit purely mechanical and manual solution. It involved separating the transmission from the engine while on trailing throttle. But the goal here was not primarily to save fuel. The function of coasting was to avoid damage to the engine that could occur in two-stroke engines if the necessary self-lubrication of the gas-oil mixture was no longer guaranteed while driving downhill.

AUTOMATIC START-STOP SYSTEM

Toyota's automatic start-stop system was invented in the mid-1970s to achieve fuel savings in otherwise unmodified engines after the first oil crisis. It involved shutting off the engine automatically with an electronic device after 1.5 seconds of idling. Porsche also displayed a similar technology in a concept car in the early 1970s, but it never went into production. Audi and VW presented a start-stop system in the early 1980s, whereby the driver could shut off the engine at the touch of a button while maintaining the supply of electric current. The engine first had to reach its operating temperature. When the clutch was depressed, the ignition system started the engine without the use of the ignition key. The system functioned reliably but found little customer acceptance.
A new generation of start-stop followed in the 2000s, largely driven by more stringent CO_2 limits on vehicles. The engine is shut off when the car is idling and the clutch disengaged. If the clutch pedal is depressed, the engine starts up again. With automatic transmissions, a decrease in pressure in the braking system from release of the brake pedal causes the engine to start.

STARTER GENERATOR = DYNASTART

Starter generators based on direct-current motors have been in series production since 1935. The component known as the dynastart combines the functions of a starter and an alternator. The machine sat right on the crankshaft and was widely used in scooters and small cars in the 1950s. In two-stroke engines, it was possible to start the engine running in the opposite direction by reversing the polarity of the starter generator and thus do without a reverse gear. Dynastart systems were a compact, low-cost yet low-performance alternative to the conventional separation of starter motor and alternator.
Today, starter generators that combine the functions of starters and alternators are far more powerful. Their advantages play out in their lower weight, extremely smooth starting characteristics and up to 10 kilowatts of boost for the internal combustion engine when needed. Many experts assume they will ultimately replace the separate function of starter and generator.

THERMAL MANAGEMENT = RADIATOR BLINDS

Electronically adjustable radiator blinds, as used by many automakers, reduce fuel consumption by about 5 percent. The reason is that the engine warms up faster and there are aerodynamic benefits. Sophisticated thermal management ensures that the engine does not overheat.
The advantages of variable radiator surfaces were recognized in the 1950s. The main reason was – in addition to faster response by the heating system – that carbureted engines with standard settings did not run smoothly enough at very low outside temperatures and it was possible to compensate for this with blinds. In the best examples, the blinds were activated manually with a cable pull, which was used to raise and lower the blinds.

AUTOMOTIVE NEWS

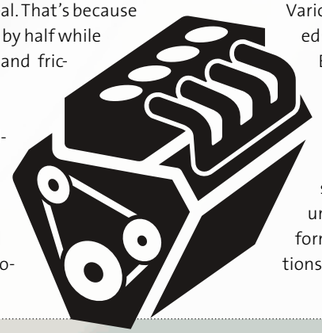
DOWNSIZING WITH BLUESEAL

It is not just engines that are getting smaller and lighter as their performance improves and they become more robust. Sealing technology from Freudenberg Sealing Technologies is following the downsizing trend and opening up enormous opportunities for improved efficiency. The perfect example is the BlueSeal, a Simmerring optimized in several evolutionary steps at the company's facility in Langres, France.

Downsizing engines doesn't just involve reductions in friction, it also means less installation space and weight. Every millimeter saved on a crankshaft Simmerring can lead to advantages in installation space and weight for the entire engine block. These are the ideal preconditions for the BlueSeal. That's because it reduces axial installation space by half while reducing weight by 40 percent and frictional losses by 30 percent.

The BlueSeal's design takes advantage of Freudenberg's long experience with PTFE as a Simmerring material. Since the 1980s, the company has produced radial shaft seal rings that have robust PTFE sleeves with reverse conveyance threads. PTFE has a wide range of applications thanks to its outstanding resistance to temperature extremes and chemical media – various lubricants, for example.

The BlueSeal's fundamentally new feature is that the static seal with the housing is also made of PTFE. As a result, the seal design consists of just two materials: PTFE and metal. In all conventional concepts, axial installation space is required so the air side can be rubberized. The BlueSeal dispenses with this axial rubber coating and binds the PTFE sleeve externally on the air side of the metal stiffening ring.



Various automakers have already tested sample parts with positive results. Besides crankshafts, they are suited for other applications, including fuel pumps, turbocharging and heat recovery systems. Even industrial motors and transmissions benefit from the BlueSeal's unique compactness. In modified form, it is the first choice for applications such as high-pressure pumps.

A DEFINITE WINNER

The "World Car of the Year" award has been around since 2003. The coveted title honors a vehicle that an international jury of experts has judged to be especially innovative and forward-looking. Ten vehicles reached the final in 2015. One winner was clear even before the announcement.

Jeff Michalski was able to look forward to the jury's decision with composure. That's because, whatever vehicle was ultimately endowed with the prestigious award, "it would be a car for which we deliver sealing components and systems," said Michalski, Global Director, Automotive Marketing, Freudenberg-NOK. "Vehicles equipped with our seals are winners anyway." In the end, the new Mercedes C-Class won the nod, simultaneously earning honors as the "2015 World Luxury Car". The Mercedes AMG GT was named "2015 World Performance Car", while the Citroën C4 Cactus was honored as "2015 World Design Car of the Year". The "2015 World Green Car", the BMW i8 hybrid sports car, also trusts in Freudenberg Sealing Technologies when it comes to sealing technology. It all demonstrates that the global market and technology leader is tackling the challenges of modern mobility – and is the right partner for winners, be it for classic friction reduction or alternative drives.

SEALS WITH LIGHTNING RODS

Seals that can do more than just seal will play an important role in the transmissions of the future. At the International VDI Congress entitled "Transmissions in Vehicles" in June 2015, Freudenberg Sealing Technologies presented a seal for hybrid and electric vehicles that can selectively draw off electric current and protect against electrostatic charging.

Stringent CO_2 requirements are leading to the growing popularity of plug-in hybrids. An electric motor running on an operating voltage of about 400 volts is most often positioned at the automatic transmission's input shaft in place of a hydrodynamic converter. A good seal has to do more than protect the electric portion of the powertrain from contamination by transmission oil. That's because electric potential can build up in the engine between the housing and the shaft; in extreme cases, this can lead to the uncontrolled flow of electricity and cause damage, especially around the bearings. A conventional elastomer sealing ring has an insulating effect and cannot draw off the buildup of electric potential.

The solution to the problem is a conductive transmission seal that works like a lightning rod. Electric current is selectively conducted from the housing to the shaft through a conductive nonwoven material applied to the seal, preventing electrostatic charging from occurring in the first place. Experts from Freudenberg Performance Materials provided valuable help with the specification of the fabric. The solution, which is ready for series production, eliminates the need to reach the required potential equalization through the use of expensive supplementary components such as abrading carbon brushes. It is not only suited to plug-in hybrid vehicles but also for the more simply constructed transmissions for battery-powered electric vehicles.

SUMMITEERS FROM NEUTRAUBLING

KRONES AG

You would expect to run into mountain climbers at high elevations in parts of Tibet. It is a huge thrill to climb the mountains of the Himalayas. The elevation at Mount Everest's base camp is about 5,200 meters. Breathing is difficult and your pulse speeds up noticeably in the thin air. Its oxygen content is just half what it is at sea level. If you plan on lingering here, you should go through high-altitude training ahead of time. Otherwise, you face a serious risk of coming down with a much-feared ailment: altitude sickness. But you'll run into more than just mountain climbers and adventure-seeking tourists here. Employees of Krones, a leading maker of filling and packaging technology, occasionally spend time at these high altitudes.

A few years ago, specialists from the company headquartered in Neutraubling, Bavaria installed a complete beverage bottling facility in a high mountain valley not far from Llasa, Tibet's capital. PET bottles are manufactured there, filled with mineral water from glacial springs, labeled and shipped throughout the world. Today, Krones employees handle service and system maintenance.

"The stretch-blow-molding machine used to produce the PET bottles at the facility is the highest in the world," said Danuta Kessler-Zieroth, Head of Press Relations at Krones AG. "The extremely low atmospheric pressure up there is not just hard on people, it was a challenge for our development work as well." For example, in the Himalayan highlands, a machine designed for pressures at sea level cannot deliver enough pressure to completely blow-mold PET bottles and press them into the mold. Moreover, the facility's touchscreen operating panels were actually designed for altitudes up to 3,000 meters. Another issue is the bottle design that Krones developed in concert with the beverage producer. The mineral water bottles are intended for export, so they should not be deformed when shipped to lower-elevation regions of the world. That means the containers must be configured to compensate for the forces resulting from pressure differences with defined deformation.

BECOMING A GLOBAL COMPANY THROUGH INNOVATION

The beverage industry has always been Krones' most important segment. The company generates about 90 percent of its revenue from this sector. The remainder includes, among other things, cosmetic and medical technology, for which Krones supplies labeling and packaging machines. In 2014, Krones AG, which is listed on the MDAX index, generated nearly 3 billion euros in revenue and employed about 13,000 people worldwide.

The Krones success story began in 1951 in a roughly 100 square-meter workshop constructed by founder Hermann Kronseder. It served as the production facility for his first semi-automatic labeling machine. Just a year later, Kronseder, a master mechanical and electrical technician, presented his St 1500 model. The semi-automatic labeling machine consisted of just 150 parts, but handled a throughput of 1,500 bottles per hour on six bottle supports. Piccolo, its successor, was already processing 2,100 bottles per hour. It had a closed cast housing and bottle table made of aluminum.

The innovations then came in quick succession. The oscillating glue pallets introduced in 1970 represented one more developmental milestone. They allowed the much faster labeling of standing beverage bottles. A fixed label container and the pendulum motion of the aluminum pallets for label removal produced the then-sensational performance of 36,000 bottles per hour. With this technology, a label gripper on a rotating cylinder pulled a label away from the pallet and pressed it onto the bottle.

MANY CONTAINERS, ONE BOTTLER
Krones generates 90 percent of its turnover with beverage bottling lines

But Krones truly revolutionized system technology with its block construction of machines. The rationale was to save space and simplify the equipment's operation so one employee could operate it. The Krones Bloc of 1975 was designed with filler, capper and labeling machine without the inclusion of conveyor belts – back then, this was a completely novel equipment arrangement that has become the standard today.

Krones also had the right entrepreneurial instinct in 1997 when it came up with a solution for the still new and promising market for PET beverage bottles. A compact, two-story machine to heat up the PET blanks and stretch-blow-mold the bottles took up just 12 square meters of space.

EVERYTHING FROM A SINGLE SOURCE

"Our innovation potential today is evidenced by our more than 3,730 registered patents and utility models," explains Kessler-Zieroth. Since its foundation in 1951, Krones has developed far beyond classic machine and facility design. "We are able to implement projects like the one in Tibet because Krones offers the complete process chain for beverage production from a single source. We can build a complete turnkey factory on a green field," she says.

This starts with the planning of the manufacturing spaces and supply areas and extends to actual equipment production, related processing technology and in-house logistics, all the way to IT services spanning the entire factory. For example, the hardware and software solutions for data processing cover the operation

© Krones AG

Prior to the filling process, the freshly blown PET bottles are rinsed in a Krones rinser. Absolute cleanliness is the top priority.

© Krones AG

REGARDED AS ONE OF THE MILESTONES OF PET FILLING TECHNOLOGY: the Krones ErgoBloc L comprises the entire wet area of a beverage filling system in a single machine.

Absolute process safety and optimum product conveyance are the key demands required of the Evoguard hygienic centrifugal pumps. Sealing technology plays a key role in this.

of the equipment, diagnostics to check technologies and monitor processes, and intralogistics with inventory management, material flow controls and yard management. And, of course, the maintenance and modernization of the facilities are part of the service package.

HIGH QUALITY REQUIREMENTS

The food industry also has its own, extremely stringent quality requirements for production facilities and processes. For example, the various parameters such as mixing processes, filling and packaging must be monitored during the entire operation. Facilities and machinery must meet strict hygienic standards and may not discharge impurities that could reach the foodstuff at any point in their lifetimes. “At our company, quality begins right at the machinery’s development to guarantee maximum process reliability,” says Kessler-Zieroth. An important cornerstone is Krones’ vertical integration, which is unusually extensive compared to the competition. For example, its Evoguard subsidiary was established in 2011 for the development, design and production of valves and pumps. Details of safe manufacturing operation are considered alongside the requirements of hygienic design.

CLOSE COOPERATION WITH FREUDENBERG

Seals are the most important aspect of any valve. Early in the design phase, the Evoguard development team works closely with experts from Freudenberg Sealing Technologies to identify the optimal design in combination with the right material for the particular seal. At the same time, Freudenberg supports Evoguard in both the layout and design of the seals and with material-related know-how. Freudenberg Sealing Technologies’ current product portfolio has about 1,800 “active” rubber compounds that have been ordered at least once a year, the largest portion of them as exclusive special mixtures produced in-house. Evoguard also makes use of Freudenberg’s materials expertise for damage analyses in the event of valve and pump failures in customer operation. Freudenberg’s experts then investigate the reason for the failure and propose solutions to the problem.

The two companies’ successful partnership dates back to Evoguard’s very beginnings. Its first valve product portfolio, introduced in 2011, was equipped with radial shaft and butterfly-valve seals from Freudenberg Sealing Technologies. “At the time, we went all out to develop the seals so we could display our production-ready valve lineup on schedule at trade fairs and exhibitions,” recalls Willi Wiedenmann, Sales and Product Management at Evoguard.

Another result of this close cooperation is the use of seals made of Fluoroprene XP instead of the usual EPDM in Evoguard valves. This premium material is recommended for high stability, its suitability for hot-steam sterilization and its low risk of flavor transfer from one food product to the next. Among other products, Freudenberg Sealing Technologies supplies Krones’ Evoguard subsidiary with shaft seals, seat gaskets and an entire series of O-rings and butterfly-valve seals of the highest quality.

120,000 BEVERAGE CANS PER HOUR

“One out of every four beverage cans opened worldwide are produced with the help of Krones solutions – whether we are providing a complete production facility or individual machines or contributing process or IT expertise,” Kessler-Zieroth explains. The largest facilities are designed for production volumes of 80,000 bottles per hour. The figure is 120,000 units per hour for beverage cans, which are currently enjoying great popularity, especially in China. The maximum capacity of the facilities is limited primarily by the output of the filling machine that fills the containers with water, soda, cola, beer or wine.

INTERNATIONALIZATION AS A SUCCESS FACTOR

Another of Krones’s success factors is its international structure. Back in 1961, the company was able to develop Japan as its first export market with the licensed production of packaging machines. Today, Krones has 80 sales and service subsidiaries throughout the world, and about 90 percent of its products are shipped abroad. Thanks to its global presence, the company can offer its customers local service around the clock. In addition to continuing education for its own employees, the company offers training for its customers through its “Krones Academy”, qualifying them to operate, monitor and maintain their facilities. The service offerings also include online diagnostics in which a Krones employee remotely monitors facilities via a digital data connection and can intervene early in the event of problems. “With our equipment, we have a presence throughout the world, whether it is in the Australian outback, the Brazilian jungle or the Tibetan highlands,” says Kessler-Zieroth. After some thought, she adds: “There is only one region that we haven’t developed since it doesn’t have any customers – the South Pole.” ◎

LEAK-PROOF EVEN IN HOT CONDITIONS

IT IS NO DOUBT HARD TO IMAGINE TOUGHER REQUIREMENTS THAN THE STANDARDS ISO 2685 AND AC 20-135 FOR ELASTOMERS. THEY REQUIRE SEALS IN ENGINE NACELLES TO WITHSTAND TEMPERATURES GREATER THAN 1,832 °F (1,000 °C) FOR AT LEAST 15 MINUTES. FIBER-REINFORCED SPECIAL MATERIALS ARE CURRENTLY IN USE. HOWEVER, FREUDENBERG EXPERTS IN TILLSONBURG, ONTARIO, CANADA, ARE NOW INVESTIGATING ESPECIALLY LIGHTWEIGHT REINFORCEMENT AND FIBERLESS ALTERNATIVES THAT OFFER ADDITIONAL PROTECTIVE FUNCTIONS AND ALLOW LESS COSTLY PRODUCTION.

It is a worst-case scenario, but it fortunately occurs only very rarely in modern aviation - an engine fire. Still, precautions must be taken for just this eventuality. Seals in the engine area provide an important safety function. “In an engine fire, it is essential that the seat of the fire remain enclosed within the body of the engine,” says Sean Morgan, Director, Aerospace at Freudenberg in Tillsonburg,Ontario,Canada. “Otherwise, smoke can reach the cabin. It would be even worse if the flames were to ignite the jet fuel in the wings.” Fiber-reinforced silicone materials are used in the engine seals, which are continually being improved.

“Using conventional materials, we meet the requirements of aviation authorities that the seals be able to withstand temperatures up to 2,000 °F (nearly 1,100 °C) for 15 minutes,” says Todd Blair, Development Manager at Freudenberg. But the seals are exposed to high thermal loads even in regular operation. To save fuel, modern engines operate at increasingly high combustion-chamber temperatures. Temperatures as high as 300 °C prevail on the inside of the engine casing, while the air flowing by outside can be as cold as -65 °C.

AEROSPACE SAFETY

HIGHEST DEMANDS

Nowhere are safety requirements for components and materials higher than in the aerospace industry. Freudenberg Sealing Technologies supplies numerous sealing products for the aerospace sector.

A typical engine housing with the associated components for thrust reversal may contain several hundred seals that Freudenberg Sealing Technologies has developed and validated for the particular application. Fireproof seals may only rarely be brought to their load limits, but they are still some of the most sophisticated seals in commercial aviation. That is why the specialists in Tillsonburg work closely with turbine and engine housing manufacturers to develop the optimal design and materials mixture for the particular area of application.

RESISTING EXTREME HEAT
The jet engine sealing withstands 1,000 degrees Celsius for up to 15 minutes and functions as a fire barrier.

"We are constantly doing research on materials that, on one hand, provide the necessary temperature resistance and, on the other, are as light as possible to maximize the payload on board," Blair said. For example, low-density reinforcing elements result in up to a 20 percent reduction in the seals' weight with the same functionality. The material is already used in other areas of the airplane, and its fireproof qualities are being further developed. When its development is complete, it is expected to meet standards based on jet fuel tests such as ISO 2685. Incidentally, the official specifications are becoming more and more demanding. To test fire resistance, for example, the propane flames previously used in test procedures are being replaced with nebulization burners.

The Canadian engineers have yet another iron in the fire. They are currently testing a new silicone material for use in the engine area that uses less fiber reinforcement – or even dispenses with it entirely. The new development's main attraction is that when the surface of the silicone comes into direct contact with flames, the material "ceramicizes" and forms a fireproof barrier. This surface barrier slows the disintegration of the lower elastomer layers by the flame front. Material costs decrease thanks to the elimination of fiber reinforcement. Moreover, the new material simplifies molding, making it less costly to manufacture the seals.

"This new development is another example of Freudenberg's innovative strength in producing seals for the aviation industry," says Morgan. "It makes it possible for our customers to continually improve their performance and meet the requirements placed on the aviation industry. This is above all a question of greater efficiency and greater safety." ©

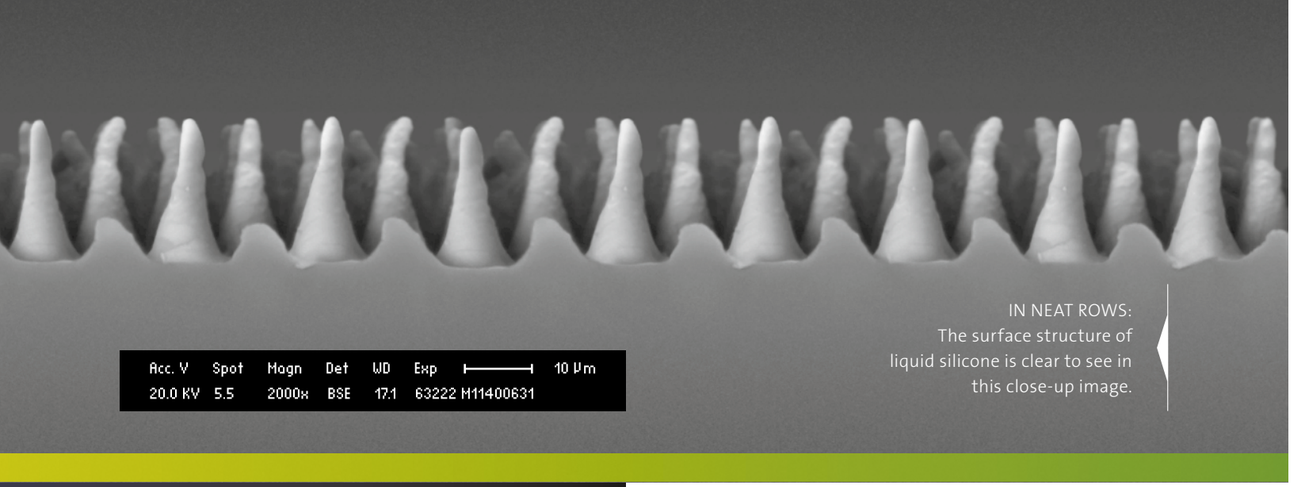
FROM NATURE'S MAGIC BOX

WHAT IF WATER JUST DRIPPED OFF A SURFACE WITHOUT LEAVING A TRACE? SCIENTISTS AT FREUDENBERG SEALING TECHNOLOGIES' LIQUID ELASTOMER SOLUTIONS COMPETENCE CENTER HAVE BEEN ABLE TO IMPLEMENT WHAT NATURE HAS PROVEN IN THE PLANT WORLD - THE LOTUS EFFECT. THE INNOVATION DOES NOT REQUIRE A COATING AND PRODUCES ITS WATER-REPELLING CHARACTERISTICS SOLELY THROUGH THE CONFIGURATION OF THE SEAL SURFACE.

LEONARDO DA VINCI
Pioneer of bionics

Leonardo da Vinci (1452–1519) is considered the pioneer of bionics. Around 1505, he was already studying the flight of birds, and he transferred his observations to his flying machines. The polymath never took off in one, however. His attempts at flight failed; the output of human muscles is insufficient to produce the lift required for the weight of a human being. So da Vinci was left with just notes and sketches. Meanwhile, the basic principle of his work on bionics – transferring natural phenomena into technology – is now more current than ever. Da Vinci is supposed to have summarized his philosophy thus: "Human subtlety will never devise an invention more beautiful, more simple or more direct than does nature because in her inventions nothing is lacking, and nothing is superfluous." Since da Vinci's time, a number of scientists have dealt with bionics. But until the second half of the 20th century, there were only sporadic attempts that did not enter broader use. The technological possibilities lagged too far behind those of nature. Today, however, biological structures in the micron and nanometer range can be replicated – looking inside nature's magic box pays off for scientists.

In the development labs of Freudenberg Sealing Technologies, scientists are also working on bionic solutions to multifaceted development challenges. The Liquid Elastomer Solutions Competence Center has now succeeded in producing nature's lotus effect in seals made of liquid silicone. In the scientific world, the phenomenon is called superhydrophobicity. Water drips from a surface while rinsing away particles of dirt.



IN NEAT ROWS:
The surface structure of liquid silicone is clear to see in this close-up image.

THE LOTUS EFFECT

For thousands of years, Buddhism has considered the lotus plant (nelumbo nuciferal) to be a symbol of special purity. The reason is the so-called lotus effect, which can be observed on the leaves of this plant. Drops of water simply drip away, and the leaves remain dry and clean. The lotus effect is not a biological, but rather a physico-chemical phenomenon. The exterior surface of the leaves has countless knob-like bumps known as papillae. The papillae, which are about 10 to 20 thousandths of a millimeter high, are positioned every 10 to 15 thousandths of a millimeter, making the leaf's surface resemble a mountain and valley pattern under the microscope. For their part, the knobs are covered with a fine nanostructure of extremely small wax crystals. The water droplets have only a few contact points with the leaf and thus cannot adhere to it. Due to its superhydrophobic surface, the droplets roll off, washing away dirt and dust in the process.

DEVELOPMENT MILESTONE

Employees at the Liquid Elastomer Solutions Competence Center have been looking into the further development of liquid silicones for a long time. "With superhydrophobicity, we have now reached a further crucial milestone," said Michael Klemt, development engineer. He explains further: "Our development is based solely on a modified seal surface. We can produce the lotus effect without changing the material and without applying a coating."

This is possible due to the specific qualities of liquid silicone during processing. During manufacturing, the material – which consists of two components – is mixed shortly before the casting process and injected under high pressure into a mold heated to between 170 and 220 °C. At this temperature, the two liquid silicone components cross-link in seconds. Due to its low viscosity – in some cases below that of water – and the substantial injection pressures, the material penetrates into the smallest cracks. The experts at Freudenberg Sealing Technologies are using this effect to produce the very detailed surface structure needed for the lotus effect. "The tool is crucial. It forms the surface of the seals in a geometric pattern that consists of countless detailed knob-like contours only about ten thousandths of a millimeter in size," Klemt explains. After the solidification of the liquid silicone, the result is a highly flexible, robust seal with superhydrophobic properties. Freudenberg's own toolmakers create the high-precision molds for this sophisticated process. To achieve the lotus effect successfully, the precision mold that shapes the water-repellent surface during casting must be implemented with extremely tight tolerances.

DEPOSITS AVOIDED

Superhydrophobic seals are always of interest where the adhesion of fluids should be avoided, whether their viscosity is high or low. A simple test provides an impressive demonstration: Not just water but also viscous honey drips off the seal's velvet-like surface without leaving behind a sticky residue. Dirt and dust particles are carried away at the same time, preventing the buildup of deposits. The destructive calcification of seals in water lines can thus be avoided. "Until now, our development objective was to make surfaces as smooth as possible in these applications. With the lotus effect, we are going in completely the opposite direction: We are producing a rough surface that repels water and dirt," Klemt explains.

EASIER ASSEMBLY

"Since we're not applying a coating that can wear off during operation, we achieve a long seal lifespan," Klemt says. He cites yet another advantage of liquid silicone bionic seals: "Due to the lotus effect, their coefficient of friction is cut in half." This benefit is especially important if the seal is supposed to be mounted dry, meaning without lubrication. In other products, this can lead to jerking instead of smooth motions that make automated installation more difficult. This so-called "stick-slip" effect occurs when solid bodies run over one another. One example of the phenomenon may already be familiar to some - windshield wipers that screech loudly over the car's windshield instead of gently wiping them.

LIQUID SILICONE IS AN ALL-AROUND PLAYER

The processing of liquid silicone has a long history at Freudenberg. Silicone specialist Lederer GmbH began manufacturing sealing components made of liquid silicone for the auto industry in 1984 in Öhringen in the Hohenlohe region of Germany. In 2004, Freudenberg acquired all shares in Lederer GmbH. Liquid silicone has outstanding chemical and physical properties. "This makes it a true all-around player for a wide variety of applications," Klemt says. For example, the material is resistant to temperatures as high as 300°C for short periods, has good electrical insulating properties and very good resistance to weathering and aging, while retaining its elastic properties down to -40 °C. Today, its range of use extends from headlight seals in the auto industry to connectors in electrical applications and all the way to products in the medical and dental technology fields, as well as household goods and sanitary facilities.

FIRST HIGH-VOLUME APPLICATION

Due to its bio-neutral behavior, liquid silicone is also superbly suited to the food and beverage industry as well as contact with drinking water; among other things, it lends itself admirably to sterilization. Along with other manufacturers, makers of dosing valves for the food industry are expressing great interest in these new superhydrophobic liquid silicone seals. The innovation has recently entered mass production for shower heads, where the lotus effect reduces friction. Seals designed to prevent calcification are currently under development. When they take a shower, most customers are probably unaware that a tiny echo of da Vinci's spirit is in there, too.

A PARTNER THROUGH THREE LIVES

CORTECO DELIVERS AUTOMOTIVE REPLACEMENT PARTS AROUND THE WORLD. THE FREUDENBERG EXPERT FOR THE INDEPENDENT AFTERMARKET OFFERS ORIGINAL PARTS AND SYSTEMS – AS INSTALLED BY AUTOMAKERS – IN THE AREA OF VIBRATION CONTROL, CABIN AIR FILTRATION AND SEALING. UNDER THE BRAND NAME TRANSTEC, IT DISTRIBUTES CUSTOMIZED SEALING SOLUTIONS FOR AUTOMATIC TRANSMISSIONS AND POWER STEERING APPLICATIONS. IN ADDITION, CORTECO DEVELOPS ITS OWN PRODUCTS FOR THOSE MARKETS IN AFRICA OR ASIA WHERE THE STREETS ARE CHARACTERIZED BY OLDER CARS WHICH CAN ONLY BE MAINTAINED WITH THE HELP OF AFFORDABLE REPLACEMENT PARTS. THIS MAKES FREUDENBERG A COMPANION TO CARS OVER THEIR ENTIRE LIVES – FROM NEW TO A SECOND OR THIRD LIFE IN ANGOLA OR BELARUS.

Even if the life of each individual car unfolds differently, the pattern is still similar. Brand-new cars almost invariably head to authorized service shops for maintenance and repair during the first four years, but this relationship switches by the age of eight years. In their second life as used cars, they tend to be driven by budget-conscious owners who prefer independent workshops. This is where Corteco comes into play. The subsidiary of Freudenberg Sealing Technologies is one of the leading global suppliers to the independent automotive replacement parts market. With Corteco, Freudenberg offers service shops, distributors and remanufacturers access to original replacement parts – as supplied directly to automakers. “The selection of replacement parts currently includes more than 19,000 items from the sealing, vibration control and filtration technology areas. They are spread out over the more than 300 product groups that make up the current Freudenberg product range for the automotive area,” says Ralf Schmid, Managing Director, Corteco Europe. At the same time, the quality of products marketed by Corteco meets the same high standards demanded by manufacturers.

ORIGINAL EQUIPMENT QUALITY FOR REPLACEMENT PARTS, TOO

After just a few months, spots on the garage floor signal that savings on the repair of a used car were misplaced. Anyone who wants to avoid unpleasant surprises after purportedly low-cost repairs will turn instead to replacement parts to original equipment quality. Original Simmerrings® and seals from Corteco significantly improve the quality of the repair and offer as-new functional reliability.

On the other hand, generic aftermarket parts can deviate substantially from the original. Visually, the products are often barely distinguishable from the original. But a technical examination can quickly separate the wheat from the chaff. For example, a comparison test of engine mounts from Freudenberg subsidiary TrelleborgVibracoustic revealed that not a single imitation even came close to the performance of the Corteco original. An engine mount developed back in 1998 was compared with three reproductions. In load testing, only the Corteco engine mount was within the specified tolerance range. The reproductions were between 5 and 68 percent outside of it. The results are evident during idle and pulling away. The excessive rigidity of the mount lifts the engine above its normal position, placing it in an excessively pronounced lateral position. The resulting tensile forces lead to substantial drive shaft wear.

In the damping test as well, the reproductions fell far short of manufacturer specifications. Due to low damping, the engine transmits more vibration to the vehicle as a whole. The result impairs driving comfort and can damage the engine and auxiliary assemblies.

Incidentally, the micron Air® interior filter is a classic in the Corteco product lineup. Even if annual inspections no longer take place in a specialized workshop, the interior filter should always be changed – especially since one child in three in Germany suffers from allergies. The micronAir® filter is used in nearly half of new cars equipped with an interior filter.

A THIRD LIFE IN AFRICA

Things eventually reach this point: The odometer has long been in the six-digit range, the repairs are piling up and marks in the form of scrapes and scratches bear witness to everyday use. A car's second life is nearing its end. Vehicles that are more than 12 years old are overwhelmingly headed for export – to countries in Eastern Europe or directly to Africa. Vehicles from Germany are especially popular among used car customers in Africa. In general, they are viewed as well maintained. Cars considered jalopies in Germany live out their third life in West African countries such as Benin, Niger and Nigeria or as a taxi in Togo. About 100,000 old cars are shipped from Germany to Africa every year. These rusty specimens often have more than 15 years ahead of them before they finally land in a scrap heap. One reason they live for so much longer is the dry heat that prevails in many parts of Africa, which slows corrosion. Low purchasing power is another reason: An investment in a car generally puts a much bigger hole in the budget than in Europe. There often just isn't the money for a new car. Corteco offers suitable solutions here as well.

The dichotomy is obvious: These endurance runners are beset by great heat, frequent overloading and rutted lanes filled with potholes. But the money for expensive repairs is lacking. The important thing is for the service costs to stay within limits. Steering-wheel vibrations are a classic sign of damage and eventually the shaking from the engine compartment becomes so loud and unpleasant that something has to happen. As a rule, worn-out engine mounts are the cause, and replacement is inevitable.

Corteco specialists have a solution ready for cases like these. "For markets like Africa, we develop special products that permit repairs appropriate to the life expectancy of the vehicle," said Corteco CEO Jason Meier. While the economically priced replacement parts still meet Freudenberg's high quality standards, they are geared to the car's lower projected remaining lifespan, and their functional scope is reduced. After all, it does not make sense to install an adaptive high-tech engine mount in an 18-year-old taxi in Togo. On offer instead are technically simplified components without hydraulic adjustment capability. "For the vehicle's remaining operating life, these repair methods are exactly fit for purpose, especially in terms of requirements for comfort and driving dynamics, which are generally lower in Africa."

Africa is not the only region where Corteco offers components specifically developed for older vehicles with limited remaining life spans. It offers them in regions such as Russia as well, alongside original Freudenberg replacement parts. With great success: In 2014, Corteco was honored with the coveted "Brand of the Year" award at Automechanika in Moscow. The award is a project of the Russian transport ministry and has been highly regarded in that market for years.

"One of our major advantages is the fact that we are very flexible and can adapt quickly to the different needs of customers across regions," says Ralf Schmid. Corteco has a successful presence in the market globally, with its own branches in 15 countries. Through the closely knit network of the Freudenberg Group, the company reaches customers in a total of 60 countries. This makes Freudenberg a reliable partner in each of a car's lives – be it first, second or third. ◎

A DIFFERENT TAKE ON SEALS

FOUR TIMES A YEAR, MORE THAN 800 SEALING RINGS ARE USED AT DARMSTADT'S CENTRAL STATION. BUT IN THIS FORMER STREETCAR DEPOT, THE O-RINGS ARE NOT NEEDED TO SEAL AGAINST OIL, WATER OR STEAM. INSTEAD THEY ARE PUT TO A MORE POETIC USE. AFTER ALL, THE TERM FOR "SEAL" AND "POETRY" IS ONE AND THE SAME IN GERMAN – "DICHTUNG." AS IT TURNS OUT, SEALS PLAY A KEY ROLE IN SELECTING THE WINNER OF GERMANY'S LARGEST POETRY SLAM. ESSENTIAL PAID A VISIT TO THE DARMSTADT POETRY COMPETITION.

Poetry slams have been in existence for almost 30 years. The American performance poet Marc Kelly Smith was tired of the usual readings with a table, chair and glass of water. On July 20, 1986, he organized his first Uptown Poetry Slam at "The Green Mill" in Chicago. The idea was to have poets compete against one another in a competition, presenting works they had written themselves. The audience was then supposed to determine the winner for the evening. The entertaining format quickly caught on. The first National Poetry Slam in the United States took place in San Francisco in 1990, and MTV took the format to television with its MTV Poetry Unplugged broadcast in 1992.

There have been poetry slams in Germany since 1997. On Oct 14, 2001, 12 slammers subjected themselves for the first time in Darmstadt to the critical judgment of an audience of nearly 800. The rules have not changed since the first poetry slam: All the works must have been written by the poet him or herself, aids such as instruments or other props are prohibited, and the length of the reading cannot exceed seven minutes. The special feature of the poetry slam is that the quality of the reading is determined in the preliminary rounds with scores between zero and 10 per ballot, but, in the final round, the poets compete for the coveted sealing rings. Each audience member receives a ring on entry and gives it to the poet whose reading they enjoyed the most. Whoever collects the most sealing rings wins fame and honor.

Some of the slammers are invited by organizers of the poetry slam. The other spots are allocated from an open list. The performance sequence is random. The "slam masters" organizing the event fulfill the important roles of moderators, networkers, talent scouts and advisors. They have been organizing the German-language poetry slam championships in changing locations since 2001. The winners of regional slams select their national champion in front of an audience of 15,000.

Slam poetry – a particularly rhythmic, audience-oriented approach to performing lyric poetry – has developed into its own genre at the more than 130 regularly occurring slams. The material is not simply read; it is recited as a performance art – often accompanied by cries, whispers, whines or gasps. But every form of modern literature and verbal art is found among the more than 2,000 slammers on the German-language scene – from classical or modern lyric poetry and sound poetry, to cabaret and comedy performances, all the way to short stories. 21 year-old slammer Julia Engelmann caused a sensation in 2013 when she mirrored her generation with her presentation "One Day, Baby..." and won unexpected success. Her performance has so-far chalked up 8 million views on YouTube.

The success of poetry slams has had an effect beyond literary experimentation. For example, the format has become especially well established in university towns, where scientific findings or projects are presented in succinct form and even evaluated by an audience. Slam Master Alex Dreppec organized Germany's first "Science Slam" in 2006. Dreppec, who researches comprehensibility, was aiming to improve scientists' ability to communicate – by having them try to inspire their audience in the space of seven minutes with the likes of a lecture on "Entropy – from Cooling Towers to the Irreversibility of Things". In 2012, 22-year-old medical student Giulia Enders enthralled her audience with the findings of intestinal research – her nonfiction book "Darm mit Charme" ["Gut: The Inside Story of Our Body's Most Underrated Organ"] emerged from her slam presentations and has topped the national bestseller lists since the spring of 2014.

Sealing rings as an expression of literary quality are still the unique attribute of the Darmstadt poetry slam. Oli Gaußmann, co-founder and original Slam Master, can still remember his early procurement efforts – including a phone call to a technical distributor:

GAUSSMANN: "Hello, I would like 1,000 O-rings with a diameter of 35 to 40 millimeters or so."

SALESPERSON: "What do you mean by 'or so'?"

GAUSSMANN: "Well, it can be any size with a diameter between 35 and 40 millimeters. I would like 1,000 of them."

SALESPERSON: "If you don't know the exact size, the ring won't fit. Please measure it and call us back."

GAUSSMANN: "I don't need the rings to seal anything. We need them for a poetry competition. The precise size doesn't matter. They only need to be larger than 35 millimeters so they fit over a wooden rod."

SALESPERSON: "Okay, why didn't you say that in the first place? What kind of material should it be?"

GAUSSMANN: "Rubber."

SALESPERSON: "We have to know more precisely. What medium is being sealed against and in what temperature range?"

GAUSSMANN: "The event takes place in a heated hall. So around 20 degrees Celsius."

SALESPERSON: "We can offer you isobutylnitrile, acrylic rubber, Hypalon or Perbunan."

GAUSSMANN: "I'll take the cheapest one."

SALESPERSON: "That can cause trouble later. I assume no responsibility if it isn't leak proof."

GAUSSMANN: "No, no, I don't want to seal anything. I only need the rings to run them over a rod at a poetry event. We call it a poetry slam, and the sealing rings are supposed to be a word play."

SALESPERSON: "Hmm. I'd better hand you over to my boss ..."

Oli Gaußmann's purchases have now become routine: "When we run short on O-rings, I just order 1,000 units of the 36-by-4 millimeter size in Perbunan. And sometimes I talk shop a bit with the salesperson about their improved tolerance for chloric solvents." ◎

SETTING STANDARDS FOR THE PROCESSING INDUSTRY

Well-founded materials expertise is the foundation of made-to-order sealing solutions for the processing industry. Freudenberg Sealing Technologies has just added a new FKM to its product portfolio. In addition to the tried-and-tested red material 70 FKM 37508, a black version, 75 FKM 38269, is now available to customers.

The new material stands out especially for its temperature flexibility. With this material, the leading sealing specialist for the processing industry is responding to the market's demands for fluorinated sealing materials that offer applications across a wide temperature range.

Seals made of fluororubber (FKM) are used throughout the processing industry. In the chemical and pharmaceutical industries, FKM is a good solution for applications with non-polar solvents, aliphatic compounds, fats and oils. In the food industry, seals made of FKM are employed if high operating temperatures prevail or the media would attack other elastomers such as EPDM or HNBR. FKM is resistant to pure citrus juices and is suitable for contact with dairy products.

The new 75 FKM 38269 is a material for O-rings and incorporates the above-mentioned characteristics. Thanks to approvals in accordance with FDA 21 CFR 117.2600 and EU Regulation 1935/2004, along with its classification in Class I of the e3-A® Sanitary Standards, the material is suited to the food industry worldwide. The red 70 FKM 37508 remains available for the manufacture of O-rings and molded parts. It is also suited to pharmaceutical applications since, in addition to the above approvals, it is certified to USP Class VI.

It is its temperature flexibility in particular that makes the new material an attractive sealing solution for the chemical industry – a sector that primarily uses FKM. PTFE has even greater chemical and thermal stability and is happily used as an alternative, but it does not have elastic qualities.
Another plus for the new material is that comprehensive studies have shown that 75 FKM 38269 is also well suited to cleaning processes using CIP (cleaning-in-place) and SIP (sterilization-in-place) procedures. The material has proven to be very stable for long-term static use in both oxidizing and alkaline cleaning and disinfecting agents.

EXEMPLARY PURITY

The interactions of elastomers with pharmaceutical preparations are investigated in "extractables" studies. This is a particularly important issue for seals that come into direct contact with medications during production or packaging. The blue universal material Fluoroprene XP and the perfluoroelastomer Simriz have just been analyzed. Both materials are impressive for their extraordinary purity.

Manufacturers of pharmaceutical products – such as an inhalation spray head – consider it important to know the ingredients of a seal. But in isolation, they say nothing about potential reactions. The reason is that, even when they meet the current FDA, USP Class VI and EU Reg. 1935/2004 specifications, the migration values – for which there are no guidelines – can be critical.

Freudenberg Sealing Technologies has analyzed its Fluoroprene XP and Simriz materials. Both produced exemplary test results. There are no detectable extraction quantities in ethanol and hexane. The TOC values in the phosphate buffers are below those of EPDM compounds, which have been shown to be "low extract" in preliminary tests.

Extractables studies are important for the documentation requirements of facility operators. Anyone who knows the interactions between the seals in use and the processing media can prevent contamination. And the purity of pharmaceutical products protects patient health.

EFFICIENT APPLICATION

The tie-bar-less technology of the Engel company is known for allowing the use of relatively small injection molding machines even with large tools. At a symposium in Linz, Austria, three companies have just been honored for their outstanding applications. In the "efficient automation concept" category, the award went to Freudenberg Sealing Technologies' Lead Center Thermoplastic.

At its facility in Losenstein, Austria, Freudenberg Sealing Technologies produces more than 3 million modules for measuring oil levels in the engine compartment. The components are made of plastic because space is tight under the hood. The core of the fully automated manufacturing cell is Engel's tie-bar-less injection molding machine. Four integrated multi-axis robots handle insertion of the projectiles, removal of the injection-molded parts from the tool, separation of overflow cavities, printing on the front of the funnels, fitting of the O-rings, assembly of the oil sleeves and dipsticks, passageway and leak testing and packaging of modules ready for installation.

Space is not only a luxury in the engine compartment, it is tight on the manufacturing floor as well. Only a tie-bar-less solution came under consideration for the manufacture of these oil level modules. The system allows the robot to work especially close to the clamping unit and directly access the cavities. A conventional machine with tie bars would have required a considerably more complex removal process – and at least 6,000 kN of clamping force and thus more space. In this application, the tie-bar-less technology makes a crucial contribution to the high efficiency of the automated manufacturing process – the most important rationale for giving the award.

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