SCHAEFFLER

2016

FACT SHEET XXL PRODUCT INNOVATIONS THE LAST SEVEN DECADES



1946

TIME LAPSE

Milestones from 70 years of Schaeffler

From components to globally active system manufacturer: the transformation of Schaeffler

p.



HOBILITY FOR TOMORROW

HERE'S TO THE NEXT 70

p.

Think about tomorrow today: the future of Schaeffler

EDITORIAL

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Maria-Elisabeth Schaeffler-Thumann Shareholder of the Schaeffler Group

Dear Readers, 70 years ago the company Schaeffler was founded in Herzogenaurach by the brothers Dr. Georg Schaeffler and Dr. Wilhelm Schaeffler. The historical overview of our company, enclosed in this edition of 'tomorrow,' uses the genesis of the company and the successful products that Schaeffler has created as its focal point. Today, as 70 years ago, our entrepreneurial courage, our employee orientated culture, our technological know-how and our long-term thinking are the key factors in how Schaeffler has evolved into a worldwide technol-

ogy corporation. The success of Schaeffler as a company is based upon the complete competence and high motivation of our dedicated staff – in the past, present and future. We would like to thank our employees for their accomplishment, and our customers and partners for the trust that they have placed in their cooperation with Schaeffler. Our heritage and the rise of our successful family company inspire us for our future plans. In particular, we will continue our global course of growth by investing in new sites and factories as well as in research and development, for we will implement our corporate strategy staying true to our motto, 'together we move the world,' and decisively shape 'mobility for tomorrow.'

Yours **Maria-Elisabeth Schaeffler-Thumann**

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On the road with a case of samples Dr. Georg Schaeffler demonstrates the INA roller bearings to potential customers in traditional fashion with a collection of demo items

N SUITCASE RPORATE GROUP

In 1946, a genius idea lay the foundation for the global company, Schaeffler. How it all started.

TIN

Herzogenaurach, at the end of 1945: the small Middle Franconian town hears that there are two brothers in Schwarzenhammer in Fichtelgebirge, who manufacture trolleys among other things. This form of transport is very popular. Mayor Hans Maier sets out to meet Dr. Wilhelm and Dr. Georg Schaeffler. While talking, it soon becomes clear that the Schaefflers are searching for a suitable plot of land to be the new home of their growing company – the manufacture of needle roller bearings. It should have a rail connection. As chance would have it, Mayor Maier has reserved exactly such a plot of land south of the station in Herzogenaurach for interested industries and firms wishing to settle



INDUSTRIEWERK SCHAEFFLER FABRIC FOR NADELLAGER HERZOGENAURACH BEI NURNERG Telefen 170 172 5 Teleparamen Schaeffermet Telefen Wilfe **Cutting to the point** Schaeffler advertises its caged needle roller bearing with large billboards

in his town and enhance its value in the difficult post-war era. A 10,500 square meter building plot, a large pool of skilled employees and the required long distance transport hub. The parties come to an agreement.

The Schaeffler's new business in Herzogenaurach is a done deal: a simple subsidiary is not the target, but in fact an entirely new metalworking company separate from the Schwarzenhammer site. The company is established in 1946 under the name 'Industrie-GmbH' and from 1948 the Schaefflers trade under 'Industriewerk Schaeffler oHG.' From 1947 small quantities of needle roller bearings, thread cutting jaws, cold punches and universal joint bearings are manufactured. From this time comes the name 'Industrie-Nadellager' (INA).

THE BREAKTHROUGH

Prior to 1949 only the full complement sets without cage and with loose needles are known in the needle bearing sector. Lateral thinker Dr. Georg Schaeffler has long since been working on eradicating the weaknesses of this bearing. The first prototype for a caged needle bearing is created. If the needles, as the long, cylindrical rolling elements are called, are not fitted loosely

ANOTHER ANNIVERSARY

In 1976, a small team of eight employees starts the first aftermarket service company of a clutch manufacturer: the AS Autoteile-Service GmbH & Co. KG. 40 years later the repair and maintenance sector is called Schaeffler Automotive Aftermarket, which employs around 1,600 specialists and impresses its customers through technical excellence, intelligent solutions and outstanding services.

SCHAEFFLER IN THE AUTOMOTIVE AFTERMARKET

11,500	sales partners
50	sales offices and subsidiaries
3,300	tons delivery volume weekly
66	technical trainers implemented about
1,700	training sessions with more than
56,000	

PIONEERING ROLE MODELS

DR. WILHELM SCHAEFFLER

Rorn School

University

Deceased

3 April 1908 in Lothringen High school graduation in Saarbrücken Business Administration Imprisonment 1946–1951 in Poland due to false denunciation 22 October 1981





DR.-ING. E. H. GEORG SCHAEFFLER

Born School

> University Deceased

4 January 1917 in Lothringen High school graduation in Neunkirchen Apprenticeship Businessman **Business Administration** 2 August 1996

into the bearing, but in fact retained in a cage, which prevents contact between the rolling elements, they no longer tilt. Frictional losses due to contra-rotation are eliminated. As a result, such bearings can withstand significantly higher dynamic loads.

AN INVENTION ON A TOUR OF GERMANY

A good idea must be spread around the world. So, Dr. Georg Schaeffler and one of his engineers go peddling just a few weeks later. For presentation purposes they have a case of samples in the car, which is today on display in Herzogenaurach. The first orders quickly follow. In 1950, the component is an integral part in the design of the DKW F89, from 1952 also in the Volkswagen Beetle's gearbox - the caged needle bearing becomes a bestseller in record time. From 1953 onwards, there is not a single new car in the young Federal Republic in which the Schaeffler bearing is not fitted as standard. Schaeffler's innovative bearing technologies allow car manufacturers beyond the present day to develop increasingly more powerful and efficient vehicles.

However, general industry in post-war Germany gets wind of this innovation. The new needle bearings from Herzogenaurach - to name just one example - crucially pushed forward the use of roller bearings in printing machines. The classic concept of the main cylinder floating bearing in the offset printing machine is based for 50 years now on a Schaeffler solution – the double row needle roller bearing with offset cage pockets. One innovation is followed by another. So typical for the history of the Schaeffler company.

SUCCESS RUNS ITS COURSE

Another important year in the company's history is 1969. The INA linear recirculating roller bearing makes it possible for the first time to replace linear plain bearing guides with roller guides. This simple component is at this time an innovation for production machinery: highly resilient yet smoothly running and simple to install. Now in its fifth generation.

Over the years, Schaeffler repeatedly discovers new business areas to expand the product portfolio. However, such inventions do not come from nowhere. The company's constantly growing know-how proves to be the perfect growth medium. The cooperations with universities, institutes and research facilities play an important role for Schaeffler as leading innovator.

It's extremely likely that one of more than 2,300 patents, which Schaeffler registered in 2015, will be equally relevant as the robust needle roller bearing from 1949.



★ LOCATION HERZOGENAURACH

THEN THE EARLY BREAKTHROUGH

Extension of the first manufacturing hall +++ Construction of the administration building (still in use today) at the main entrance +++ Acquisition of the so-called Glockbau – named after the former owner – for the cage manufacturing +++ Construction of a production shop for the machine shop



1960s RAPID PROGRESS

Construction of the 'Hochhaus' and the bus garage +++ Construction of the 'Elefantenhalle' – christened as such because of its enormous size for the time +++ During this period an area of 48,300 square meters is covered with buildings



YER

74 factories, 17 research and development centers, service stations – the international Schaeffler network currently includes 170 sites in 50 countries.



1970s CRISIS OVERCOME

The number of employees in Herzogenaurach factory rises from 2,325 (1960) to 3,400 (1970) +++ 1971 production of a new cage generation +++ Despite global economic crisis the turnover is stable +++ The new data processing moves into a building of its own



TODAY 'SMALL TOWN' WITHIN THE TOWN

All the strings are pulled at the headquarters of the global company +++ Around 8,500 employees alone at this site (to compare: Herzogenaurach has about 23,000 inhabitants) +++ Many buildings from the early days still exist today



LIKE YOU&

The cliché that large companies are mainly anonymous and heartless does not apply to Schaeffler. Then as now, the employees practically belong to the family.

In mid-1948, the currency reform laid the foundation for the rebuilding of West Germany. Every citizen was initially given a one-off payment of 40 DM. This was on 20 June.

On this day, Georg Schaeffler called a works meeting and said to his near 70 employees: "Men, I get the same 40 DM as you. Just like all of you, I must also start all over again. What should be done?" After about an hour of discussions the decision was made. Together they brought the message to the Boss: "Life goes on. We'll work and when you have money then you can pay us." A crucial point in Schaeffler's company history. This willingness to take risks can be traced to the trust placed





Georg F. W. Schaeffler Associate of the Schaeffler Group

years is the average period of employment

39.7

years is the average age of a Schaeffler employee

ACADEN

in the two Schaeffler bothers. The unique spirit that characterizes the company to this day emerged during this period.

SOCIALLY RESPONSIBLE FROM THE START

People are the focus of attention at Schaeffler. Even in the early days, the employees were cared for in a manner that was by no means the norm at that time. The 'Sozialwerk Schaeffler e. V.,' whose emphasis in the 1950s and 1960s was helping to find accommodation for the employees, formed the basis after being established in 1953.

Even today, great emphasis is placed on employee welfare. Schaeffler's objective is to support employees through personnel development and further education activities so that they are equal to the complex challenges of the working environment. For this reason, the company has bundled the many activities for the systematic establishment and expansion of knowledge under the umbrella of the Schaeffler Academy. It offers targeted measures for the training and vocational education of apprentices, employees



and management. The reconciliation of work and leisure enjoys high priority and is encouraged through measures such as company sports programs, flexible family-friendly working models and company pensions.



IDEAS STAGNATION EQUALS DECLINE TSIDE T ÊRÌ EXP **NSE**

The fact that Schaeffler has become a corporation with more than 85,000 employees is thanks to entrepreneurial endeavor and adhering to certain values. The company looks proudly back on a history packed with important milestones and innovative inventions. The following timeline recounts the last 70 years.

MILESTONES AND IN OVER THE LAST SEVEN DECA



Dr. Georg and Dr. Wilhelm Schaeffler buy a plot of land and establish the company 'Industrie-GmbH' (from 1948 'Industriewerk Schaeffler oHG')

1946

1950

The **Auto Union DKW F89** is the first automobile in which the caged needle roller bearing is used. Orders follow from other manufacturers

1955

At the Paris Motor Show, Citroën unveils the **revolutionary DS model**, which is equipped with INA needle roller bearings from the INA needle roller bearing catalogue that was only published in the same year – as a result the DS is 'autobahn proof'



With the **caged needle roller bearing**, Georg Schaeffler makes a groundbreaking invention, which ensures the company's rapid development

1949

1954

The Schaeffler brand Industrie-Nadellager (INA) presents **deep drawn needle bushes at the Deutsche Industriemesse in Hannover**





The **INA flat cage** forms the foundation for the new business sector linear technology

1955

IVENTIONS Des



Foundation of the future Schaeffler brand LuK. LuK was founded in 1927 as Lamellen und Kupplungsbau August Häussermann

1971

As one of the first manufacturers in Europe, INA supplies **hydraulic valve lifter elements** in high volume. Pictured is a switchable variant, introduced in 1996





Hydraulic camshaft timers from INA permit infinitely variable valve timing. Fuel consumption and emissions sink

Schaeffler provides spherically shaped bearings for the new Ford Taunus 12M 'Cardinal' – Schaeffler's first ever custom-made automotive product

1962

1969

Innovation for the machine tool: the **INA linear recirculating bearings** allow linear plain bearing guides to be replaced by roller guides



Schaeffler produces the **dual mass flywheel** that reduces torsional vibrations and vibration damping and thus revolutionizes the automobile world

1985

1995

Start of mass production of the **alternator freewheel clutch** that reduces oscillations while improving the energy efficiency of modern engines





The ferris wheel 'London Eye' with spherical roller bearings from the future Schaeffler brand FAG is put into operation

2004

Schaeffler's **switchable roller tappets** permit selectable cylinder deactivation and thus contribute to a reduction in both fuel consumption and emissions The LuK dry double clutch in Volkswagen's 7-speed DSG gearbox goes into production and forms the basis for mechatronics expertise at Schaeffler



2001

FAG is bought by Schaeffler



On the **Suez Canal, the world's largest swing bridge** (320 meters long and weighing 5,000 tonnes), in which Schaeffler taper roller bearings are used, is inaugurated





Commissioning of the Schaeffler Centre of Competence for Surface Technology. The turnover with coated parts is increased by more than 50 percent

2007



Schaeffler's 'Astraios', the world's most modern, largest and most powerful heavy-duty bearing test rig, is put into operation

2011

2015

Schaeffler becomes a **listed company**



Schaeffler's **electromechan ical roll stabilizer** wins the German innovation prize



2009

In cooperation with Fiat, Schaeffler develops and produces 'UniAir,' the **first fully variable valve control worldwide**. In conjunction with downsizing, fuel consumption and harmful emissions can be reduced by as much as 25 percent





The **'System**haus eMobilität' paves the way for Schaeffler in electromobility

2011



SCHAEFFLER INSIDE

On land, at sea and in the air – these three 'vehicles' don't get far without solutions 'made by Schaeffler.' In the **Mars Science Laboratory rover** used to explore the red planet, high precision bearings are installed. The Rolls-Royce jet engine on the **Airbus A380**, the world's largest passenger aircraft, includes innumerable FAG bearings. The '**Pioneering Spirit**,' **the world's largest working vessel**, is equipped with 240 large spherical plain bearings from Schaeffler.



The Schaeffler section Automotive develops and produces groundbreaking products in the fields of engine, gearbox and suspension system fields – yesterday as it does today. Over the last seven decades, the company formed and consolidated successful cooperations with innumerable manufacturers.

AUTOMOBILE INNOVATIONS IN SERIES

Audi A

Alfa Romeo MiTo

Bentley Bentayga

BMW 525eta



An average of 60 Schaeffler products are currently found in every newly built car around the entire world. The spectrum ranges from bearings to complete hybrid modules. The success story begins with the discovery of the caged needle roller bearing in 1949, which is an integral component in the DKW F89 as early as 1950. Over the following years, Schaeffler bearings appear in every German car. The company enters into close partnerships with manufacturers like Volkswagen, Mercedes-Benz, Citroën, Chrysler, Volvo, Audi, BMW and Škoda, which still hold to this day.

A comparative glance in the model history for example of Porsche – from the first 356 model to the latest high-tech hybrid 918 road going sportscar – documents impressively more than six decades of automobile progress. Progress that Schaeffler has driven from the very onset. The subject of energy efficiency is always in focus. A current example is the con-



cept car CO₂ncept-10% based on the Porsche Cayenne, in which a multitude of Schaeffler products integrated with one another reduce both the fuel consumption and CO_2 emissions by ten percent.

Schaeffler can look back on a similarly long partnership with Ford. In 1962, Schaeffler manufactures its first custom-made automotive product that is fitted to the Ford Taunus 12M 'Cardinal.' Camshaft timers that increase driving fun and reduce fuel consumption are used for the first time in the Ford Puma. The product of the most recent cooperation is the Gasoline Technology Car II based on the Ford Focus. This concept car demonstrates the potential of intelligent 48 volt hybridization and is a good example for Schaeffler's innovative powers in electromobility.

NUMBE<mark>r one</mark>

The Schaeffler Group is a world leader in the development of components and systems for the powertrain

Futuristic The Gasoline Technology Car II (above) and the CO₂ncept-10% are Schaeffler concept cars that demonstrate the innovative technology of tomorrow







Schaeffler Hybrid



Schaeffler ACTIVeDRIVE



COMPREHENSIVE **KNOW-HOW**

From the heights of aerospace to the depths of mining – the Schaeffler sector Industry supplies roller and plain bearings, linear technology, maintenance products, monitoring systems and direct drive technology to customers in 60 sectors worldwide.

Schaeffler's Industry product portfolio ranges from millimeter-sized high precision bearings via roller bearings and linear guides for tooling machines to large bearings with a diameter exceeding 4 meters for tunneling machines or wind turbines.

In the aerospace sector, the Schaeffler Group is a leading manufacturer of high precision bearings for aircraft and helicopter engines as well as for space applications. Schaeffler's special bearing systems and precision components are used for almost every aerospace application – from turbine jet engines for Boeing or an Airbus to Ariane rocket propulsion.

Renewable energies will make a significant contribu-

tion to energy supply in the future. Schaeffler's technological expertise appears today in products and solutions for hydropower, solar energy and wind power. To this end, Schaeffler operates the world's most powerful large bearing test bed – Astraios, on which rotor bearings for wind turbines weighing up to 15 tonnes and with an external diameter of 3.5 meters are tested under realistic conditions.

KEY COMPONENTS FOR THE NEW PANAMA CANAL

After a nine-year construction period, the new, third channel for the Panama Canal was opened at the end of June. With immediate effect, ships with a length of up to 366 meters and a width of almost 50 meters can use the The most recent coup Schaeffler delivers parts for the expansion of the Panama Canal, including spherical roller bearings (small photo) for the guide rollers weighing several tonnes

shortcut between the Atlantic and Pacific oceans – also thanks to Schaeffler's assistance. The German company supplies more than 3,400 roller bearings for lock systems and water management.

40,000 catalogue articles form the Schaeffler product portfolio in the industry sector

MOBILITY FOR TOMORROW

Seven successful decades Schaeffler. Reason to celebrate? Yes. Reason to sit back and relax? No. Prospects for mobility of the future.

Schaeffler is acknowledged as a leading innovator with a multitude of technologies that make the automobile more economical, environmentally friendly and safer, as well as products for trains, aircraft, and wind turbines, and for many other industry sectors. Wherever something moves, Schaeffler is there. And motion also means mobility. The demands made of mobility for the future are huge. For this reason, Schaeffler has committed itself to the integrated strategy concept 'Mobility for tomorrow,' in order to find sustainable solutions for tomorrow's world. Environmentally friendly powertrains, urban mobility and the topic energy chain are the fields in focus that Schaeffler is actively shaping through its own research and development in cooperation with customers and business partners.





ENVIRONMENTALLY FRIENDLY POWERTRAIN TECHNOLOGY

The vehicle powertrain is, to a large extent, crucial for the energy efficiency and therefore the environmental impact of mobility. With this in mind, the development of energy efficient powertrains will also enjoy top priority in the future. Schaeffler covers the entire range from optimizing the conventional combustion engine via hybrid solutions to electromobility. As a global technology corporation, Schaeffler enables its customers in every region to fulfil future emission standards. A series of concept cars, such as a car with 48 volt hybridization or a solely electric powered four-wheel drive car, demonstrate Schaeffler's innovative powers in the automobile sector. Schaeffler produces the powertrain for the cars entered by ABT Sportsline in the FIA Formula E championship for pure electric powered racecars.

URBAN MOBILITY

In the future, intermodal traffic in confined spaces with a smooth transfer between different forms of transport will be in demand. New technical solutions are required here. Schaeffler is actively involved in shaping this trend. For example with the electric wheel hub driver eWheelDrive. The compact bundling of the drive module in the wheel creates more space inside the car and increases vehicle agility. With innovations in the area of the sensor bottom bracket bearing and the automatic shifting FAG-VELOMATIC, Schaeffler makes its own contribution in establishing the E-Bike as a future form of transport. A look into the future reveals the Schaeffler concept Bio-Hybrid (photo). It unites the advantages stability and weather protection with energy consumption and the space utilization of a pedelec. The rider travels sportily and comfortable at the same time thanks to the electric supported drive.

INTERURBAN MOBILITY

For a growing part of the world population, it will be important to move efficiently between urban economic centers. Resource efficiency is required with all modes of transport be it aircraft, high-speed train or automobile. Schaeffler plays a pioneering role in the interurban mobility, for example through the development of roller bearing solutions for the railways. The business division Schaeffler Aerospace has developed into a worldwide leading provider and development partner for special roller bearings in the aerospace industry. Among other things, the bearings as well as further precision components for the Airbus A₃80 propulsion originate from the Schaeffler product brand FAG.



ENERGY CHAIN

Future mobility solutions will consider the CO₂ balance of the entire energy chain. For this purpose, the creation and storage of power for electric cars and of hydrogen for fuel cell vehicles are of particular importance. In view of diminishing resources and the challenges linked with climate change, the worldwide requirement is growing for clean energy. The regenerative energy sources are of fundamental importance in this case. Hydro, wind and solar energy also represent promising growth areas for Schaeffler.

TOMORROW IS THE NEW YESTERDAY

Seven decades of Schaeffler are not only reason to glance in the rearview mirror, but in fact the main reason to look to the future. Klaus Rosenfeld, Chief Executive Officer of Schaeffler AG, gives an insight into the company's future plans.

Seven decades of Schaeffler – how proud are you of this anniversary?

The Schaeffler Group lives from its outstanding manufacturing technology, the wealth of ideas, the ingenuity of its engineers, and the significance of its products. I'm very proud of this. However, for the success over the last 70 years we must first and foremost thank the many employees that have in part been associated with the company for decades, and who make it such a fantastic company every day. At this point, I wish to offer my heartfelt thanks to all our employees worldwide for their considerable achievements and the commitment they display every day for the Schaeffler Group.

Let's take a look at what's happening today: what inspires the company in 2016?

The Schaeffler Group is always described as an automobile supplier. We are however more. We are an integrated automobile and industry supplier. Our industry business, which currently makes around 25 percent of our total turnover, is not merely a sign of our origins. It is, at the same time, a central component of our future strategy. Our two divisions jointly use a worldwide production and research network. You could also say that the connecting element between the two divisions is our ability to process steel – but also other materials – to the highest precision and quality.



So, the component business will also remain an important element for Schaeffler in the future?

This is our foundation. Because cars of the future will not be driven virtually, which means wheel bearings or suspension components will still be necessary. And as long as there are combustion engines, these will be equipped with valve gear. The combustion engine also needs a gearbox. Even if the hybrid gearbox of the future might only have four gears there will still be gear changes, which require actuators in addition to roller bearings and switch elements.

What role exactly does electro mobility play for Schaeffler?

Energy efficiency, environmental friendliness and a correspondingly rapidly growing number of hybrid and electric cars – the automobile industry is on the verge of entering a new era. Schaeffler recognized this trend early and guides and shapes these pioneering developments featuring innovative technologies. Today, Schaeffler has a wide-ranging portfolio available of attractive technologies. Hybrid modules and electric axles currently in the production cycle originate from our research and development process. Sales revenues of the Schaeffler Group by division **75,6%**

Automotive

24.4 % Industry 30

supported by Schae just in Germany

720,000,000 €

was invested by Schaeffler for research and development in 2015. This is 45 % more than 2011 **3000** mechanical and electronic parts form Schaeffler's P2 hybrid module

FACTS AND FIGURES ABOUT SCHAEFFLER 6%

15,000 needle roller bearing versions are

manufactured by Schaeffler for automobiles, two-wheeled vehicles, construction and agricultural machines

1,900 new employees joined across the Group in 2015

60 different sectors are supplied by Schaeffler **17** Research and Development centers are operated worldwide by Schaeffler

65,000

products are offered by Schaeffler – from millimetersized high precision bearings to heavyweights for tunneling machines or wind turbines

titles (2011 and 2013) went to Schaeffler cars in the DTM

turnover on

60

oarts on average from Schaeffler are found in every car worldwide

SCHAEFFLER

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Learn more about the mobility for tomorrow

SCHAEFFLER COMPACT

≈85,000	employees worldwide
13.2	billion Euro turnover in 2015
> 2,300	registered patents in 2015
170	sites in 50 countries

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