

# SCHAEFFLER

July 2015

*special*



## A DAY IN THE CITY

WHERE TO FIND SCHAEFFLER IN EVERYDAY LIFE

# A DAY IN THE CITY

“Mobility for tomorrow” – that’s Schaeffler’s strategic concept. But what does it mean for our everyday lives? And what does it have to do with a “day in the city”? On the following 17 pages, *SCHAEFFLER special* provides answers to these questions.

She says: “Hey, let’s go to town!” – He answers: “What for?” – She replies: “So we can see all the Schaeffler products everywhere.” – Granted: This conversation is purely fictitious and most probably has never really taken place. But next time you’re out and about, take a closer look at anything that’s turning and moving. For in a city especially, Schaeffler technology pops up at every turn.

It’s only logical that there’s plenty of Schaeffler technology to be found in urban environments, and especially when looking ahead to the future. It won’t be long before about 70 percent of the world’s population will be living in cities. And so Schaeffler products will be all over the place too, in a vast range of different applications. Whether in cars – incidentally, on average, 60 Schaeffler products are installed in every vehicle – or in shopping centers, for example in elevators. Or in trains, trams, subways and refrigerators, as well as in buildings and power lines. Many Schaeffler technologies are used in power generation too, in a wide range of applications – whether in conventional power plants, hydropower plants and dams or in wind turbines and movable solar panels.

All these areas (of life) where Schaeffler products play a major role are bundled in the strategic concept “Mobility for tomorrow”. Here you will find “eco-friendly drives”, such as the wheel hub drive incorporated in Schaeffler’s E-Wheel Drive concept car, just like “interurban” and “urban mobility” and even the “energy chain” area.

In order to show you, our dear Readers, where you can encounter Schaeffler in everyday products and systems solutions, we’ve set out to follow a very average family, John Doe and his wife Janet, as they spend a day in an average city. We are with them as they get up early in the morning till late in the evening – 19 puzzle pieces long that you can see at a glance on the pop-up page.

We hope you will enjoy the adventure!



# A DAY IN THE CITY – WHERE TO FIND SCHAEFFLER IN EVERYDAY LIFE



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## 1 – REFRIGERATORS



6.30 in the morning. Today, like every day, John Doe is stirred by the annoying sound of the alarm clock on the nightstand in his bedroom. It's the same procedure every morning: Not yet really awake, John staggers to the bathroom, rubbing his eyes. He gets dressed and walks over to the kitchen to make some coffee. As he likes white coffee best of all, he opens the fridge and reaches for the milk. What he doesn't know is that Schaeffler technology has been helping to keep the milk nice and cool.

Axial ball bearings in the refrigeration compressors ensure that the friction during the start of the cooling compressor is reduced. And whilst in continuous operation, the bearing rotates extremely smoothly, supporting the crankshaft in the piston compressor, the rotation of which is converted into the linear movement of the piston via a connecting rod. The cooling medium is compressed during the process. The advantages of the Schaeffler bearing include good coolant compatibility, friction reduction of up to five percent compared to the standard design, as well as better oil lubrication conditions and simplified installation.



## 2 – CARS



Shortly after 7.30, John Doe climbs into his car, having stowed his sample case in the trunk. John is a machine tool representative. The reliability of his car therefore is crucial to his job. Schaeffler has invented and manufactured countless solutions to ensure people like John can count on their vehicles. Each car contains an average of 60 parts supplied by Schaeffler, which all help to improve fuel efficiency and thus reduce CO<sub>2</sub> emissions.

The **thermal management module** is a good example when it comes to energy efficiency: It allows the optimum engine operating temperature to be reached in the shortest time possible and the temperature balance to be precisely controlled. Or take the damper with **centrifugal pendulum absorber** on the engine: It reduces up to 70 percent of undesirable vibrations and, just like the **dual mass flywheel**, allows driving in fuel-efficient operating points at low speeds. This applies to both manual transmissions and double-clutch transmissions.

As the name suggests, the **double clutch** consists of two clutches. While one clutch is engaged during driving, the transmission control system already preselects the next gear for the second clutch. In the fully variable, electro-hydraulic **UniAir system**, the valves are not directly activated by the camshaft, but by an electrohydraulic phasing unit installed between the camshaft and valves. Partially and fully variable valve train systems also allow individual cylinders to be deactivated during the drive. Lesser or greater volumes of air and fuel are injected, depending on the driving situation.

Schaeffler offers technical solutions even for vehicles with hybrid drives. One prime example is the 48-volt electrification. The central element is a **48-V drive module**, which has also been integrated into Schaeffler's 48Volt concept car. This solution is a compact drive which includes a clutch and planetary transmission and allows significant advances to be made in terms of drive efficiency.



← Valve control unit

## 3 – BASCULE BRIDGE



Just before John Doe arrives at the customer's, he has to stop in front of a bascule bridge that has been opened to allow a ship to pass through. While John is waiting, he asks himself how such a construction works at all. Here too Schaeffler expertise is in focus.

Both moveable and fixed bridges require bearing supports that connect the superstructure with the abutments and piers, accommodate all the forces and transfer them to the supporting elements. The bearings must be capable of supporting weights totaling several tons that must be reliably swiveled, pivoted or lifted. For decades, maintenance-free ELGES spherical plain bearings have ensured the smooth operation of countless bridges – offering high load carrying capacity, low friction and reliable operation. Schaeffler technology is also found in a wide variety of buildings, one example being the bearing supports for the roof of the main railway station in Berlin.



## 4 – FORKLIFT TRUCKS



John arrives at his destination at last – a major building company. In the yard, he just about manages to avoid a collision with a forklift truck carrying a heavy pallet on its forks.

An average industrial truck can lift up to eight tons. Components enabling this include, for example, lift mast rollers that guide the telescopic mast, chain rollers in the lift mast, plain bearings in the lift cylinder and tapered roller bearings as kingpin supports. Cylindrical roller bearings are installed in the truck's transmission system, and rotating cabins are also equipped with bearing solutions from Schaeffler.



## 5 – TRUCKS



While John is still negotiating with his customer, one truck after another leaves for the construction site in the city. To be found inside such trucks is a wide variety of Schaeffler products of the INA, FAG and LuK brands. This goes for all major manufacturers of trucks, buses and trailers – worldwide.

For example, INA needle roller bearings are used in gearboxes, LuK supplies products such as clutch facings and dampers. FAG wheel bearings are crucially important: They support the entire weight of the vehicle, which can multiply during extreme cornering. In just a few square centimeters, the individual rolling elements in the wheel bearings must accommodate enormous loads. Moreover, the bearings have to withstand external influences such as heat or cold, that place special demands on the materials and lubricants.

## 6 – GARAGE



Extremely satisfied with his business transaction, John climbs into his Renault Mégane III. There, as it has done for the past two weeks, the indicator light reminds him that his car is long overdue a service. Fortunately, John had phoned the garage the day before and was able to make an appointment at short notice for today. So he heads straight there. Upon arrival, he completes the usual formalities and hands over his car keys and documents to the mechanic. Servicing can start.

But a test drive, a look into the car interior and the results from the diagnostic device bring a nasty surprise to light: The double clutch needs to be replaced urgently. However, this is no problem for the mechanic. After all, he can resort to a complete repair solution – the LuK RepSet 2CT from Schaeffler Automotive Aftermarket. Together with the correct double clutch, this solution comes with all the perfectly matched components that are necessary for proper replacement. In addition to guiding sleeves, retaining rings and fastening bolts these also include the actuator levers and clutch engagement bearings.

Thanks to the associated special tools, the mechanic has no difficulties in carrying out the repair. This basic modular set of tools is especially convenient and cost-effective since it only needs to be supplemented with the Renault-specific tool kit. If necessary, detailed repair instructions and a corresponding training video on DVD are also included in the tool box to assist the mechanic.

At the promised time, John takes back his keys – and his car drives like new.



## 7 – BOTTLE FILLING PLANTS



John uses the time while his car is in the garage to eat some lunch and treats himself to a tasty burger meal. Munching on his French fries, he gazes at the bottle of lemonade on his table. And he asks himself how exactly the soda gets into such a bottle.

The answer: Huge bottle filling plants are used for this, and once again Schaeffler expertise plays a crucial role. For example in fully automated filling plants which comprise blow molding machines for the production of PET bottles, as well as rinsers for bottle sterilization and cleaning, meter-sized product fillers, star wheel transfer units and transport systems. All these wouldn't be operate smoothly if it weren't for reliable rolling bearing technology.

The majority of movements, whether rotary or linear, require products from the broad Schaeffler portfolio: from the smallest standard ball bearings to housing radial insert ball bearing units, from needle roller bearings to slewing rings of high performance steel, ceramics or plastic, measuring several meters in diameter. INA linear tables and shaft guidance systems are designed especially for high speeds and complex movements. Schaeffler's contribution to high operational security and maximum machine service life: robust and corrosion-resistant bearings with low maintenance requirement, effective sealing and for-life or media lubrication.

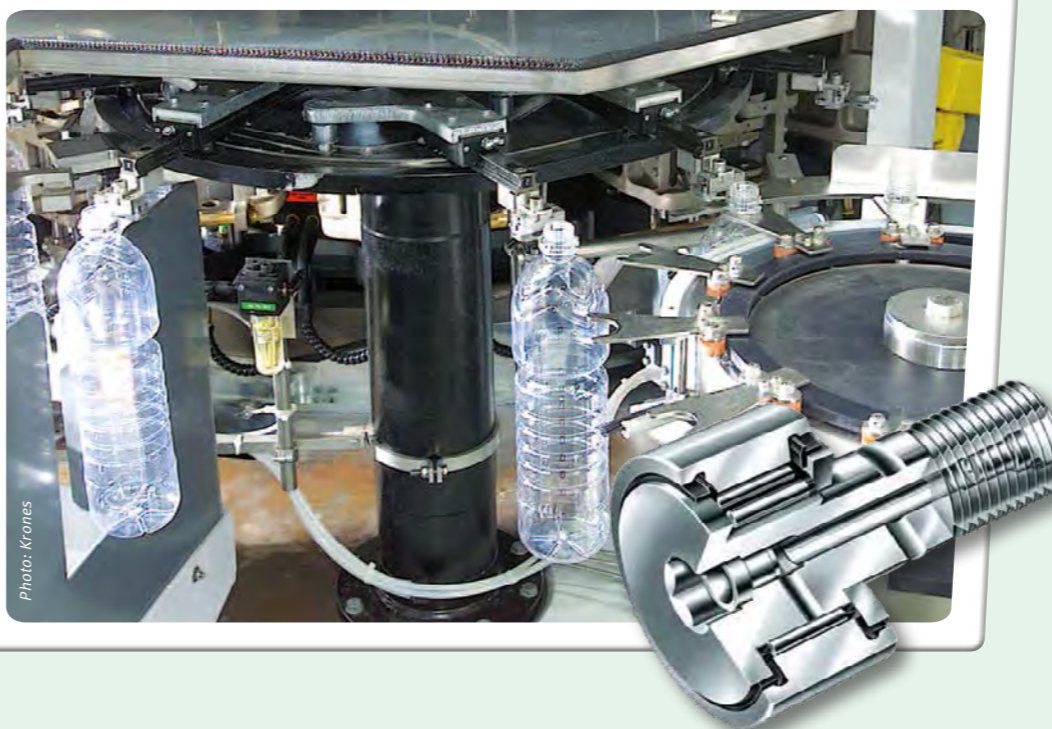


Photo: Krones

## 9 – RAILWAYS



Janet has arrived safely and takes the train home. The train is indeed a very convenient service, she thinks, as it smoothly gets going. Bearings and system solutions from Schaeffler contribute their share to make rail-bound vehicles – whether high-speed trains or city subways – fit for the future. And increasingly safer!

In close cooperation with manufacturers and operators, Schaeffler develops tailor-made solutions for every conceivable application in rail vehicles. The company's product portfolio includes not only axlebox, traction motor and gearbox bearings of the FAG brand, but is completed by bearings and components from INA that are used, for example, in wagon joints, braking systems and door systems. To ensure the maximum availability and optimal performance of modern rail vehicles, Schaeffler is committed to the development of a range of mechatronic products and systems that can cope with the challenges of tomorrow. For example, axlebox bearings for locomotives, such as the one in the insert picture below.



## 8 – AIRPLANES



While John strolls over to his car, he checks when his wife Janet is due to arrive at the airport. She is returning from a short break in London. Looking up, John watches a Qatar Airways Airbus A350 XWB taking to the sky and heading towards its home airport in Doha.

XWB stands for eXtra Wide Body, a designation that characterizes the new Airbus A350 large-capacity aircraft family. Incidentally, the huge, powerful Trent XWB engines from Rolls-Royce use bearing systems that are manufactured and supplied by FAG Aerospace in Schweinfurt. The Trent XWB is considered to be the world's most efficient large civil aero engine. It helps to reduce the fuel consumption of the A350 XWB by 25 percent compared to previous generation aircraft. At the same time, it is also one of the quietest engines that Rolls-Royce has ever produced for the wide-body market. The engine is the result of years of research and development and advanced engineering of more than 20,000 parts. It has been tested to extremes of performance on the ground and in the air, demonstrating its outstanding efficiency. The engine sucks in up to 1.3 tons of air every second at take-off. The force on a fan blade at take-off is equivalent to a load of almost 90 tons, the same as nine London buses hanging off each blade. This means that the bearing systems from Schaeffler have to deliver superior performance.



Photo courtesy of Rolls-Royce



Photo courtesy of Rolls-Royce

## 10 – ENERGY



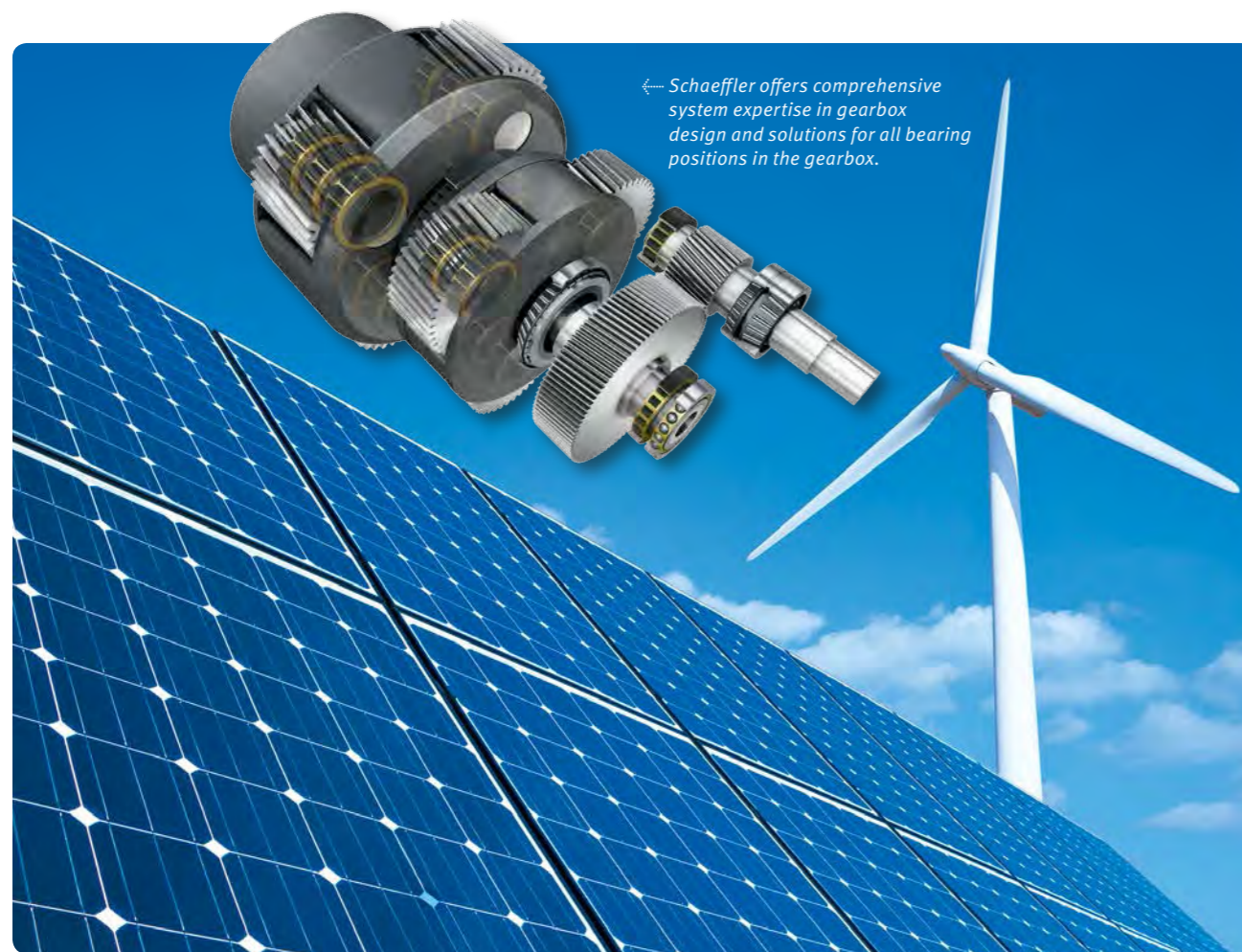
However, Janet thinks to herself, such a train certainly requires a lot of electric energy. Where does it come from? Well, the answer is it is produced outside the city, for example on wind farms. The wind year 2015 began with a new record for Germany. All the wind turbines set up there generated a magnificent total of 9,776 gigawatt hours in January, more than ever before in a single month. This new all-time high is attributable to the systematic expansion of wind power.

Schaeffler supplies bearings for the rotors as well as for the planetary gears and shafts in the wind turbine gearboxes. In order to reduce investment costs in this field, it is important to save material or to increase the power density. For Schaeffler this means mainly providing solutions that enable “downsizing”. The trend in gearboxes, for example, is toward direct bearing supports. Schaeffler has developed a “high-capacity cylindrical roller bearing” with a special design allowing space for at least one additional rolling element in the bearing. This results in increased load ratings.

In order to increase the reliability of wind turbines and be able to plan maintenance work ahead, it is important to know the condition of the machine components. Here the “FAG GreaseCheck” for monitoring the lubricating grease represents an important part of Schaeffler’s range of condition monitoring tools.

### Considering the entire energy chain

Bearing supports from Schaeffler can be found also in raw material extraction and processing, such as in the enormous bucket wheel excavators used during lignite production, in hydroelectric turbines and in dams. In addition to wind power, solar power and hydro power will make a significant contribution to supplying renewable energy in the future. Schaeffler has been a close and respected development partner and supplier for conventional hydropower plants for many years. However, new sources which utilize the power of the sea, such as tidal stream and wave power applications, are now also becoming increasingly important. And when it comes to high-precision solar tracking, Schaeffler offers a linear actuator as a complete unit from a single source in addition to bearings for swivel drives.



← Schaeffler offers comprehensive system expertise in gearbox design and solutions for all bearing positions in the gearbox.

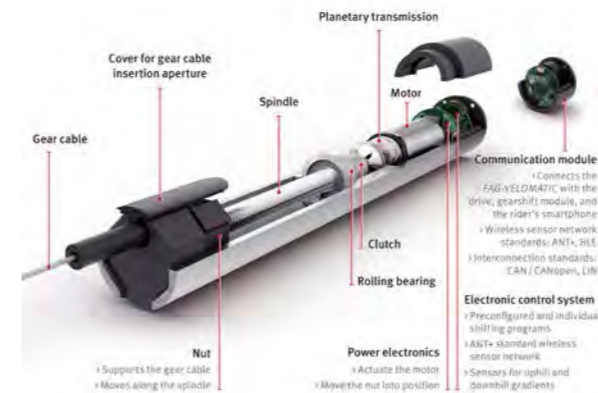
↑ The demands on component reliability have increased significantly in recent years, both in onshore and offshore wind power. With its wind-power standard (WPOS) for products and processes Schaeffler ensures the highest quality and reliability.

## 12 – ELEVATORS



Having arrived at the hospital, Janet takes the elevator up to the floor where she works. The elevator glides upward almost silently. In part this is also due to low-noise FAG spherical roller bearings that are characterized by extremely smooth running.

For this special version, “T45a”, the surfaces of the X-life bearings were further optimized for quiet operation; vibration and oscillation speeds are significantly reduced. This solution is particularly interesting for elevators without a machine room, for use in the motor as well as in the guide rollers and rope sheaves. By 2050, about 70 percent of the world’s population will be living in cities – and many in high-rise buildings. Consequently, elevators will have to carry an ever increasing number of people over a greater number of storeys – safely, conveniently and fast. To this end, the elevator motors will need to become more compact and efficient. Elevator manufacturers meet the demand for space saving designs with concepts that integrate the drives directly in the elevator shaft. Schaeffler solutions such as spherical roller bearings with high load ratings and seals that protect against contamination ensure that maintenance requirements are kept to a minimum.



## 11 – E-BIKES



After Janet has freshened up at home, she rides her e-bike to work – she is an assistant at the local hospital and has been asked to stand in for a few hours until the evening for a sick colleague. So she pedals off particularly fast.

One special feature of her bicycle is the *FAG-VELOMATIC* automatic gearshift system. Based on the cadence, force, wheel speed, and gradient, it calculates the optimum gear and the perfect shifting point. Janet also uses the corresponding *VELODAPTIC* app to create optimized scheduling, so she always stays in the best gear without having to shift manually. Janet is looking forward to the weekend, when she will go on a longer bike ride together with friends. She will then use the app to analyze her GPS, movement and performance data.

### 13 – MEDICAL TECHNOLOGY



Having arrived on her floor, Janet takes care of Mr. Miller, one of her patients who has had an accident and needs computer tomography (CT). And what do we find inside the CT scanner? You guessed it. Solutions from Schaeffler – for example, an integrated mechatronic bearing support system, consisting of highly accurate and quiet hybrid thin-section bearing with direct drive as well as high-precision adjacent parts. Or drive units without gearboxes from IDAM that ensure maximum positioning accuracy.

Mr. Miller is lying on the examination table which is about to be pushed into the CT tube. This also features Schaeffler technology: a smooth monorail guidance system and an IDAM direct drive for linear and rotary movements that accelerates and decelerates the table. The bearings mounted in the CT scanner, the four-row monorail ball guidance system and the direct drive in the examination table are so quiet that Mr. Miller does not even notice that his examination is finished. He has been listening to relaxing music all the while, with his eyes closed.

Meanwhile, Mrs. Baker is waiting patiently until it is her turn: Her arm needs to be x-rayed. Janet goes to collect her – and once again encounters Schaeffler technology. Under its Barden product brand, Schaeffler supplies assemblies that support the spinning X-ray anode. These bearing units for X-ray applications feature integral raceways on the shaft. Modern surface technology, such as plasma or ion beam coating, is used for effective bearing lubrication.

Suddenly Janet is called to the operating room, where various Schaeffler bearing solutions can be found as well. For instance, in the ceiling mounts. The ZAXB bearing unit with integrated electromechanical brake has a particularly compact design. The rotatable unit can be easily repositioned. Microbial contamination is reduced due to the closed system and the powder coating, which is specially approved for medical applications and also protects against corrosion.



### 14 – ECO-FRIENDLY DRIVES



Now that John Doe has his car back from the garage, it drives very well again. But on his way home during rush hour traffic, he thinks about what the future of urban mobility will be like. Again, Schaeffler has suitable solutions on offer.

The Schaeffler **STEP2** concept vehicle is an all-electric vehicle with a drive from Schaeffler subsidiary IDAM and a two-speed powershift transmission. The transmission comprises a planetary gear set, a wet multi-disk clutch, a band brake and a lightweight differential. The vehicle's battery is located in place of the fuel tank and the exhaust gas system below the passenger cell.

The **Gasoline Technology Car (GTC)** – a joint project of Schaeffler and Continental – features appropriately adapted Continental injection and engine control units, plus many technologies from Schaeffler. Playing key roles are Continental's 48-Volt Eco Drive System as mild hybridization and Schaeffler's electronic clutch (e-clutch) for power transmission, as well as its thermal management module.

In Schaeffler's electric wheel hub drive known as **E-Wheel Drive**, all components required for drive, deceleration, and driving safety – such as the electric motor, power electronics, controller, brake, and cooling system – are installed inside the wheel rim.

Schaeffler has developed further **concept vehicles** for each region, each fulfilling future regional environmental standards today, thanks to optimized combustion drive trains, as well as various hybrid technologies and electric drives.

### 15 – POWER DRILLS



Back home, John notices that his wife is not there and so he uses the time to hang up a picture, something he has wanted to do for quite a while now. He takes the hammer drill – without being aware at that very moment that invisible Schaeffler solutions help him in drilling the hole. Similar solutions are found not only in power drills, but also in high pressure cleaners, as well as in many other devices.

For example, power drills require an intermediate part – a so-called anvil – to transmit the impact energy of the flying piston to the tool. This anvil moves at a frequency of up to 70 Hertz and with a stroke of a few millimeters. Precise guidance of the anvil in a guide sleeve is necessary to ensure its controlled and smooth movement. Schaeffler has manufactured guide sleeves for this application for many years at its plant in Herzogenaurach. So John's drill works just fine. The only thing he still needs to learn now is to drill the hole in the right place ...





## 16 – MOTORCYCLES

John has finished his work at last. Cheerfully he climbs onto his motorcycle for a quick spin. What he does not know is that Schaeffler parts are installed in the bike that make this jaunt possible in the first place. Slowly, he pops the clutch, which is supported right away by one of the many products that Schaeffler has developed for two-wheelers.

From chain tensioners and valve train components to the motorcycle clutch and the wheel bearing, Schaeffler helps to reduce fuel consumption and emissions. For example, both the toothed chain and the integrated mechanical tensioning system reduce friction and noise, and offer high wear resistance and durability.

John notices that gear shifting functions totally smoothly. This is thanks to reduced actuating force and low drag torque. The new motorcycle clutch is based on Schaeffler core manufacturing technologies. It convinces users through its compact design and low mass. John is still contemplating the technical features of his motorcycle when he is almost back home again.

*For some years, Schaeffler has been working intensively on the optimization and further development of motorcycle clutches.*



## 17 – LONDON EYE

John and Janet arrive home with the onset of dusk. Janet tells her husband all about her short vacation in London. She is especially enthusiastic about the London Eye, a giant Ferris wheel on the River Thames that has deeply impressed her.

Janet goes into raptures about the magnificent view across London which over 50 million other visitors have enjoyed too during the past 15 years. Originally, the 135-meter-high observation wheel was meant to be in place for only five years – now it can remain permanently on the south bank of the River Thames. This is also a huge success for the FAG rolling bearings that were mounted in the center of the observation wheel with its structure made using about 1,500 tons of steel. The two radial FAG spherical roller bearings are installed as a locating/non-locating bearing combination in the hub. Featuring outside diameters of 2.66 and 2.62 meters respectively, they weigh in at 6.3 and 5.2 tons. The non-locating bearing can move back and forth on the shaft to compensate for thermal expansion. Every two years, specialists from Industrial Aftermarket carry out inspections to ensure the smooth and safe operation of the bearing. Endoscopic inspections of the raceways and rolling elements would reveal any damage at an early stage. Furthermore, ELGES large spherical plain bearings compensate for even the smallest movements of the wheel caused, for example by wind, which would otherwise affect the comparatively rigid steel construction.

## 18 – FITNESS



John Doe loves sports. In the gym he can work off stress really well. Therefore, he suggests continuing the conversation during fitness training. Janet agrees. And once again, here Schaeffler technology features, hidden behind the scenes – after all, bearings and systems from Schaeffler ensure top performance in almost all sports and fitness equipment, whether spinning bikes, inline skates, skateboards or treadmills. With its product brands INA and FAG, Schaeffler is one of the leading suppliers in this sector. The products are characterized by the highest quality and durability, as well as great value for money.

The list of workout devices using Schaeffler technology is long: Deep groove ball bearings are found, for example, in treadmills, rowing machines and exercise bikes, INA shafts are installed in multigyms to guide the weights. These shafts are made in different lengths and diameters. Due to the consistently high quality of the material used, they are characterized by very high dimensional stability, robustness and offer very long operating life.

Plain bearings and deep groove ball bearings are the standard bearings for multi-function training stations. Linear bearings and shafts are used in weight benches and in leg presses too. The bearings ensure uniform running with minimal noise generation. John Doe can thus rely on always achieving the same result when inputting the same amount of force.

*INA shafts are used to guide the weights in fitness equipment.*



## 19 – PRINT SHOPS



It's nighttime and John and Janet Doe go to bed, exhausted but happy. While John falls asleep immediately, Janet is still awake reading a magazine that a friend of hers has given to her. Looking at this magazine, she wonders how exactly things in a print shop work.

Janet is not aware of the fact that high-precision and virtually wear-free bearing supports in the press rollers play a crucial part in achieving razor sharp printing results. Schaeffler with its product brands INA and FAG has decades of experience and expertise in all relevant applications and, depending on the technology and market share, is a global leader in this segment.

The product range includes all bearing supports used in printing equipment and also covers units for operations such as vibrating, cutting, binding or stapling. Products range from high-precision standard bearings to customized system solutions. To achieve the best possible printing results, main cylinders in printing machines must be guided clearance-free and rigidly on the locating bearing side, both axially and radially. Matched tapered roller bearings used as locating bearings have proven to be a reliable and efficient solution. They are clearance-free and can support high axial and radial loads. And because of that, Janet can read her precision printed magazine in peace – just as you, dear Reader, can read this issue of SCHAEFFLER special ...

*"A Day in the City": with contributions from Anja Koch, Kerstin Fellenzer, Reiner Streber, Jürgen Stühler, Selina Ley, Johanna Katzenberger and Martin Mai*



# MOBILITY FOR TOMORROW URBAN MOBILITY

How will people travel in the future, and how will goods be transported? What resources will we use, and how many will we need? The passenger and freight traffic sector is developing rapidly, and we provide the impetus for innovation and movement. We develop components and systems for internal combustion engines that operate more cleanly and more efficiently than ever before. We are also pushing forward technologies that are bringing hybrid vehicles and alternative drives into a new dimension – for private, corporate, and public use. The challenges are great. We deliver the solutions.

[schaeffler-mobility.com](http://schaeffler-mobility.com)



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