

SCHAEFFLER

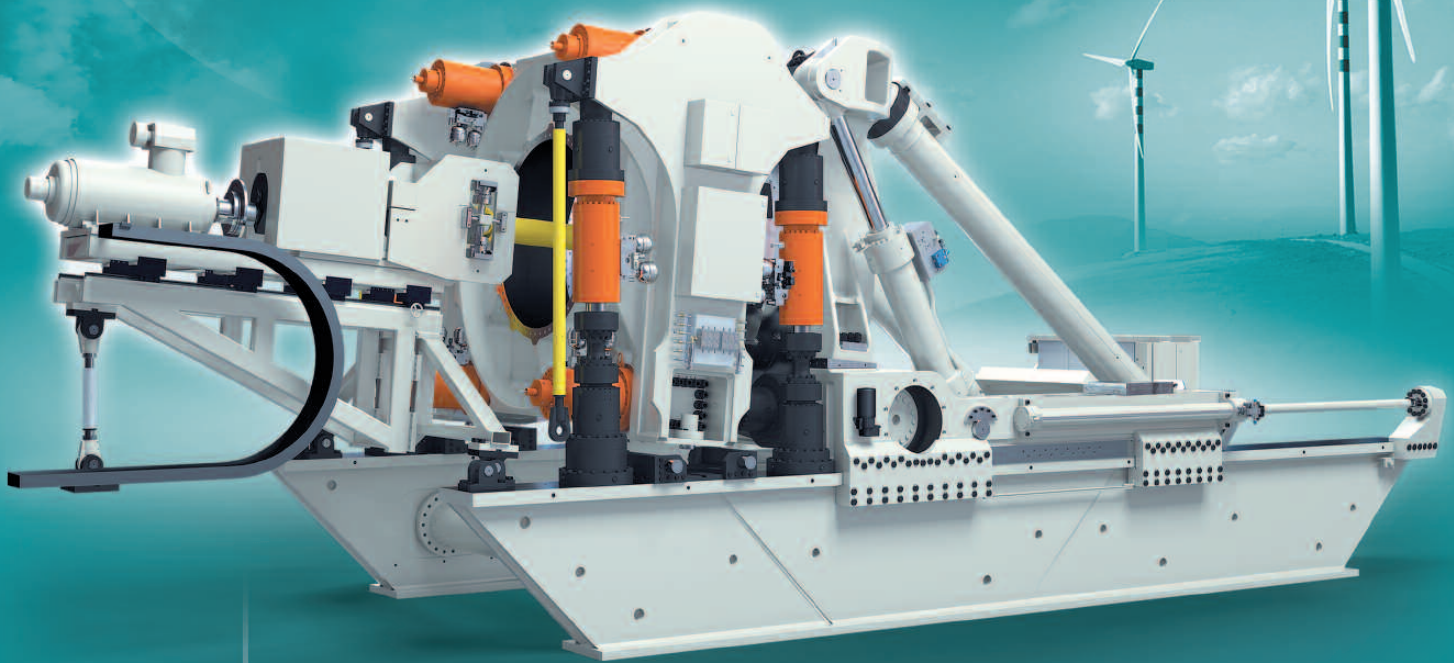


FAG

# INMOTION

ISSUE 10 - DECEMBER 2012

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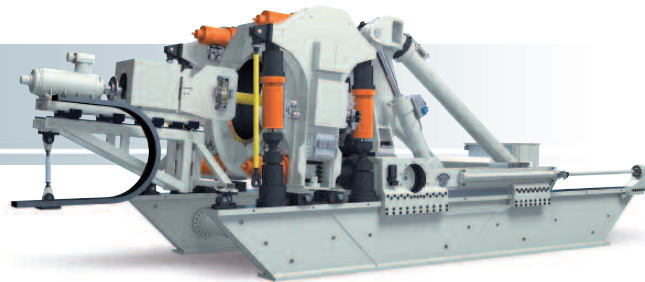
New eMobility  
Systems  
Division





## COVER STORY THE WORLD'S LARGEST BEARING TEST RIG

# INMOTION



## SCHAEFFLER RECEIVES GLOBAL QUALITY AWARD FROM NISSAN

SCHAEFFLER HAS RECEIVED THE 'GLOBAL QUALITY AWARD' FROM NISSAN FOR ITS OUTSTANDING PERFORMANCE AS A SUPPLIER AND SERVICE PARTNER.

Nissan's annual 'Global Supplier Award' ceremony honours above-average results achieved by its suppliers in key areas such as on-schedule deliveries, quality, innovation, sustainability, cost structures, social responsibility, and customer satisfaction. Schaeffler was recognised first and foremost for good cooperation and communication, as well as for the production quality of its engine components and dual mass flywheels. Matthias Zink of Schaeffler commented: "As a global supplier of complex components, it is a great honour for us to receive this award. It is both a demonstration of the close cooperation between our two companies and recognition of the outstanding commitment shown by our teams worldwide. The award is a further incentive for us to continue on this path as a strong partner to Nissan, and to continue to fulfil the Japanese quality standards with above-average performance."

Last year, Schaeffler also received the 'Global Innovation Award' from Nissan. With the Global Quality Award, Schaeffler has proved once again that operational excellence, quality and technological innovation are indispensable when it comes to fulfilling the extremely high demands of its customers. ■



▲ Matthias Zink, President of Schaeffler Automotive Asia-Pacific (right), receives the 2012 Nissan "Global Quality Award" from Toshiyuki Shiga, COO of Nissan (left).

## SCHAEFFLER'S ROGER EVANS RECEIVES HONORARY FELLOWSHIP

ROGER EVANS MBE, PLANT DIRECTOR AT SCHAEFFLER (UK) LTD, HAS RECEIVED AN HONORARY FELLOWSHIP FROM SWANSEA METROPOLITAN UNIVERSITY – THE HIGHEST HONOUR THAT A UNIVERSITY CAN BESTOW.

Roger Evans received the honour during Swansea Metropolitan University's Graduation Ceremony at the city's Grand Theatre on the 19th July 2012. Professor David Warner, Vice-Chancellor at Swansea Metropolitan University commented: "We bestow Honorary Fellowships upon individuals from, or who have a connection to, Wales and, in particular, South West Wales. They will have excelled themselves in their chosen profession, whether in arts, politics, industry, academia or sport.

They are individuals who have not only done themselves proud but who bring a sense of pride to the region. During his acceptance speech, Roger Evans lauded the Welsh manufacturing industry but said that Wales needs to do more to promote its success.



Best regards.  
Kate Hartigan,  
Managing Director

Pupils tour the  
Llanelli plant



## MORE PUPILS BENEFIT FROM SEE INSIDE MANUFACTURING OPEN DAYS

SCHAEFFLER UK'S LLANELLI PLANT HAS OPENED ITS DOORS TO LOCAL SECONDARY SCHOOL PUPILS TO GIVE THEM A TASTE OF WHAT IT IS LIKE TO WORK IN A FAST-PACED MANUFACTURING ENVIRONMENT.

Schaeffler UK's Llanelli plant has opened its doors to local school pupils to give them a taste of what it is like to work in a high-volume, fast-paced automotive manufacturing environment. The open days took place over two days. A total of 53 Year 10 and Year 11 pupils from 10 local schools took part.

The open days are part of the Government's See Inside Manufacturing Initiative (SIM), a programme developed in order to help improve the image of UK manufacturing to young people, with the objective of attracting the brightest and best talent into a career in manufacturing and engineering. The Initiative is supported by the Society of Motor Manufacturers and Traders (SMMT), with major UK-based automotive vehicle manufacturers taking part.

Following the success of a similar, one-day event held in 2011, this year's event was extended to two full days in order to give pupils more time to see the factory, ask questions, discuss their career plans and to take part in an engineering challenge and team building exercise.



This year, each open day was split into a morning and afternoon session, with 29 pupils attending on the first day and 24 pupils the following day. On arrival pupils and teachers were welcomed with presentations from Training Officer Donna Williams-Bevan and from the plant's own engineering apprentices, Jamie Green and Luke Stacey. The pupils and teachers were then given a guided tour of the factory.

After the tour, pupils were divided into teams in order to compete in Schaeffler's Engineering Challenge. This involved pupils having to correctly interpret an engineering drawing before devising a suitable method for assembling an idler hub bearing.

After lunch, representatives from the local college, Coleg Sir Gar, one of the largest Further Education Colleges in Wales,

ran a two-hour team building exercise. This involved teams of pupils being asked to design and build a hovercraft and then racing these against each other.

Before departing the plant, pupils and teachers were given an opportunity to ask questions of senior managers and apprentices in an informal environment.

The pupils themselves thought the day was extremely interesting and rewarding. Feedback questionnaires completed by the pupils stated that the event was "a very worthwhile, fun day", "well thought out and so interesting to see the facilities and machines and how engine tappets are actually made and I would love to work in a company like this".

Alex Robinson, Automotive Components Section Manager at SMMT commented: See Inside Manufacturing is part of both redressing manufacturing's image and the reluctance of young people with STEM qualifications to work there. Schaeffler UK has now held two very successful open days at its Llanelli plant and we thank them for their continued support"



His message to the students was "to keep on learning, keep on gaining knowledge and remember to promote Wales to the world."

An alumnus of the university, Roger Evans was awarded an MBE in 2009 for his services to manufacturing industry in Wales. In May 2012, Roger also received the Chairman's Award 2012 from the Institute of Directors' Wales Director of the Year Awards.

Since his appointment in 2001 as Plant Director of Schaeffler UK's engine components plant in Llanelli, Roger has helped spearhead the country's strategic approach to manufacturing. As well as his current role as Plant & Automotive Director at Schaeffler UK, Roger is also Director of the Wales Management Council, Chairman of the Welsh Manufacturing Forum and Director of the Welsh Automotive Forum. ■

## SCHAEFFLER WINS GOLDWIND SUPPLIER AWARD

The Schaeffler Group has received an 'Excellent Supplier Award' from Xinjiang Goldwind Science and Technology Co. Ltd., an internationally recognised manufacturer of wind turbines based in China. The award is an indication of Schaeffler's leading position in the Chinese wind energy industry. Schaeffler was the only bearing company to receive an Excellent Supplier Award.



▲ Li Zhaodong of Schaeffler China (first from left) with Mr. Wu Gang, Chairman of Goldwind Science & Technology Co., Ltd. (third from left) and other winning suppliers.

# NEWS

We welcome your comments on this or any of our articles, and would be very pleased to receive your feedback on "In Motion"

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## SCHAEFFLER UK OPENS NEW CUSTOMER TRAINING CENTRE

THE NEW CENTRE IS EQUIPPED TO PROVIDE BOTH CLASSROOM-BASED AND PRACTICAL HANDS-ON TRAINING COURSES FOR CUSTOMERS FROM EVERY INDUSTRY SECTOR.



**S**chaeffler UK offers a comprehensive range of one, two and three-day training courses for managers, engineers and technicians involved in the selection, operation and maintenance of rolling bearings, as well as condition monitoring, vibration analysis and mounting of rolling bearings. Courses are held either at the Sutton Coldfield training centre or on-site at the customer and can also be tailored to the needs of individual customers.



Kate Hartigan, Managing Director at Schaeffler UK commented: "In industries where the loss of a critical piece of plant or equipment can result in costly lost production or downtime, condition monitoring can help to minimise disruption and reduce costs.

Our new training centre and the courses that we offer have been carefully structured to ensure that we give customers the maximum support possible during the initial design process through to the successful operation and monitoring of their plant and equipment."

These courses include an **Introduction to rolling bearings**, which covers topics such as bearing types, basic functions, load directions and bearing fits, as well as brief introductions to bearing lubrication methods and failure modes.

For more information and to request copies of the Schaeffler Training Brochure and 2013 Training Calendar please contact Marketing Services e-mail: [info.uk@schaeffler.com](mailto:info.uk@schaeffler.com)

For more experienced delegates, a 2-day course on **Rolling bearing technology** is available.

Other training courses include an **Introduction to bearing lubrication**, which covers the fundamentals of bearing grease lubrication;

**Bearing failure analysis** covers the basics of bearing failure modes and analysis, showing delegates how to identify the more common failures through knowledge of the load patterns on the bearing raceways and rolling surfaces.

**Mounting of bearings** provides trainees with an understanding of how to get the most from plant and machinery by ensuring that the correct methods and procedures are in place for the mounting of bearings.

**Bearings for electric motors** provides engineers with an in-depth understanding of the types of bearings used in electric motors, as well as factors to consider when selecting these types of bearings.

**Condition monitoring** is a one-day introductory course that covers the fundamentals of noise and vibration, starting from basic concepts and progressing to Fast Fourier Transform (FFT) as a diagnostic technique.

**FAG Detector III** is a one-day training course on how to get the most from Schaeffler's handheld vibration monitoring device.

Schaeffler UK also offers two training courses on **Vibration analysis (Level 1 and 2)**. Level 1 is a 2-day course that covers the fundamentals of noise and vibration and FFT. Level 2 is a more in-depth three-day course that detailed information on the principles and application of vibration analysis.



Matthew Orme, Senior Mechanical Engineer, Mechanical Testing Support at Lubrizol, recently attended a rolling bearing training course. He commented: "The rolling bearings training provided by Schaeffler was great and very well presented. The technical/practical mix was just right and my colleagues who also attended the course came away with a good understanding of rolling bearings and condition monitoring and have already started to look more closely at what we do at Lubrizol." ■

## SCHAEFFLER BEARINGS ENABLE SMOOTH MOVEMENT OF KINETIC SCULPTURES

COMBINED NEEDLE ROLLER/AXIAL DEEP GROOVE BALL BEARINGS ARE PLAYING A KEY ROLE IN ENSURING THE SMOOTH, QUIET MOTION OF WIND-POWERED SCULPTURES DEVELOPED BY UK SCULPTOR DAVID WATKINSON.



**I**ve been a full time sculptor for the last 18 years, working from my home studio in Leeds. Although most of my pieces are static, over the last four years I've developed three kinetic sculptures that are powered by the wind and small currents of warm air. All of these rely on combined axial and needle roller bearings, precision manufactured by Schaeffler," says David Watkinson.

David's work is sold either to private individuals as garden displays, or to organisations and charities for display to the general public.

"Four years ago, when I first started developing kinetic sculptures, finding suitable bearings that could provide the appropriate degrees of freedom, as well as enabling smooth, low friction, quiet movements, proved very difficult," he explains. "However, I suppose my Eureka moment came after I purchased an old George Rickey catalogue from an art gallery in California. This book contained some detailed photographs and handwritten letters to component suppliers, which together helped to explain the complex bearings and counterweight arrangements at the heart of George Rickey's kinetic sculptures. I therefore began looking for suitable bearings that would enable me to bring my own designs to life."

For his first kinetic piece, the 'Kinetic Seed Sculpture', David spent 18 months experimenting with different types of bearings. Eventually, due to the complex angles of motion needed for the sculpture, he selected a combined roller/axial bearing that would meet his design requirements and so searched on Google for a suitable supplier. "I came across a bearing on Schaeffler's website that I thought was suitable and started to examine the bearing drawings in more detail. My sculptures are high quality precision-engineered art pieces that sell for between £8,000 and £12,000 each. I therefore needed precision-made, high quality, reliable bearings that would also provide longevity."

After speaking to Schaeffler UK, David was put in touch with a local distributor of Schaeffler bearings based in Bradford, which provided David with additional technical data and drawings of the bearings. "The first bearings that I fitted to the sculpture worked perfectly. All I needed to do was make some minor adjustments to the Y-piece of the sculpture. I've never had a single problem with any of the Schaeffler bearings since," states David.

David's latest kinetic piece, 'Orbit', consists of two seed-like pods, which gently dip and weave around one another in a slow, graceful dance.



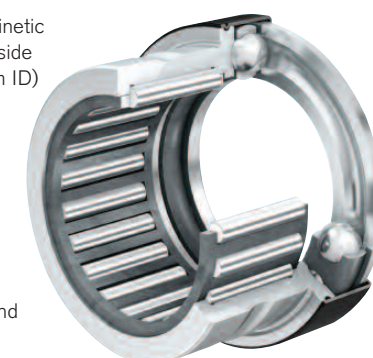
David Watkinson with the Kinetic Seed Sculpture

The structure of the pods is exposed and the aluminium fins are angled to catch the breeze. Precision manufactured lead counterweights are also provided for perfect balance, as well as three sets of combined needle roller/axial ball bearings from Schaeffler.

The bearings supplied to David Watkinson for all three of his kinetic pieces are NKX35Z (35mm inside diameter) and NKX25Z (25mm ID) combined needle roller/axial deep groove ball bearings. The bearings are supplied with separate inner rings and are manufactured to Schaeffler's premium quality X-life grade. These bearings have optimised raceway surfaces that provide higher load carrying capacity and longer rating life.

"As well as supplying the bearings and providing technical support and guidance, Schaeffler has also been extremely supportive in other ways. For example, Schaeffler is now an official sponsor of my kinetic sculpture work." ■

Schaeffler's NKX-Z combined needle roller/axial deep groove ball bearings



Orbit, David's latest kinetic sculpture





## CHANGING NEGATIVE PERCEPTIONS OF ENGINEERING

AS A MAJOR EMPLOYER IN LLANELLI, SCHAEFFLER UK IS CONTINUALLY INVESTING IN ITS PEOPLE AND WORKING CLOSELY WITH THE LOCAL COMMUNITY. A KEY PART OF THIS COMMITMENT IS SUPPORTING THE LOCAL COLLEGE IN HELPING TO CHANGE YOUNG PEOPLE'S NEGATIVE PERCEPTIONS OF ENGINEERING.

**D**uring the last 30 years, we've developed a very close working partnership with our local college, Coleg Sir Gar, which has played a significant role in our successful engineering apprenticeship schemes and in helping us to change local school pupils' perceptions of engineering" says Donna Williams-Bevan, Training Officer Schaeffler (UK) Ltd. "We view these pupils as potential future engineers for our Llanelli plant or as future leaders of our business. So the time and resources that we commit every year will reap their rewards in the long term."

The Llanelli plant currently employs 250 people, seven engineering apprentices and one graduate trainee. Two of the apprentices work in the toolroom, the other five in maintenance and production. In 2011, four new apprentices were recruited.

Schaeffler's strong links with Coleg Sir Gar are vital in maintaining the plant's pool of engineering talent, says Williams-Bevan. Coleg Sir Gar is one of the largest Further Education Colleges in Wales, with more than 9,000 students enrolled.

Adam Twells, Head of Engineering at Coleg Sir Gar comments: "The Engineering School at Coleg Sir Gar has around 200 full time students and 300 part time students.

The courses we run include mechanical and electrical engineering, electronics, welding, maintenance and automotive engineering, from level 1 to Honours Degree. Our aim is to provide engineering courses and apprenticeship training that matches the needs of local businesses such as Schaeffler."

The working relationship between Schaeffler and Coleg Sir Gar is mutually beneficial. As well as offering work experience placements for Coleg Sir Gar engineering students, Schaeffler also supports many local engineering initiatives held at the college and organises its own 'open days' at the factory.

Both Schaeffler and Coleg Sir Gar are also particularly keen to change the negative perceptions that many young people have of working in engineering.

As Adam Twells puts it: "In other European countries such as Germany, engineering is well respected as a profession, but here it seems that engineering is deemed as not being a worthy career choice. But engineers work in highly technological areas, and so in my opinion, they should be comparable to say a doctor or a lawyer."

The key to changing these negative perceptions, says Adam Twells, is to target primary school children first. "That is where the misconceptions begin and where we can have the most influence."

He continues: "We are therefore working with local primary schools, in particular targeting 9 to 11 year-olds and talking to them about what it is like to work in engineering.

Schaeffler is also trying to influence the same age group. Recently, Schaeffler Llanelli organised an engineering challenge for 11-year-olds from Penyrheol Primary School in Llanelli. More than 30 pupils took part in the challenge, which was a variation of the Young Engineers' Egg Challenge.



▲ Coleg Sir Gar College

The aim was to design and build a system that allowed the safe transportation of two eggs across chasms and cliff faces without damaging the eggs.

Graham Griffiths, South Wales Regional Director, EESW (Engineering Education Scheme Wales), who also attended the egg challenge commented: "The engineering project with Penyrheol school was a resounding success. The children modelled their innovative solutions and were able to discuss why they chose the designs they prototyped. The project provided the pupils with a good insight into the way engineers work, which will hopefully open their minds to the educational and career opportunities available."

### Engineering Week Wales

One event that has been hugely successful in changing Year 9 pupils' negative perception of engineering is Engineering Week Wales (EWW). Every year in November, EWW gives Year 9 pupils (13-14 year olds) hands-on engineering experiences at further education colleges across Wales.

Coleg Sir Gar and Schaeffler are both keen supporters of EWW. In November 2011, Coleg Sir Gar, supported by engineering apprentices from Schaeffler Llanelli, held its annual EWW Hovercraft Challenge for local schools. The challenge this year was to design and build a hovercraft and then race these. ■



## YOUNG ENGINEERS CREATE THE NEXT BIG BANG

TWO SIXTH FORM STUDENTS RECENTLY WON THE TITLE OF YOUNG ENGINEER OF THE YEAR AND ALSO SCOOPED THE YOUNG ENGINEERS DUKE OF YORK AWARD FOR CREATIVE USE OF TECHNOLOGY BY DEVELOPING A DEVICE FOR MONITORING FOETAL CONTRACTIONS. JESSICA LEIGH JONES AND WASIM MIAH TALK TO SCHAEFFLER'S KAREN PRESTON ABOUT THEIR DEVICE AND WHAT THEY PLAN TO DO NEXT.

**L**ike many other A Level students in the UK, Jessica Leigh Jones and Wasim Miah had some very tough decisions to make over the last few months regarding their future careers. However, by winning both the 'UK Young Engineer of the Year Award 2012' and 'The Duke of York Award 2012 for Creative Use of Technology', there appears to be little that can now hold these two students back. As Jessica Leigh Jones states: "I wasn't really getting the practical experience that I needed from studying three A Levels. I therefore decided to study a Level 3 National Diploma in Electronics with the overall aim of making a career for myself combining electronic engineering with astrophysics, which has always been my passion."

Wasim Miah also studied three A Levels: Mathematics, Computing and Economics. He is currently studying for a degree in Business Computing Systems. Wasim has an incredible passion for new product development and taking new ideas to market. As he puts it: "I prefer the Dragon's Den type stuff really. But what this engineering project has done is to teach me the importance of team work, the importance of patents and how to take a new idea from concept through to a marketable product."

In September 2010, whilst studying for their A Levels, Jessica and Wasim decided to put their skills to the test by entering the Engineering Education Scheme Wales (EESW) annual engineering competition. The project they chose was to be carried out for a UK-based medical device manufacturer. The project team – which initially comprised eight students, but by the end of the project comprised just Jessica and Wasim – was to redesign an existing foetal contraction monitor. As Wasim explains: "We had to either make the device cheaper or design a more

accurate version. The existing device cost around £160 to produce but we managed to reduce this figure to just £2.58 by using an optical LED system and by making the device portable rather than a benchtop machine."

In April 2011, Jessica and Wasim's efforts were rewarded when they were given a prize for the 'Product with the most commercial potential' at EESW's annual awards that year. The two students were therefore eligible to enter the Big Bang Wales Awards, which they did, and subsequently won in July 2011. This meant, along with 350 other 11 to 18 year olds from across the UK, they were then given the chance to enter the National Science & Engineering Competition at The Big Bang UK Young Scientists & Engineers Fair at the NEC in March 2012. The awards didn't stop there. In 2011, Jessica and Wasim were both recognised by winning the Wales CREST Award and the Wales Young Engineer of the Year Award.

But their most significant triumph came at the 2012 Finals of the National Science & Engineering Competition. Against some amazing student projects, Jessica and Wasim again came up trumps, winning two further prizes:



UK Young Engineer of the Year Award and the Duke of York Award for Creative Use of Technology. Better still, in June 2012, Jessica and Wasim were both invited to Buckingham Palace for a private meeting with the Duke of York, Patron of Young Engineers, to discuss their future career plans. Since then, Jessica has started an Astrophysics Degree at Cardiff University.

### Women as engineers

Jessica is very passionate about engineering and has strong views on the challenges facing those women who wish to have a career in engineering: "I believe there is simply not enough encouragement for women in this country to work in engineering roles, particularly at primary and secondary school levels, where girls are heavily influenced by their teachers, parents and the overall negative perceptions of having a career in engineering or manufacturing. I'm female but I was taught Ohm's Law at the age of three by my father. I've got an extensive knowledge and background in electronics. In a job I had recently, men would come into work but not want to speak to me because I'm a girl. So yes, it is a genuine issue. However, I don't see this as a barrier to a career in engineering, just a challenge to overcome."

**Schaeffler (UK) Ltd is a sponsor of Young Engineers and an active member of EESW.**

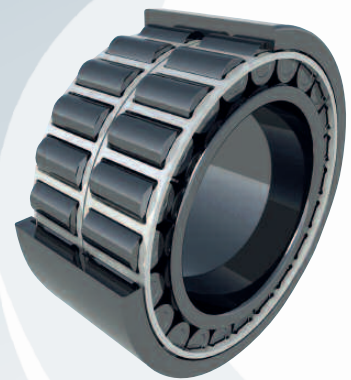


▲ Left to right: Science presenter Greg Foot, Kate Hartigan presenting the Duke of York Award 2012 to winners Wasim Miah and Jessica Jones



L to R: Karen Preston, Joanne Mitchell, Wasim Miah, Jessica Jones, HRH The Duke of York and Ken Sanders





## BEARINGS AND SIMULATION SOFTWARE KEY TO FUTURE RENEWABLE ENERGY SYSTEMS

ONE OF THE GREATEST ENGINEERING CHALLENGES THAT WE FACE TODAY IS IN MEETING GLOBAL ENERGY REQUIREMENTS WHILE PRESERVING THE ENVIRONMENT. ALTHOUGH SOLAR ENERGY WILL PLAY ITS PART, IN THE UK, WIND, WAVE AND TIDAL ENERGY SYSTEMS WILL BE THE MOST LIKELY FUTURE SOURCES OF RENEWABLE ENERGY.

In the UK wind energy sector, for example, experts predict that by 2020, more than 6,000 wind turbines will need to be installed if the country's future energy targets are to be met.

Investment in renewable technologies requires a significant financial commitment. Protecting this investment is therefore critical. As a manufacturer of high precision rolling bearings, Schaeffler will continue to play an important role in improving the reliability and safety of renewable energy systems.

Rolling bearings are a core component of renewable energy systems and are key to reducing operator costs. The design of low friction bearings for a wind turbine rotor shaft and gearbox, for example, are important considerations, as well as the associated lubrication methods for the bearings, mounting, maintenance and the use of remote condition monitoring and diagnosis techniques to ensure that maintenance costs are minimised and service life is increased.

In a typical wind turbine drive train, rolling bearings are used to support the rotor, alternator and gearbox.

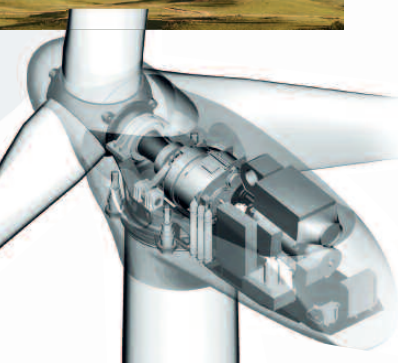


multi-megawatt wind turbines will lead to more radical changes in the design of the bearings. 'Single bearing' designs will become increasingly important.

With single bearings, the wind turbine rotor is supported only by a single, double row tapered roller bearing, typically in a back-to-back arrangement that supports all forces and moments. This concept can take many different forms, for example, with a shaft and gearbox and a high-speed generator, as a hybrid solution with shortened gearbox and medium-speed generator, or as a direct drive without a gearbox. Single bearings always result in more compact designs. For example, the wind turbine nacelle can be fully integrated with the bearing-gearbox-generator unit, reducing weight and eliminating components.

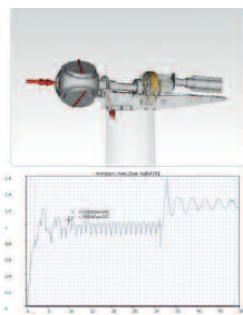
Another advantage of the single bearing design is that preloaded tapered roller bearings can be utilised, which prevent axial clearance and small axial misalignments.

Spherical roller bearings from Schaeffler are already playing an important part in several high profile European wave and tidal energy systems, including the Pelamis P2 wave energy converter. Key to the success of this development is a new joint concept that utilises a new low friction material developed by Schaeffler. This modified PTFE fabric liner has low friction characteristics that effectively eliminate the problem of 'stick-slip'.



This has enabled the operating envelope of the P2 machine to be extended beyond the capabilities allowed by standard bearing materials.

Rolling bearing calculation software, Finite Element Analysis (FEA) and dynamic simulation tools will also play a critical part in developing next-generation renewable energy systems. For this to succeed, collaborative development projects between multiple component suppliers will be necessary. Schaeffler is currently working closely with three companies – a gearbox manufacturer, a wind turbine manufacturer and a software developer – to develop new simulation software that is able to calculate the dynamic operating loads acting on wind turbine powertrains. Used in combination with FEA tools, this multi-body simulation (MBS) model will enable engineers to optimise the design of individual powertrain components and to establish how these interact with other powertrain systems. Simulation tools such as these, will prove invaluable in helping to make future wind turbine designs more reliable and cost effective. ■



▲ Simulation software

## SCHAEFFLER PROVIDES ONLINE CONDITION MONITORING OF TURBINES AT CRYSTAL RIG WIND FARM

SCHAEFFLER (UK) LTD HAS SUPPLIED FIVE ONLINE CONDITION MONITORING SYSTEMS TO WIND FARM DEVELOPER AND OPERATOR FRED. OLSEN RENEWABLES (FOR). A FURTHER 20 SYSTEMS FROM SCHAEFFLER ARE EXPECTED TO BE INSTALLED ON THE REMAINING TURBINES.

In May 2012, FOR installed five FAG WiPro s systems on five wind turbines at the Crystal Rig wind farm in Scotland. These systems continuously monitor the condition of the main rotor bearings, gearbox and generators, with Schaeffler UK also providing remote monitoring services on a 24/7 basis.

Crystal Rig wind farm is located in the Scottish Borders. The 25 wind turbines on the farm generate a total capacity of 62.5MW.

Stuart Naylor, Operations Manager at Fred.Olsen Renewables UK commented: "We are delighted with the condition monitoring systems and remote monitoring services provided by Schaeffler and we look forward to continuing and further developing this working relationship in the future. Back in September 2011, when we were looking for a suitable UK-based supplier, we found Schaeffler to be extremely

professional and competitive, as well as demonstrating confidence that their system could provide us with the most suitable condition monitoring system.

Schaeffler's FAG WiPro s is an online condition monitoring system that is suitable for the permanent monitoring of wind turbines. The system is extremely compact, with the monitoring unit and multiplexer integrated in a single unit, which offers a high degree of flexibility for end users. The system combines all control modules into a single compact housing. The integrated multiplexer enables the recording of signals from up to eight different sensors.

FAG WiPro s monitors vibration conditions, which if left undetected, can cause costly unplanned shutdowns of wind turbines. If a specified threshold value or alarm limit is exceeded, the system triggers an alarm. The vibration monitoring data can be analysed directly

on site or this data can be retrieved via a TCP/IP communications link and analysed by either the end user or by Schaeffler.

"On each of the five wind turbines being monitored at Crystal Rig wind farm, we've installed six vibration acceleration sensors," stated Dr Steve Lacey, Engineering Manager at Schaeffler UK. "One of these sensors is a special, low frequency vibration sensor that monitors the main rotor bearing and there is also a low frequency vibration sensor on the input shaft to the gearbox. Two additional standard vibration acceleration sensors are installed on the power train gearbox, with a further two vibration sensors on the generators. These sensors provide us with 24/7 vibration data which enables us to look for faults or to detect problems early." ■



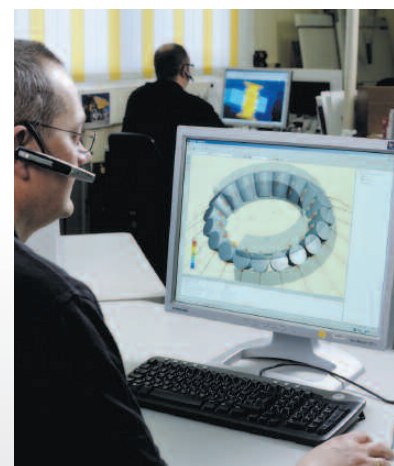
▲ FAG WiPro s Online Condition Monitoring System



▼ Schaeffler Wind Power Standard (WPOS): FAG spherical roller bearings E1.

## WPOS WIND POWER STANDARD ENSURES IMPROVED RELIABILITY

THE DEMANDS IN TERMS OF COMPONENT RELIABILITY IN WIND TURBINES HAVE INCREASED CONSIDERABLY OVER THE LAST FEW YEARS.



Rolling bearings for example play a critical role here. The development of multi-megawatt turbines has led to higher forces and torques, which means components are subjected to ever increasing loads. At the same time, any downtime or maintenance can be very costly, especially in the case of offshore plants.

In response to these increasing demands, bearings and condition monitoring specialist Schaeffler has introduced a new Wind Power Standard (WPOS) for its bearings for wind power applications.

This new standard for products and processes means that Schaeffler is ensuring the outstanding quality and reliability of its bearings and offering customers the same

high standards of quality as it is already successfully providing in the automotive and aerospace industries. In future, the relevant bearings will be labelled with a 'WPOS' mark. It is expected that all Schaeffler bearings for wind power applications will be included in the WPOS standard by the beginning of 2014.

"The Schaeffler Wind Power Standard is a comprehensive concept developed by the company, which further increases the reliability of rolling bearings in wind turbines. This new quality standard includes all products and processes that are relevant to the wind power sector," says Dr. Volker Maier, Director of Market Development and Key Account Management at Schaeffler's Wind Power Business Unit. ■



## NEW ULTRA COMPACT SENSOR ENABLES COST EFFECTIVE ONLINE CONDITION MONITORING OF PLANT AND MACHINES

THIS UNIQUE SYSTEM NOT ONLY MONITORS VIBRATION AND TEMPERATURE, BUT ALSO A RANGE OF OTHER MACHINE AND PROCESS-SPECIFIC PARAMETERS SUCH AS PRESSURE AND FLOW RATE.

**T**he new FAG SmartCheck is ideal for the online monitoring of small, process critical and non-process critical plant and machinery, including machine tools, spindles, motors, drives, pumps, compressors, HVAC systems and gearboxes.

By using novel features and new, patented diagnosis technology, FAG SmartCheck can help companies to optimise their manufacturing processes, whilst maximising plant availability and therefore reducing the Life Cycle Cost (LCC) and Total Cost of Ownership (TCO) of plant and machinery.



Despite its wide range of features and functions, FAG SmartCheck is incredibly easy to operate and requires no special programming skills or knowledge.

### Unique sensor solution

The system offers much more than conventional measuring devices.

In spite of its compact design (44mm x 58mm x 45mm), the intelligent system records not only standard parameters such as vibration and temperature, but also other operating parameters such as pressure and flow rate. By correlating process parameters with vibration data, users can optimise their processes and therefore reduce LCC.

Customers are increasingly asking machine manufacturers to guarantee LCC. This is only possible if manufacturers know the LCC or can assess it as accurately as possible. This is now feasible using FAG SmartCheck.

### Commissioning

The compact, cost-efficient system is easy to install and is typically mounted to the machine housing. The small, lightweight (210g) device requires less wiring and can fit into areas on a machine where space is restricted.

The device is also supplied with a set of basic parameters that can be used to reliably monitor most general machinery and equipment. In addition, users can also choose from more than 20 pre-defined parameter templates for monitoring a range of other process and machine parameters such as imbalance, shaft alignment errors, rolling bearings, fans and gearings.

### Data storage, visualisation and analysis

Due to its patented self-learning or 'Teach-In' mode, FAG SmartCheck's alarm thresholds are adjusted automatically. After set up and commissioning, the device operates autonomously. The relevant machine parameters are measured and saved continuously in the system. Users can also access the FAG SmartCheck web server via a standard Internet browser



in order to configure the system and visualise the latest data in real time. The recorded data can be retrieved directly and easily via FAG SmartCheck's Ethernet interface and analysed using the analysis software supplied.

### Flexible and expandable

FAG SmartCheck is a modular, scalable system that provides multiple expansion options. Both the number of sensors and the level of system integration can be adapted according to the customers' specific requirements.

### Unique service

Schaeffler offers a unique range of services to support FAG SmartCheck users. These include training, commissioning, technical support and consultancy, remote monitoring services, rolling bearing solutions, and tailored maintenance and service contracts. ■

## OIL ANALYSIS SYSTEM DETECTS EARLY DAMAGE TO GEARS

**A** new oil analysis and vibration monitoring system is now available from Schaeffler. The system enables the early detection of damage to heavy duty, oil-lubricated industrial gears, providing plant operators with a reliable system that prevents unplanned downtime and minimises maintenance costs. Industrial gears and gearboxes are critical to the smooth operation of

most production environments and so maintaining these systems is often a high priority. If excess wear or damage is allowed to develop within a gearbox, this could result in secondary damage to other vital plant and machinery.

The new FAG Wear Debris Monitor is designed to solve these issues. This online oil analysis system is capable of pinpointing the precise location of any

## NEW INDUCTION HEATERS OFFER UNIQUE TECHNICAL BENEFITS AND SAFETY FEATURES

SCHAEFFLER HAS IMPROVED ITS RANGE OF FAG INDUCTION HEATERS TO INCLUDE SEVERAL UNIQUE TECHNICAL INNOVATIONS, WHICH NOT ONLY IMPROVE THE SAFETY AND RELIABILITY OF THE DEVICES, BUT ALSO MAXIMISE PLANT AND MACHINE AVAILABILITY FOR END USERS.

**S**chaeffler's HEATER range includes seven induction heater models, which are suitable for the mounting of bearings – or other circular steel components such as gears, couplings, pulleys and bushings – with a minimum bore diameter of 10mm, up to bearings with outside diameters of 1,500mm, with a maximum weight of 1,200kg.

High machine availability depends on the quality and reliability of individual machine components. Prior to mounting, workpieces such as bearings must therefore be heated uniformly. If heat output is too high, this can cause temperature differences between the inside and outside of the workpiece, which in turn, can lead to cracks or distortions in the material. In order to prevent this, Schaeffler's new redesigned FAG induction heaters are equipped with various new features, including temperature-time (ramp) controls, which prevent overheating of the workpiece. No other induction heater currently available on the market is equipped with these controls.

### Unique temperature-time controls

Ramp controls now provide continuous temperature monitoring of critical heater components such as the main circuit board, coil and housing.

An automatic overheating switch-off function is provided, which reduces the risk of damage (stress fractures or cracks) to the workpiece. The operator can now set the heating time (duration) so that the temperature of the workpiece is carefully controlled and heated in a uniform manner.

Another unique safety feature provided is an infrared remote controller. Health & Safety regulations stipulate that an operator must not stand for long periods in an electromagnetic field. In terms of induction heaters, this means standing at a safe distance from the heater during the heating process. When using the HEATER10 and HEATER20, the heating process starts 5 seconds after the start button is pressed, giving the user sufficient time to move away. When using the larger induction heaters (HEATER40 to HEATER1200) an infrared remote control is provided, allowing the user to start the heating process from a safe distance.

As workpieces become magnetised during the induction heating process, all FAG induction heaters incorporate an automatic demagnetisation feature, which ensures that the workpiece does not attract any unwanted metallic particles during the heating process, which could result in long term damage to the workpiece.

### Faster, easier heater selection

For users who may be unsure of the size of induction heater they require, Schaeffler's FAG Heating Manager software ensures that the correct selection is made quickly and easily.

This software is freely downloadable from the media library at [www.schaeffler.com](http://www.schaeffler.com) ■



damage or wear to gears, bearings and cages within a gearbox or other industrial gear unit. The system is therefore suitable for use in almost every industry sector.

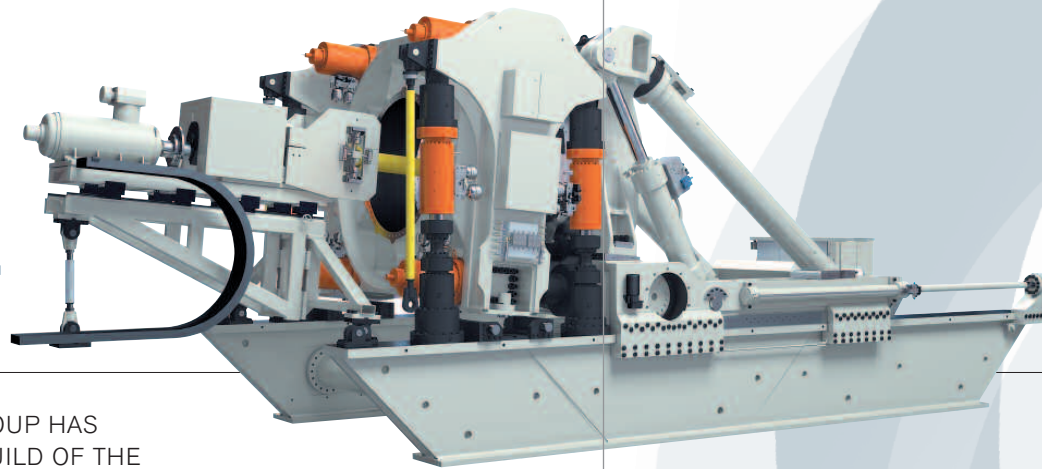
The system's oil monitor works by utilising an inductive particle counter (sensor), which is able to distinguish between ferrous and non-ferrous metal particles that are present in the lubricating oil. The sensor operates on the principle that any wear to a component such as a bearing or gear tooth will result in small metal particles being rubbed off into the oil,

often several months prior to an actual failure. The sensor provides information on the number of particulates present in the oil, and then classifies these according to their physical size. Analysing the oil in this way enables damage and wear to the gears to be detected much earlier.

In addition to oil analysis, the FAG Wear Debris Monitor can be set up to operate in conjunction with online condition monitoring systems, including Schaeffler's FAG DTECT X1, FAG WiPro or FAG ProCheck systems. ■



## WORLD'S LARGEST BEARING TEST RIG NOW OPERATIONAL AT SCHAEFFLER

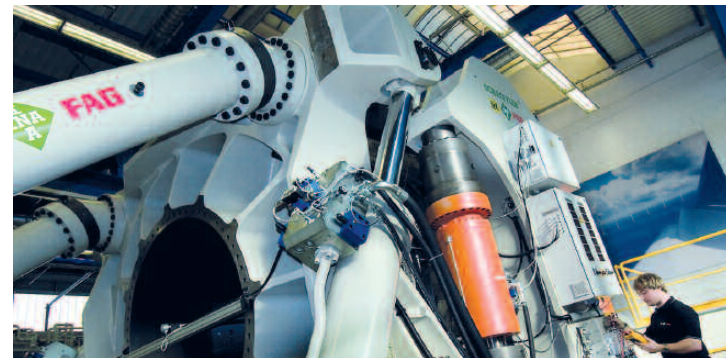


IN LESS THAN TWO YEARS, THE SCHAEFFLER GROUP HAS SUCCESSFULLY COMPLETED THE DESIGN AND BUILD OF THE WORLD'S LARGEST, MOST POWERFUL TEST RIG FOR LARGE SIZE BEARINGS.

**T**he 'Astraios' test rig – named after a Greek mythology Titan who fathered the four wind gods – enables large size bearings weighing up to 15 tonnes with outside diameters up to 3.5m, particularly those used in wind power applications, to be fully tested in realistic conditions using a comprehensive simulation programme.

At a cost of around 7 million euros, Astraios is a significant investment but will enable Schaeffler to help reduce wind turbine development times for customers, as well as improving the reliability, safety and cost effectiveness of future wind turbine designs.

Astraios will be primarily used to test rotor bearings for multi-Megawatt wind turbines and will help to further



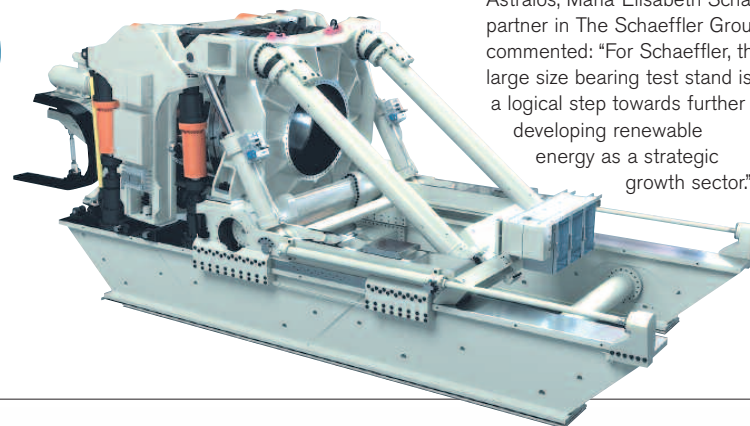
improve the understanding of wind turbine systems, the influencing factors and the interrelationship between drive train components. The tests will also provide useful insights into wind turbine operation and maintenance.

In her speech at the opening of Astraios, Maria-Elisabeth Schaeffler, partner in The Schaeffler Group, commented: "For Schaeffler, this large size bearing test stand is a logical step towards further developing renewable energy as a strategic growth sector."

### Set up and function of Astraios

The test rig will perform realistic simulations of static and dynamic loads that act on the rotor bearings and slewing rings. All rotor bearing concepts for wind turbines with an output of up to 6MW can be tested on Astraios. Functional tests will provide insights into rolling bearing kinematics, temperature and friction behaviour, loads and deformation.

The loading frame is the most important part of the test rig. Four radial and four axial hydraulic cylinders are fixed to this frame, which generate the real loads and moment forces that occur in a wind turbine. The radial cylinders simulate the weight of a rotor hub with rotor blades, while the axial cylinders generate the wind loads.



## ASTRAIOS IS A PRIZE WINNER IN COMPETITION "365 LANDMARKS IN THE LAND OF IDEAS 2012"

The ASTRAIOS bearing test rig at is a prize winner in the competition "365 landmarks in the land of ideas".

The nation-branding initiative "Germany – Land of Ideas", an initiative of the German Federal Government and the Federation of German Industry (BDI), recognises 365 outstanding projects and ideas each year that make a significant contribution to Germany's future viability. "This award is another example of Schaeffler's outstanding innovative force and shows that we are making a significant

contribution to the further development of renewable energies with our investment in the new large-size bearing test rig at our development location here in Schweinfurt", said Dr. Arbogast Grunau, President of Product Development at Schaeffler Group Industrial.

In addition to winning the award as a "selected landmark", Schaeffler is also amongst the prize winners nominated in the "Environment" category as a winner at Federal level. The jury nominates one winner at Federal level for each

category from the 365 "Selected Landmarks". These landmarks are shining examples of the quality of the ideas and projects in the competition and Germany's innovative force.

The jury of experts comprising scientists, business managers, journalists and politicians selected ASTRAIOS for the environment category from over 2,000 entries. The 365 competition prize winners are an indicator of an exceptional culture of innovation and a reflection of important future trends.

## RAIL TEST RIG FOR AXLEBOX BEARINGS SIMULATES SPEEDS OF UP TO 500KM PER HOUR

SCHAEFFLER'S RAIL TEST FACILITY IN SCHWEINFURT, GERMANY IS NOW AVAILABLE FOR UK CUSTOMERS TO ASSESS THE PERFORMANCE OF AXLEBOX (WHEELSET) BEARINGS FOR RAIL APPLICATIONS.

**T**he special axlebox bearing test rigs are able to simulate travel speeds of up to 500 km/h. All test rigs at Schweinfurt enable independent testing in accordance with the requirements of the latest European Standard DIN EN 12082. The functional tests carried out in accordance with this standard are used as verification of the suitability of axlebox bearings for real operational conditions.



The AN55 bearing test rig at Schweinfurt, for example, is primarily used to test double-row tapered and cylindrical roller bearings in their original housings. This system provides data on bearing behaviour under constant radial load and varying axial loads, as well as data on operating temperatures and grease operating life. Axlebox housings and bearings are air-cooled, which has a considerable influence on grease operating life. The test rig is therefore equipped with an air stream simulation facility, which is able to generate wind speeds of up to 10m/s.

On another test rig at Schweinfurt, axlebox bearings and their original housings undergo leak-tightness water spray tests. During these tests, axlebox bearings mounted in their housings are sprayed continuously with water, both in their stationary position and under simulated operating conditions. During these tests, no water must penetrate the sealed spaces of the bearings.

The Rail Test Facility in Schweinfurt is now one of only two test labs outside of Russia that are authorised to conduct independent tests on rolling bearings used as a method of transport for the Russian Federation. Under Russian Law, these test labs must be certified.

The rotors and hub on a large wind turbine can weigh in excess of 100 tonnes. This weight acts on the bearing and generates a static radial load and a static 'nodding' moment. Accordingly, the four radial cylinders have extremely large dimensions, as each cylinder can generate a maximum of one mega Newton of force, which is equivalent to 100 tonnes of weight. The axial cylinders provide even more – up to 1.5 mega Newton for simulating static axial loads as well as the dynamic nodding and yawing moments.



Different wind speeds are simulated using the test rig's drive train and planetary gearbox. Typical speeds are 4-20 rpm, although it is also possible to simulate significantly higher speeds.

The tensioning frame acts as the connection side of the wind turbine's nacelle. Wind seldom blows at the same speed or from the same direction, but acts with varying intensity and at different points on the wind turbine. Varying moments are generated on the rotor hub, depending on the position of the rotating rotor blades. If the wind acts on the top or bottom of the rotor blades for example, it generates a dynamic nodding moment. This is supplemented by a dynamic yawing moment if the wind turns and blows more strongly from the side.

Together, these factors mean that wind turbines are subjected to extremely complex conditions due to the continuously changing wind conditions. This is a Herculean task, not only for the test stand and the eight hydraulic cylinders that simulate all loads and moments, but also for SARA (Schaeffler's Automation System for Research and Development Applications), which automatically controls the comprehensive test and measurement programme.

The relevant certification tests can only be carried out by accredited test centres in accordance with application requirements.

In order to obtain the accreditation, Schaeffler Group's Railway Sector Management and Corporate Engineering worked closely with representatives from the Russian Federation over a two-year period. Following successful accreditation, the first certification tests on FAG TAROL bearings for the Siemens 'DESIRO RUS' project have now commenced. In addition, FAG cylindrical roller bearings are being certified for 200 dual-voltage type EP20 locomotives, which are also destined for the Russian market.

Jeremy Spencer, Rail Sector Manager at Schaeffler (UK) Ltd commented: "With increasingly complex operating demands and more strict safety standards in the rail industry, Schaeffler's test facilities in Schweinfurt provide our customers with complete peace of mind. We are able to conduct functional tests on complete assembled bearings, specific individual components, materials and lubricants. The test rig simulations are helping to contribute to significant increases in the service life and maintenance intervals of rolling bearings for rail applications." ■





## ROBUST, RELIABLE ROLLING BEARINGS PREVENT UNPLANNED DOWNTIME OF DRILL RIG PLANT AND MACHINERY

ROLLING BEARINGS USED IN OFFSHORE DRILLING APPLICATIONS MUST WITHSTAND EXTREMELY HARSH OPERATING CONDITIONS. DRILL RIG OPERATORS MUST THEREFORE SELECT BEARINGS THAT MAXIMISE MACHINE AVAILABILITY AND PREVENT UNPLANNED DOWNTIME, SAYS DR STEVE LACEY, ENGINEERING MANAGER AT SCHAEFFLER UK.



◀ Sheave and axial bearings

**R**olling bearings for offshore drilling rig applications such as mud pumps, winches and drill string rotary tables, must operate in some of the harshest conditions on (and under) the Earth. These unforgiving environments subject the drilling equipment to extremely high stresses, so the bearings must be robust and reliable. In terms of Total Cost of Ownership (TCO), when selecting suitable rolling bearings, the entire lifecycle of drill rig plant and machinery must be considered, not simply the purchase costs of individual components such as the bearings.

As well as finding a suitable supplier of rolling bearings, drill rig operators must also consider what type of related support services that supplier is able to offer. For example, does the supplier offer expert technical advice from experienced engineers who are familiar with oil and gas industry applications? Can the supplier tailor its bearing products to meet my exact needs? Is the supplier willing and able to develop new bearings for specific applications? Perhaps the OEM or drill rig operator is looking for a bearing supplier that is willing to collaborate as a development partner?

◀ Spherical roller bearing

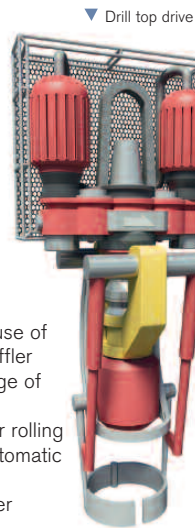
Bearing technical support is also an important consideration here. These services typically include guidance on the mounting and dismounting of bearings, as well as recommendations on suitable lubricants and how to properly inspect used bearings.

Schaeffler is also able to offer powerful bearing design calculation software tools to help analyse bearing designs in more detail and to ascertain whether these designs are suitable for a particular drill rig application. The friction values of alternative bearing designs, for example, can be compared quickly and easily. Using these software programs, it is also possible to precisely calculate, display and document the load acting on each individual bearing location on a mud pump or motor, while taking into account a wide variety of environmental conditions. In this way, Schaeffler is able to work closely with the customer to design an optimum bearing for the application – that provides maximum service life, minimum space requirements and extremely reliable bearing operation. Bearing design calculation and analysis software will become increasingly important to drill rig operators and their equipment OEMs, as operators continue to search for new oil and gas reserves at ever increasing drill depths.

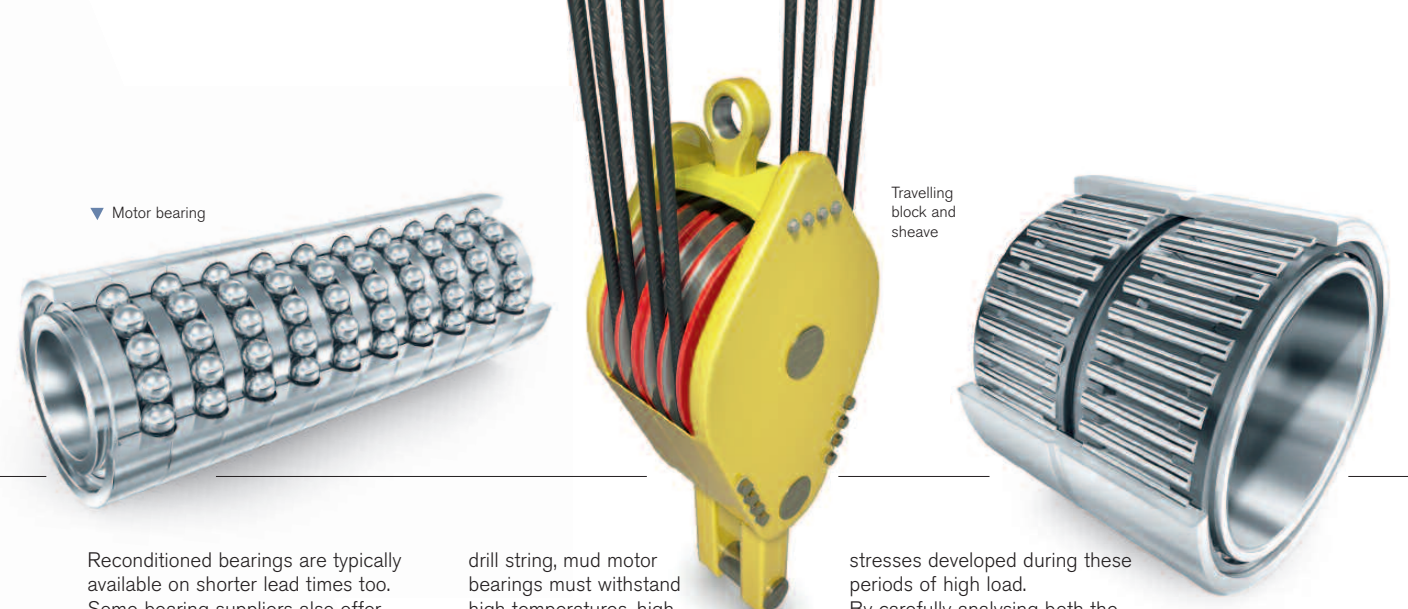
### Condition monitoring, lubrication and training

Condition monitoring (CM) of bearings is also an important consideration and can prolong the life of critical items of equipment. CM services include vibration analysis, acoustic emissions monitoring, force/torque measurements, multi-channel systems for modal analysis, thermal imaging cameras and endoscopes. Schaeffler also offers explosion-protected online (fixed) condition monitoring systems (up to Class 1/Div 1 resp. ATEX II 1G IIC T4) that can be used to monitor the condition of rolling bearings on rotating plant in hazardous areas.

Incorrect lubrication is the most common cause of bearing failure. Schaeffler therefore offers a range of bearing greases and lubrication systems for rolling bearings, including automatic lubrication systems. In addition, some larger size bearings can be reconditioned as a cost effective alternative to buying new.



▼ Drill top drive



▼ Motor bearing

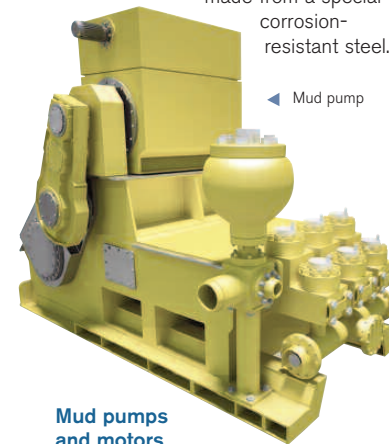
Travelling block and sheave

▲ Needle bearing

Reconditioned bearings are typically available on shorter lead times too. Some bearing suppliers also offer tailored training on-site at the customer's premises. Typical training courses provided by Schaeffler include the fundamentals of rolling bearing technology, vibration monitoring, or how to install and remove bearings.

### Typical applications

There are numerous applications for rolling bearings on a drilling platform, from the crown block down to the drill string. These applications require all types of rolling bearing, from basic application-specific bearings to complete ready-to-install systems. This includes needle roller bearings, tapered roller, axial tapered roller, cylindrical roller, needle roller, spherical roller, ball bearings and custom special bearings such as Schaeffler's mud motor multi-row bearings, which are made from a special corrosion-resistant steel.



◀ Mud pump

### Mud pumps and motors

Mud pumps supply the drill rig with a constant flow of high-pressure mud, which is used as the drilling fluid. These positive displacement pumps operate at pressures of up to 10,000 psi, resulting in high radial loads at the typical bearing positions, including the crosshead bearings, eccentric bearings, crankshaft main bearings and drive shaft bearings. Schaeffler provides complete mud pump bearing sets for some of the most technically advanced mud pump designs used in the oil and gas industries. Similarly, mud motors on a drilling platform represent one of the most demanding applications for rolling bearings. Operating at the end of the

drill string, mud motor bearings must withstand high temperatures, high loads, impact forces, as well as direct contact with the contaminated drilling fluid (i.e. mud). For mud motors, Schaeffler's solution is to utilise special, multi-row geometries created from speciality steels. Working closely with the leading manufacturers of downhole drilling tools, Schaeffler has designed bearings that maximise operation in a wide range of drilling conditions.

### Sheaves and pulley systems

Sheaves and pulleys are used in crown and traveling blocks, as well as for heave compensation systems, whose function is to decouple the dynamics of a floating drilling platform from those of the drilling tools. Reliability under high static and dynamic loads is therefore required in order to ensure maximum uptime under such an extreme range of drilling conditions. For these applications, Schaeffler provides traditional, high capacity, double row taper bearings in common oilfield sizes and in accordance with API 8C requirements. The bainitic microstructure of the hardened components gives a soft core with lower retained austenite levels to provide thermal stability under extreme operating conditions. A complete range of full complement cylindrical bearings can also be specified. Seals are available on both cylindrical and tapered roller bearings, which are specifically designed for these extremely harsh operating conditions.

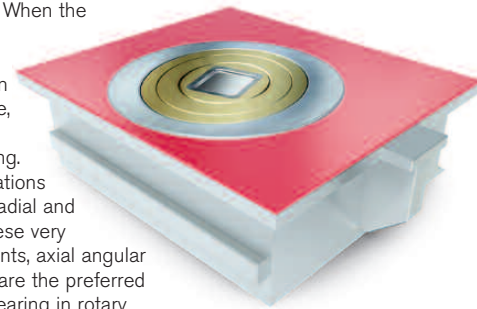
### Swivel/top drives

The top drive or swivel supports the drill string, whilst simultaneously acting as a rotating passageway that permits drilling mud to flow into the drill string. In addition, the top drive provides the torsional force required to turn the drill string. This application requires high reliability bearings that also withstand the shock loads generated during the drilling process. The solution here is to utilise high capacity bearings that are resistant to any possible spikes (peaks) in load. As well as providing these types of bearing, Schaeffler also encourages operators to work more closely with its application engineers in order to better understand the

stresses developed during these periods of high load. By carefully analysing both the bearing design and structural components, these resulting stresses can be minimised.

### Rotary tables

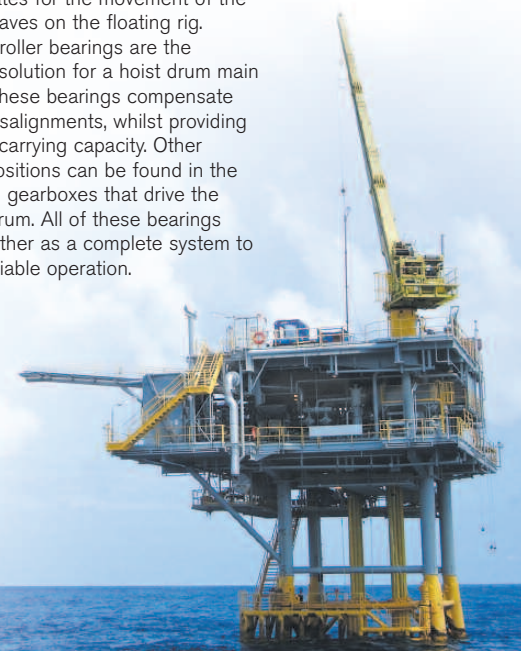
The rotary table is the traditional method of providing the rotational force to turn the drill string. When the drilling process is interrupted, the rotary table can also function as a supporting device, carrying the entire weight of the drill string. Here, the bearing locations are exposed to high radial and axial loads. Due to these very demanding requirements, axial angular contact ball bearings are the preferred choice for the main bearing in rotary tables, in either single row designs or as three race assemblies. These bearings are distinguished by their high axial load carrying capacity. Schaeffler also manufactures the pinion bearings that help provide trouble-free operation on the input shaft.



▲ Rotary table

### Winches and draw works

The primary function of the draw works is to raise or lower the drill string and to provide the correct weight on bit (WOB). The latest draw works and winches can also operate using Active Heave Compensation (AHC), which compensates for the movement of the ocean's waves on the floating rig. Spherical roller bearings are the preferred solution for a hoist drum main bearing. These bearings compensate for any misalignments, whilst providing high load carrying capacity. Other bearing positions can be found in the motor and gearboxes that drive the hoisting drum. All of these bearings work together as a complete system to ensure reliable operation.





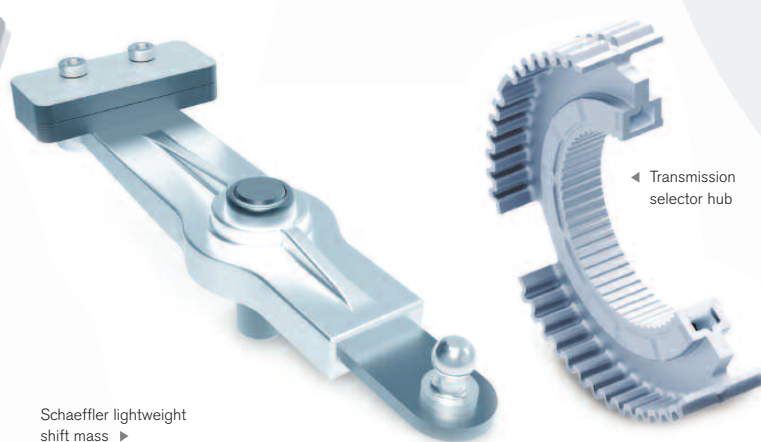


## NOVEL, LIGHTWEIGHT DESIGNS CUT VEHICLE FUEL CONSUMPTION AND CO<sub>2</sub> EMISSIONS

DEVELOPING COMPONENTS, MODULES AND SYSTEMS THAT HELP TO REDUCE VEHICLE FUEL CONSUMPTION AND CO<sub>2</sub> EMISSIONS ARE IMPORTANT AREAS OF ACTIVITY FOR THE AUTOMOTIVE INDUSTRY.



▲ Schaeffler hybrid design gearshift fork



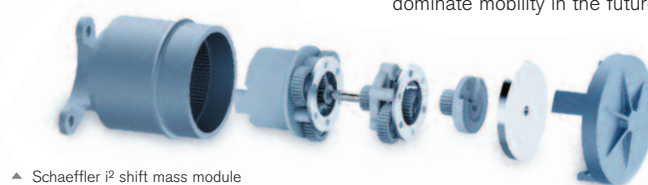
Schaeffler lightweight shift mass ►

**O**ne key area in which developers are currently focusing their efforts is in the optimisation of vehicle drive systems to reduce the overall weight of vehicles. Indeed, lightweight vehicle designs are quickly becoming fundamental to future sustainable mobility, not only for conventional drive systems, but also for electric vehicle concepts. As a Tier Two supplier to the automotive industry, Schaeffler is also focusing its efforts on developing innovative lightweight technologies as a key element in sustainable strategies for reducing CO<sub>2</sub> emissions.

### Shift mass

Reductions in weight and design space can be achieved using shift masses, while simultaneously enabling improvements in driver handling and comfort. Conventional shift masses comprise a steel component with a relatively high mass. These generate mass inertia, which balances out force peaks and vibrations that occur during gearshift operations.

Here, Schaeffler offers two optimised mass solutions. The mass of Schaeffler's i<sup>2</sup> shift mass module has been reduced by up to 70 per cent compared to conventional components. However, the lower inertia level of the i<sup>2</sup> shift mass module is increased using a gearbox. At the core of the gearshift module is a two-stage planetary gearbox that enables very high ratios.



▲ Schaeffler i<sup>2</sup> shift mass module

A slipping clutch reduces the load on the plastic gear teeth during overloading, which helps to ensure a long operating life. Schaeffler's lightweight shift mass also utilises a different approach to more conventional shift masses, which improves the distribution of weight. Fitting the actual mass on the outer end of the lightweight carrier ensures optimum utilisation of the lever action provided. The lightweight carrier is made of aluminium or plastic combined with a steel gearshift lever for transmitting the gearshift forces.

### Selector hubs in transmissions

With its new selector hub made from sheet metal, Schaeffler can now facilitate reductions in weight of up to 25 per cent compared to conventional solid sintered metal versions. The new two-part design comprises geometrically compatible sheet metal half shells, which, after the design optimisation process, can transmit higher torques than sintered components.

### Hybrid design gearshift forks

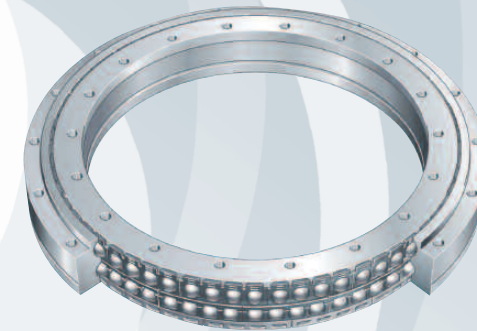
In manual transmissions, intelligent use of mixed designs is key to opening up further potential efficiency improvements.

For example, Schaeffler's new hybrid gearshift forks with aluminium bodies can replace the more traditional, conventional steel gearshift forks. The striker jaw is a high precision sheet metal blanked component. This mixed design not only reduces the weight of Schaeffler's hybrid gearshift forks compared to conventional systems, but also makes them more compact, which in turn, reduces the design space required. This simplified assembly process enables the hybrid design to be manufactured anywhere in the world. These hybrid gearshift forks are already in volume production.

"Schaeffler's new lightweight concepts enable reductions in weight of up to 1.2 kg for transmissions," explains Pascal Kohtes, product developer at Schaeffler. "Often, lightweight designs not only have a positive effect on the components themselves, but also initiate significant positive secondary effects on the vehicle as a whole. These range from advantages in driving dynamics and weight reductions, to cutting fuel consumption and CO<sub>2</sub> emissions. Lightweight designs are therefore a specialist area with a strategic focus that will dominate mobility in the future." ■

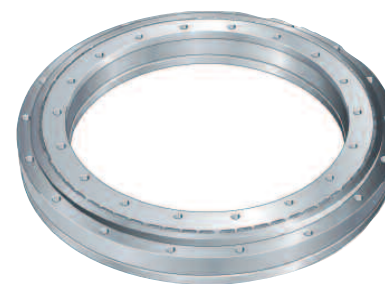
◀ Transmission selector hub

## NEW ROTARY TABLE BEARINGS OFFER REDUCED FRICTION AND INCREASED MACHINING ACCURACIES



SCHAEFFLER HAS EXTENDED ITS RANGE OF ROTARY TABLE BEARINGS FOR MULTI-AXIS MACHINING APPLICATIONS WITH TWO NEW BEARING SERIES. THE YRTC AND ZKXDF SERIES ARE AVAILABLE WITH INSIDE DIAMETERS FROM 580MM UP TO 1030MM AND OFFER TECHNICAL ADVANTAGES SUCH AS REDUCED FRICTION, INCREASED RIGIDITY AND OPERATING SPEEDS, AS WELL AS MORE COMPACT DESIGNS.

**T**he demand for larger rotary table bearings with reduced friction and increased speed capability is growing. To meet this demand, Schaeffler's new YRTC range of rotary table bearings is available with IDs from 580mm up to 1030mm. The design of the bearings is based on a combination of Schaeffler's YRT and RTC series of rotary table bearings. This provides the basis for extremely dynamic rotary axes for rapid positioning and for form milling using multi-axis simultaneous machining. Operation at continuous speeds, for example, in intermittent turning, is also possible within the operating limits. Compared to traditional combination thrust and radial cylindrical roller bearings, power dissipation is also significantly reduced.

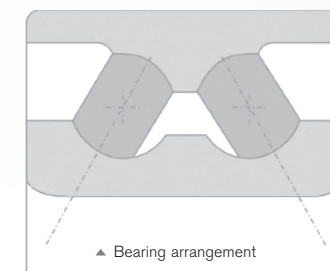


As a result of this marked reduction in friction, a significantly increased proportion of the drive torque supplied by the machine tool drive is freed up for axis acceleration – which increases machine productivity. By using YRTC bearings with reduced friction, the control properties of the rotary axis improve, resulting in more precise geometry transitions when machining shapes and contours.

### Unique ball roller design

Schaeffler has also developed a completely new design of rotary table bearing based on the company's innovative ball roller design concept. This innovation is based on a double row angular contact, thrust ball roller

bearing in an 'O' arrangement that uses new assembly methods and a unique rolling element. For the Ball Rollers, all parts of a conventional ball that are not under load are removed. This means that around 15 per cent of the ball diameter is cut away from both sides. The result is a ball that is flattened on both sides and which is approximately 30 per cent narrower (and therefore lighter) than a conventional fully spherical alternative.



▲ Bearing arrangement

Ball roller elements offer all the axial load handling capabilities of fully spherical balls, but allow overall bearing width and mass to be decreased by 15 to 20 per cent, as well as reducing friction. This not only saves valuable design space, but means that the 'slim' shape of the ball roller, in combination with new assembly methods, enables the number of rolling elements to be increased. This in turn enables the filling capacity of the bearing to be increased by up to 90%. Using more rolling elements in the same design space results in higher load ratings and longer service life.

The new ZKXDF rotary table bearings are currently being field tested by manufacturers of machining centres. These new bearings enable the design of more compact, higher performance rotary table supports in the high speed range. The benefits to machine tool manufacturers include increased rigidity and accuracy, simplified assembly processes and options for reducing system or machine build costs.



◀ Innovative new ball roller element

Due to the single piece bearing rings, the running accuracy of the rolling bearings can be more easily transferred to the machine sub-assembly. The number of joints is also reduced, resulting in increased rigidity. Furthermore, the new ZKXDF bearings do not require any holes to be incorporated in the raceways for inserting the rolling elements. This has a beneficial effect on the rating life and operational reliability of the bearings, particularly at high speeds.



New performance-enhanced series YRTC

By using ball roller bearings, the ZKXDF bearings provide a larger grease reservoir, which increases operating life and allows longer relubrication intervals.

For high speed precision rotary tables, Schaeffler's product range also includes the YRTS and ZKLDF series. Typically, these are used in high performance machine tools for combined milling and turning in a single workpiece clamping operation. ■



## A GUIDE TO SELECTING LINEAR ACTUATORS FOR SINGLE AND MULTI-AXIS POSITIONING SYSTEMS

SPECIFYING LINEAR MOTION SYSTEMS ISN'T THE BLACK ART MANY THINK IT IS. MIKE HUGHES, APPLICATIONS ENGINEER AT SCHAEFFLER UK, PROVIDES SOME USEFUL TIPS AND GUIDANCE FOR ENGINEERS ON HOW TO SELECT THE MOST SUITABLE LINEAR ACTUATORS FOR SINGLE AND MULTI-AXIS SYSTEMS.



**M**any engineers are still not confident when it comes to selecting suitable linear motion systems for an application. Some avoid linear systems and revert to their traditional comfort zone of specifying rotary alternatives.

If engineers discuss their application with a linear systems supplier, potential issues can be resolved and a suitable solution found. By talking through their concerns with an experienced linear application engineer, companies can save themselves a lot of wasted design effort or prevent the system from being too costly. The supplier can also inform the customer exactly what is possible in terms of linear motion systems.

In selecting linear actuators for single and multi-axis handling & positioning systems, terminology can be confusing. Many engineers commonly refer to linear actuators as 'linear modules', 'driven linear systems' or 'linear X-Y tables'. These types of systems, which

we will refer to as linear modules, normally incorporate a number of different linear drives and actuators. The following factors need careful consideration when selecting a suitable linear module for a single-axis, two-axis or three-axis positioning system:

### System configuration

Configuration, including the number of axes of motion, is often the first factor that needs careful thought. The most common are two-axis (X-Y) configurations, but single-axis and three-axis configurations are also possible.

### Orientation and mounting

System orientation and mounting are also key factors. In a single axis linear system, this is straightforward but becomes a more complex issue in multi-axis systems. Factors to consider include the direction of travel of each axis. Does the load need to be moved simultaneously in multiple axes or does each axis move individually? Does the system require a moving carriage (standard) or a moving rail?

Are the axes vertical, horizontal or inclined? Are the mounting positions of each actuator at 0, 90 or 180 degrees to the horizontal? Other factors to consider include the spacing between support points in the system, as well as how rigid and flat the supporting surface is for the system.

### Mass and centre of gravity

The mass (and geometry) of the object to be moved and the position of its centre of gravity as it moves relative to a coordinate or datum point on each axis must also be calculated. Clearly, as a mass is accelerated or decelerated along multiple axes of travel, the position of its centre of gravity relative to each axis will change. This needs careful consideration so that the moment loads at multiple points in the system can be established. Often, calculating the best and worst-case scenarios (using software such as Schaeffler's Linear EasySolution) and then averaging these is sufficient. Other questions here include whether sufficient load carrying capacity has been allowed in the system to cater for instantaneous moment loads? Also, are there any overhung loads in the system?

### Stroke lengths

The 'effective' and 'total' stroke length for each axis is also critical. With ballscrew driven linear actuators, for example, the stroke length is limited to the length of the ballscrew itself. Therefore, maximum stroke lengths tend to be around 3 metres. But with belt-driven systems, there are no such restrictions and so stroke lengths can be higher than this.

### Accuracy and repeatability

Depending on the application, accuracy and repeatability will differ greatly between applications. Most customers know what their accuracy requirements are when they contact us. Typically, the accuracy of a ballscrew-driven linear actuator is 0.16mm per metre with repeatability of +/- 0.01mm.

For belt-driven actuators, typical accuracy is around 0.5mm per metre, with repeatability of +/-0.10mm.

### Traverse speeds and accelerations

The limiting factors for traverse speeds and traverse times are the ballscrews and/or the bearings. Typically, with ballscrew-driven actuators, maximum speeds of 3m/s are possible. For belt-driven actuators with track roller guidance systems, the maximum speed is around 8-9m/s. If recirculating linear bearings are used with belt-driven actuators, maximum speeds are similar to their ballscrew equivalents. Acceleration itself is not normally the defining issue in multi-axis positioning systems. It is the loads due to these accelerations in the system that are critical.

### Cycle time requirements

Cycle times dictate the life of a linear system. For example, a positioning system such as a tool changer on a machine tool might change the tool five times per hour. How is this cycle time going to vary from day to day and how will this affect the fatigue life of the linear components within the system?

### External loads and forces

This includes external impact forces on the system such as stops or human interventions. Is something pushing or pulling on the load to be moved or does the load need to be brought quickly to a stop at the end of its travel?

### Environmental factors

Factors such as temperature, humidity and contamination will affect the choice of system. Linear actuators can be protected from the environment by incorporating special seals, corrosion-resistant materials and coatings, special greases or by using plastic parts where necessary. In medical applications, the overall noise of the system may be a factor.

### Electrical considerations

For multi-axis positioning systems, drives and other electrical systems are often complex and therefore require careful consideration. ■

## HIGH SPEED, DEFECT-FREE ROOF PANEL PRODUCTION



INA LINEAR ACTUATORS FROM SCHAEFFLER ARE PLAYING A VITAL ROLE IN HELPING A MANUFACTURER OF ROOF PANELS TO ELIMINATE VIRTUALLY ALL SOURCES OF DEFECTS IN ITS MACHINING PROCESSES.

**K**luth, based in Germany, is a specialist in producing sloping roofs made from lightweight materials.

The roof and its related components are manufactured from high quality materials such as polystyrene, polyurethane and mineral wool. In order to ensure the quality of the different construction materials used, Kluth produces the polystyrene (EPS), in block form. The roof panels are then machined to specific requirements.

The production and cutting machines run at least 12 hours a day, 7 days a week in order to produce 830,000 individual roof elements each year. This requires high performance machines with a high level of automation. According to Managing Director at Kluth Marcus Kluth, the new EPS cutting machines, which automatically adjust the cutting wires using computer control, enable rapid, defect-free production. "We are under enormous time and cost pressures. This means that our machines must be highly flexible and provide absolute reliability," says Kluth. Manually adjusting the cutting wires cannot fulfil

the requirements for dimensional accuracy and quality. Automated adjustment of the wires using linear actuators from Schaeffler has eliminated virtually all sources of defects and has also enabled Kluth to double its output.

The EPS blocks are separated into roof elements and the cutting operation is mostly automated. In order to adjust the cutting wires automatically at high speed and with repeatable accuracy, two MKUVE20-B-ZR linear actuators are used. These actuators adjust the individual cutting wire under computer control.

The MKUVE20-B-ZR linear actuator comprises an inherently rigid aluminium support rail with high load carrying capacity and an integrated linear guidance system. The extremely compact linear actuator is fitted with linear recirculating ball bearing and guideway assemblies and two carriages. This enables moderate loads, combined with high static loads about all three axes, to be moved with high positional accuracy. The drive system comprises a toothed belt and brushless servomotor. ■



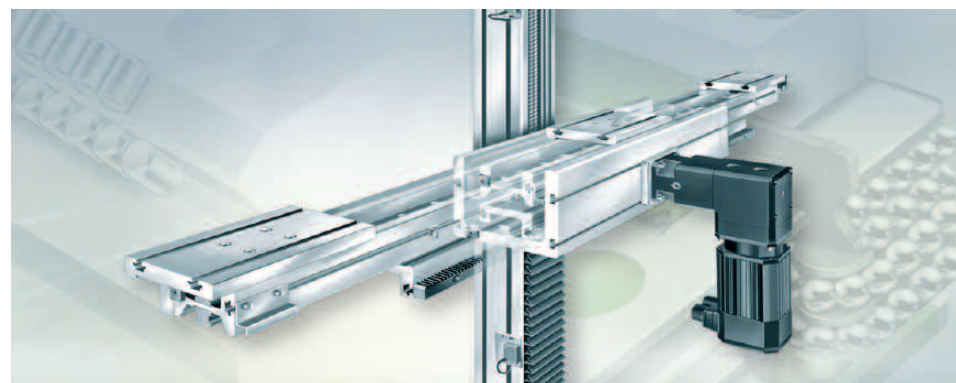
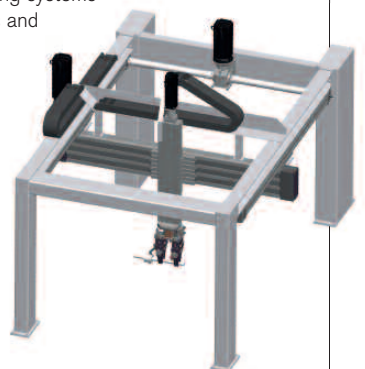
▲ One of two INA linear actuators MKUVE20-B-ZR with the gripper mounted on the carriage for the adjustment and positioning of individual wires.



## COMPLETE MULTI-AXIS HANDLING AND POSITIONING SYSTEMS CUT MACHINE BUILD TIMES AND COSTS

Design engineers and users of automated handling and multi-axis positioning systems can now source a complete range of modular, multi-axis linear components and turnkey handling and positioning systems from a single UK source.

As well as a range of modular, multi-axis components and systems, Schaeffler UK is now offering a comprehensive range of technical support services. These services include planning, detailed design, engineering, purchasing, pre-assembly and final assembly of components, safety protection, control and programming, transportation and final assembly of machines, initial set up and servicing, as well as maintenance. With Schaeffler's comprehensive portfolio of multi-axis positioning systems and support services, the customer is supplied with a fully functional, reliable solution manufactured from modular components that are perfectly matched, saving machine build time and costs during project planning, design, procurement, assembly and initial operation and set up – backed up by Schaeffler's global service network. ■





▼ Schaeffler components for e-mobility also include sensor bottom bracket bearings.



## SCHAEFFLER PURSUES A HOLISTIC APPROACH TO ELECTRIC MOBILITY

SCHAEFFLER IS BUNDLING ITS NUMEROUS ACTIVITIES RELATING TO ELECTRIC MOBILITY IN AN EMOBILITY SYSTEMS DIVISION. THIS HOLISTIC APPROACH INTEGRATES THE EXPERTISE OF BOTH THE AUTOMOTIVE AND INDUSTRIAL DIVISIONS.

**E**lectric mobility is generating sustained and growing interest. As a development partner and supplier, we must react to this development", says Rolf Najork, Development Director of Transmission Systems and Electric Drives at Schaeffler.

Accordingly, Schaeffler is creating an eMobilitySystems Division for the purpose of combining the numerous individual competencies and developing the market at systems level.



▲ In the Schaeffler Hybrid, Schaeffler presents the innovative in-hub motor eWheel Drive. The system allows the development of completely new vehicle architectures.

"Suppliers play an active role in the development of electric mobility. With innovations and future-oriented products, they make an important contribution to progress and securing the future, which are always associated with considerable investments", says Prof. Peter Gutzmer, Member of the Board of Management and Chief Technology Officer at Schaeffler. "With the eMobility Systems Division, we are also creating structures at an international level that will enable us to cover this important field in its entirety."

The eMobility Systems Division will initially provide jobs for 300 employees. Development capacities at Schaeffler's locations in Herzogenaurach, Bühl and Suhl will be expanded accordingly. Activities relating to electric mobility will also be increased at Schaeffler's development locations in China and North America. Schaeffler is searching for engineers with qualifications in technical subjects, natural scientists and industrial engineers.

"Schaeffler offers excellent opportunities for starting and developing a career in an international environment and in an important market segment that is at the cutting edge of technology. Our product range includes key components for the entire electric drive train and solutions for drives in hybrid vehicles and electric cars. Mechatronics is playing an increasingly significant role", says Rolf Najork. "Our innovations are used in both automotive and industrial environments."

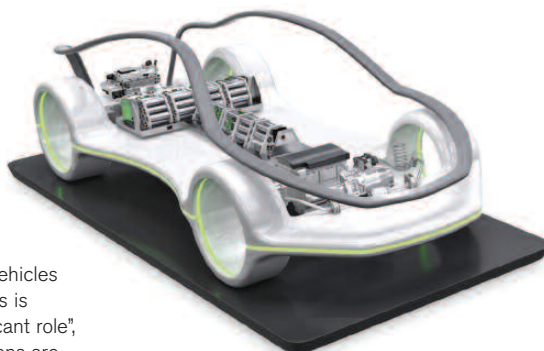
The product range already includes numerous solutions relating to electric mobility. The range extends from sensor bottom brackets for so-called pedelecs, start-stop solutions and hybrid clutches right up to electric drives.



▲ ACTIVE DRIVE – Electric Vehicle with Active Torque Distribution



▲ The Schaeffler Hybrid is a concept demonstrator allowing a comparison of various hybrid configurations.



▲ The e-Solutions Concept vehicle reflects a series of Schaeffler solutions for electric mobility

Schaeffler has made a name for itself, for example, with the hybrid solutions presented in the "car full of ideas", the Schaeffler Hybrid, and the wheel hub drive eWheel Drive, as well as the eDifferential presented in the concept vehicle ACTIVE DRIVE. ■

## LIGHTWEIGHT DIFFERENTIALS CREATE SPACE

SCHAEFFLER REVOLUTIONIZES DIFFERENTIAL CONSTRUCTION – THE INNOVATIVE LIGHTWEIGHT DIFFERENTIAL CREATES SPACE FOR HYBRID MODULES AND IS THE KEY TO THE E-DIFFERENTIAL

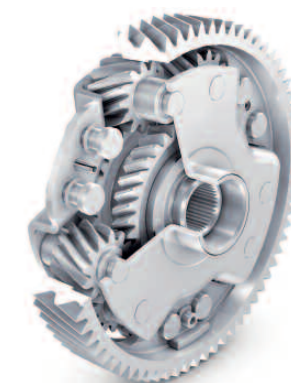
**M**ore compact, lighter, quieter, more efficient and with higher performance – These are the attributes of the new, innovative lightweight differential from Schaeffler's INA brand. This is made possible by a completely new differential design.

The architecture of this space-saving component is completely different from traditional differential designs. Instead of using conventional differential pinions, the lightweight differential has spur gears arranged as a planetary gear set in one plane, as used in automatic transmissions.



▲ Differentials of the traditional design with bevel gears require significantly more space.

This means that the required space and weight are significantly reduced and the potential torque capacity is noticeably increased. "The lightweight or spur gear differential has enormous advantages", explains Dr. Tomas Smetana, Head of Advance Development at the Transmission Business Unit, Schaeffler Automotive. "We save up to 30 percent weight compared with a classic bevel gear differential while creating up to 70 percent more axial space due to the streamlined design. In specific terms, this means a reduction in mass of up to three kilograms per differential and 90 millimetres of additional space in the transmission!"



▲ Schaeffler lightweight differential with the axial spline

In addition, the lightweight differential – beyond creating space for hybrid modules – is also a key element for the innovative eDifferential from Schaeffler. This component combines an electric drive with the option of controlling the drive power in each wheel individually. The active electric differential gives a significant improvement in load transmission when travelling on surfaces with varying friction values. It also supports the steering function. This facilitates torque vectoring (distribution of torque between the left and right wheel), which is beneficial for driving dynamics, safety and comfort.



Schaeffler lightweight differentials with the axial spline

If eDifferentials are used on both axles, this also enables the longitudinal distribution of drive torques. It is also possible to intervene in driving dynamics through selective power supply instead of through braking intervention and thus power reduction as is the case with ESP.

With the solution presented in the ACTIVE DRIVE concept vehicle, Schaeffler is showing the way ahead in electric vehicle drive systems. ■

## SCHAEFFLER MOTORSPORT QUARTETS APP LAUNCHED



**V**ehicles from the over 25-year motorsport history of the Schaeffler Group are pitted against each other in a new quartets app from Schaeffler. Players can "gamble" against digital opponents with horsepower, cubic capacity, number of cylinders and weight.

The 44 cards range from the Formula Ford flyweight, in which F1 heroes like Michael Schumacher started their careers in auto racing, to the massive pulling tractor with 3,000 HP. The player who most successfully wangles the cards out of his/her opponent through clever use of the technical data is the winner.

The Schaeffler Motorsport Quartets game is now available as an iPhone and iPod touch app for free downloading from the Apple Store.





## 'HELLO' AND 'GOODBYE' FROM THE ENGINEERING DEPARTMENT

THIS YEAR HAS BEEN A BUSY ONE FOR THE ENGINEERING DEPARTMENT IN SUTTON COLDFIELD. WE HAVE SAID GOODBYE TO THREE LONG SERVING EMPLOYEES AND WELCOMED THREE NEW FACES TO THE TEAM.



**Andrew Marshall** left the Company in February to pursue other interests and we wish him all the best for the future.

**Derek Peasley** retired in June after 26 years with Schaeffler. Derek worked at FAG Sales Europe, UK for years before moving to Sutton Coldfield in 2004 for Schaeffler UK. Two highlights of his career included creating the original bearing designs for the hub bearing for the London Eye, and the design specification for the bearings used in the LTA Wimbledon Centre Court retractable roof. He is looking forward to spending more time entertaining the local community with his Punch and Judy shows, and is currently putting the finishing touches to a spin off Medieval Show.

**Mike Evans**, who recently joined the Engineering Department as an Applications Engineer took over the mantle of "Oldest Apprentice" from Derek Peasley, continuing the longstanding in-house tradition.

**Wolfgang Schroeder** left Schaeffler UK in March to join the Industrial Aftermarket team in Herzogenrath, Germany. His career with Schaeffler in the UK spanned 8 years. His friends and colleagues joined him for an evening of ten pin bowling and a meal in a local restaurant to wish him a fond farewell, followed by a traditional "Full English" on the morning of his last day with the Company.



▲ Kate Hartigan presents Wolfgang with his leaving gift on behalf of the Company.



▲ A fond farewell from Marketing and Engineering colleagues  
▼ Closing your eyes won't help you Wolfgang!



### NEW KIT FOR PENGELLI UNDER 14s

Schaeffler UK is pleased to sponsor the Pengelli under 14 boys football team managed by **Derrick Lewis**, Technology Manager, Llanelli. The new kit must have inspired the boys as they won their first league game of the season 7-1.

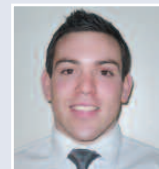


▲ Derrick Lewis pictured on the far left, next to Adrian Roberts, HR Director (2nd from left)



Welcome to 3 new engineers based in the Sutton Coldfield Engineering Department. **Birgitta Liesching** joined the Company as a Graduate Applications Engineer. **Dan Anderson** and **David Goves** both joined as Applications Engineers – MRO.

## NEW STARTERS SUTTON COLDFIELD



**James Pritchard** – Key Account Manager, Automotive Division

Having previously worked as a Technical Sales Executive for Alchemie Limited, James now assumes responsibility for Chassis, Transmissions and OES.



**Ed Harrison** – Regional Sales Engineer, Industrial Division

Ed is responsible for the North East of England, having previously worked for the Henkel Group as a Sales Engineer.



**Mike Addington** – Regional Sales Engineer, Industrial Division

Mike is based in Edinburgh and is responsible for the sales region of Scotland and Northern Ireland. He previously held the position of sales engineer at Precision Products Ltd in Chesterfield.



**Christopher Battey** – Regional Sales Engineer, Industrial Division

Christopher will be based in Derby and is responsible for the Midlands sales region. Chris joins us from Henkel Loctite Adhesives, where he held the position of Senior Sales Engineer.

## KEITH'S MEXICAN 'MOVEMBER'



Keith McGowan

Congratulations to **Keith McGowan**, Key Account Manager for the Automotive Division who raised over £265 for the Movember campaign to raise awareness of men's health problems. "It's not been easy!", says Keith. "I didn't like the look of it and it was very itchy, so much so that I couldn't wait to shave it off at the end of the month". Well done to Keith and another Sutton Coldfield colleague, **Richard Oldfield** who helped to raise over £400 for charity.



Richard Oldfield

## AUTOMOTIVE AWARENESS TRAINING SESSIONS ARE A SUCCESS

A SERIES OF TRAINING SESSIONS WAS ROLLED OUT TO ALL SUTTON COLDFIELD EMPLOYEES TO RAISE AWARENESS OF CURRENT ACTIVITIES AND FUTURE MARKET TRENDS WITHIN THE AUTOMOTIVE SECTOR.

**T**he sessions were held over two days and covered new product developments and application examples for the transmissions, engine systems and hybrid and electric vehicle sectors. Richard Hall, President Automotive, comments, "As a technology leader offering our Automotive customers an

extensive product portfolio for tomorrow's vehicles, it is important that all of our employees are kept up-to-date on the innovative components, modules and systems that we develop. All sessions also included an overview of the UK automotive industry and, following very positive feedback from staff in Sutton Coldfield, we plan to roll these out in Llanelli in the near future". ■



## SUTTON COLDFIELD LONG SERVICE AWARDS

SUTTON COLDFIELD LONG SERVICE AWARDS WERE PRESENTED AT THE ANNUAL PRESENTATION DINNER DANCE ON 30<sup>TH</sup> NOVEMBER AT THE MOOR HALL HOTEL.



▲ Left – right: **Terry Melloy** (40 years), **Roger Evans**, **Janet Hopkins** (15 years), **Chris Lait** (10 years), **Ann Sargent** (15 years), **Kate Hartigan**, **Kathy McCann** (10 years), **Richard Hall**, **Roy McDonald** (40 years), **Angela Powell** (15 years), **Adrian Roberts**, **Stewart Davies** (25 years), **Des Pattinson**.





# SCHAEFFLER

## Together we move the World...

Innovative technology partner for  
automotive, industrial and precision  
engineering applications

Increased energy efficiency, lower costs, strict low carbon objectives and improved operational safety are just some of the challenges presented to us by our customers. As a development partner, Schaeffler delivers the reliability, the quality and the innovation you need to move your world.

Our award-winning engineers excel at creative engineering that often involves an unconventional approach. We question established conventions, find unusual paths and dare to apply different perspectives to enable us to realise new and remarkable ideas.

Let us work together to realise your new and remarkable ideas. Together we move the world.

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