added competence

SCHAEFFLER

LuK INA FAG

A Customer Newsletter Issued by the Production Machinery Business Unit of Schaeffler Technologies AG & Co. KG

Issue 2012/2013

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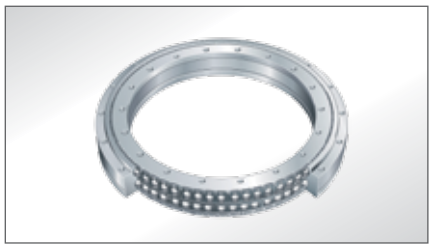
New standards in mechanical engineering



New INA high-speed rotary table bearing ZKXDF

Innovative rolling element – the "ball roller"

Dynamic and extremely precise machining centers that, thanks to their modular design, can be easily and economically converted to perform a variety of functions offer significant cost-saving options and time-to-market advantages for leading German machine tool manufacturers. As a rotary table bearings specialist, Schaeffler plays a significant role in determining the performance capacity of a crucial component in these machining centers. In the spirit of "added competence", close collaboration between machine tool makers and bearing manufacturers has recently made it possible to create 5-axis machining centers that are able to target the highest levels of performance for a given application, while still utilizing proven standard machine components. This enables them to strike the best-possible compromise between cutting-edge technology and cost-effectiveness. New standards for precision, rigidity and speed capacity have allowed this technical breakthrough to give the machine tool sector a valuable competitive edge in the international marketplace. The heart of any industrial high-performance machining system is the work spindle and rotary table system. Ensuring that these systems operate at peak levels invariably depends on the optimized performance of the drive units and bearings. By drawing on over 100 years of experience in machinetool bearings and by using YRTC and ZKXDF rotary table bearings with a minimum size of 580, it is now also possible to build larger 5-axis-machining centers with specific performance modules. In this particular case, the standard version was able to be equipped with direct-drive rotary tables that are based on bearing supports that utilize compact YRTC units. YRTC rotary table bearings are axial-radial cylindrical roller bearings that ensure maximum rigidity within the design space and enable high-precision milling, thanks to their uniformly low rotational resistance. For smaller machines, another option would be INA's YRTS high-speed rotary table bearings, which have been in use throughout the world for many years. For end customers who require special applications, such as high-precision workpiece turning and milling in a single chucking, it is now possible, on the basis of the standard machining center, to produce precise and highly rigid rotary axis bearings in a variety of sizes that can also operate at extremely high speeds. This is achievable, in part, because of the new ZKXDF rotary table bearing, which represents an expansion of the friction-optimized ZKLDF-series bearings from INA with high-speed capabilities.

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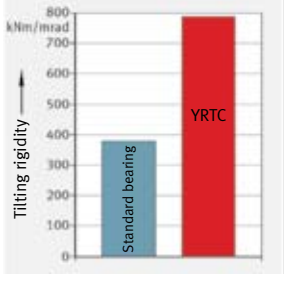
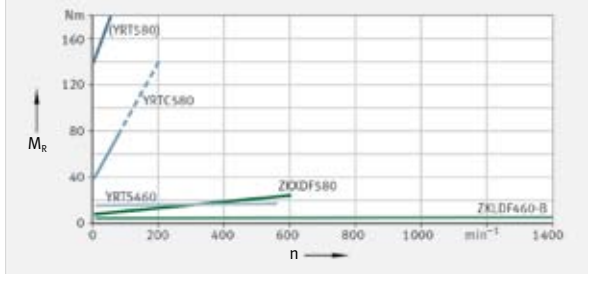


Higher tilting rigidity as shown in the example of YRTC580



Speed and frictional torque of rotary axis bearings
YRTC: Improved rigidity; ZKXDF: Improved speed capacity

Editorial

A Bearing ®evolution – added competence for Machine Tools

2012 will be remembered as a year steeped in competition – and not just because of the Olympic Games and the European Soccer Championship. On our own mutual "playing field" – the machine tool – we, too, have engaged in the occasional heated battle to stay ahead of the competition. Against this backdrop, reliable partners are more important than ever. As you look through this issue of our PM news, you may notice more than the usual number of customer-focused contributions and articles in which we provide an overview of some of the breakthroughs we have been able to make with you, as well as those that we deem to be of interest to the machine tool industry in general. Within this context, we believe that ®evolutionary progress does not only come about in spectacular major advances that can be immediately applied to volume production. Rather, it is the faithful and dependable raising of the bar by the pacesetters in our day-to-day business that pushes us on our shared paths. Of course, this does not rule out that truly great accomplishment, just as the high jumper must take a long, measured approach run to achieve a truly great Olympian leap. Indeed, looking beyond one's own disciplinary boundaries can often lead to product improvements. We invite you to take a closer look and join us in amazement at

- Our combined skills and expertise in turning and milling in one chucking using INA YRTC and ZKXDF rotary table bearings
- The new opportunities that are available by treating the surface as a design element
- The innovative bearing and relubrication solution used in an HP Indigo digital printing press
- Superior service for super-precision cylindrical roller bearings
- The earthquake-proof, state-of-the-art warehouse of our Japanese distributor Fukuda
- And much more, including linear solutions, direct drives

The bar has been set high in all areas of the machine tool industry, but with our combined expertise, good sportsmanship and ®evolutionary – even visionary – ideas on both sides, the solutions that we developed as partners will "clear the bar" on both the global as well as the local level.

We hope you will be able to pick up lots of useful ideas for your day-to-day work from our "added competence 2012/2013"!

Sincerely,

Helmut Bode
President, Production Machinery

Combined Expertise for Machining Centers

Continued from Page 1

One of the innovative features employed here are so-called ball rollers. These Schaeffler-developed novel rolling elements make it possible to have single-piece bearing rings without filling plugs. This not only enables a higher level of rigidity at maximum speeds, it also results in significantly improved machining accuracy. Yet despite these improvements, installation is as easy as ever, since the bearings allow direct flange mounting. The outside dimensions of YRTS/YRTC-series bearings are compatible with those of the new high-performance ZKLDF/ZKXDF-series bearings. Consequently, only one type of table housing is required for each diameter size. This provides significant cost advantages for the manufacturer, while end customers benefit from machines that are designed to perfectly match the particular application. And while both partners are able to enjoy substantial time savings, the entire machine tool sector is being presented with a new level of peak performance!

For Schaeffler Technologies this design represents the new standard in bearings for high-speed turning/milling applications. The ZXDF was presented for the first time at EMO 2011. For more detailed information, please refer to our brochure "High Performance Rotary Axis Bearings for Combined Milling and Turning" (SSD 24), available for download at www.schaeffler.com, Media Library.

Prestigious Quality Award for Schaeffler

2011 DMG Deckel-Maho-Gildemeister Supplier of the Year award

Timo Rickerman, Head of Central Purchasing, Gildemeister AG, praised Schaeffler's outstanding track record at the 2011 DMG Supplier award of the year with following words.

"In the quality category, we are rewarding a supplier with whom we have enjoyed a close and intensive partnership that goes back decades. Zero-defects in all processes and products is not only a company statement, but the result of a continuous quality policy that has been successfully implemented at DMG."

DMG and Schaeffler enjoy an enduring relationship characterized by a level of mutual trust that allows each partner to use the other's know-how and products in their own manufacturing processes and development projects. The entire line of Schaeffler rotary table bearings as well as super precision spindle bearings, ball screw support bearings and various linear technology components are integral parts of Deckel-Maho-Gildemeister's machine tools. This impressive collaboration confirms that such win-win partnerships between leading companies in the bearing and machining segments become quality drivers for the entire industry. This outstanding example of "added competence" between these two global players holds great promise for future opportunities.

from left.: Timo Rickermann, Head of Central Purchasing, Günther Bachmann, Executive Board Technology and Production, both Gildemeister AG; Helmut Bode, Head of Production Machinery, Schaeffler Technologies AG & Co. KG

2011 DMG Supplier of the Year award

Helmut Bode, Head of Production Machinery, accepted the prestigious award on February 7, 2012 at the Gildemeister Supplier Days in Pfronten, Germany.

Japanese Distribution Partner Fukuda Corp. Sets Benchmark in Warehousing

FUKUDA
Fukuda Corporation

President Ryozo Fukuda

State-of-the-art protection against earthquakes, humidity and temperature fluctuations for employees and high-quality products - here it is put into practice. Not a single bearing fell from the shelves during the terrible earthquake of March 2011, even though the entire building shifted by 10 cm! added competence took the opportunity to interview company President Ryozo Fukuda, our partner and friend for over 50 years:

Mr. Fukuda, what was the motivation behind your decision to proactively invest the quite remarkable amount of approximately 8 million euros in an impressive new warehouse back in 2007?

Our primary intentions were to secure our products in an acceptable environment and protect the products and our employees working in the warehouse against any potentially foreseeable problem. Our manufacturers devote a tremendous amount of time and energy producing products to the highest possible levels of precision. If these products are stored in an unacceptable environment, it will not be possible for them to deliver maximum performance. In a worst-case scenario, the products might deform or rust while in storage. This is especially true for the high-accuracy spindle bearings that we stock, which is why we have mandated the temperature and humidity specifications listed below. Consequently, temperature and humidity levels do not fluctuate; they remain constant. This ensures that all of our stock is fully protected, especially our sensitive spindle bearings.

Was your warehouse affected by this past year's terrible earthquake?

Our warehouse was not affected by the terrible earthquake of March 2011. Because Japan has suffered several big earthquakes in recent memory, including the 7.3-magnitude Great Hanshin Earthquake of 1995 as well as the 6.8-magnitude Niigataken Chuetu-oki earthquake of 2007, we felt it would be important to prepare for a large earthquake.

We expected a large earthquake to hit the Tokyo area. And indeed, there was a large earthquake – although it struck the Tohoku area with a 9.0-magnitude tremor. This seriously affected the Tokyo area. Despite the devastation, no products fell from the shelves of our warehouse as a result the 2011 earthquake. Also, no employee was injured or struck by debris because none of our shelves collapsed. The dampers in our warehouse absorbed the shock and, according to our data, they shifted the entire building 10 cm.

If you would be asked to share any recommendation from your rich experience with handling, storing and distributing bearings to the machine tool industry, what would it be?

The demands from the machine tool industry always fluctuate. Some sizes move slowly and some move very fast. Therefore, we need sufficient stock to meet our customer's fluctuating demands. This trend made us establish this warehouse to provide the ideal environment.

Fukuda distribution center in Chiba

Constant monitoring of temperature and humidity

Fukuda's impressive warehouse specifications:

Land space: 3,636 qm
Warehouse space: 5,737 qm
Foundation Stones:
26 damping lamination rubbers;
9 elastic sliding bearings
Max. Sliding Distance:
60 cm (= the building can physically move 60 cm)
Air Conditioner: 24 hours/365 days
Temperature: 25 °C
Humidity: Below 50 %
First Floor:
Warehouse, Office, Inspection Room
Second Floor:
Warehouse, Inspection Room, Laboratory
Third Floor:
Conference Room, Dining Room

FAG spindle bearings DLR

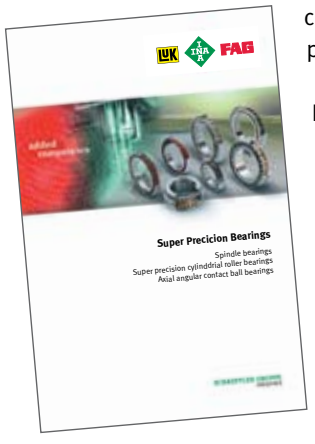
Earthquake-proof structure: Damping elements in the building's foundations

Mounting Our Super Precision Cylindrical Roller Bearings Just Got a Lot Easier:

Effective immediately, measurement reports are now included with delivery

FAG super precision cylindrical roller bearings

Super precision cylindrical roller bearings enable extremely precise radial shaft guidance. They are also ideal non-locating bearings, since they ensure unrestrained axial displacement. As a rule, the bearings are mounted so that they operate without clearance or with only slight preload. This results in a guidance system that is both extremely precise and highly rigid. Recommendations for adjusting the radial clearance during mounting are available in our SP1 "Super Precision Bearings" catalog on page 169.



In most cases, the bearings feature a tapered bore. This enables the clearance to be adjusted by sliding the bearing onto the shaft seat by a prescribed distance. Schaeffler offers its MGA31 and MGI21 enveloping circle gauges which can be used to precisely set the bearing clearance. The procedure for adjusting the radial clearance is described in detail in the SP1 catalog, starting on page 59. For large size bearings (D › 320 mm), however, there are no such enveloping circle gauges available. In these situations it is necessary to measure the radial clearance after premounting, after which the drive-up distance of the inner ring on the shaft has to be corrected accordingly. The mounting procedure will be much easier if both the outer ring's overlap inside the housing as well as the radial bearing clearance are known. Then the required drive-up distance can be calculated beforehand with sufficient accuracy by using known factors (see catalog SP1, page 61) so that the radial clearance only needs to be checked after mounting.

Available now: measurement reports for bearings with outside diameters › 320 mm

Going forward, all FAG super precision cylindrical roller bearings with a tapered or cylindrical bore and outside diameters greater than 320 mm will include standard measurement reports, regardless of accuracy specifications, radial clearance classes or rib arrangements. For double-row cylindrical roller bearings, beginning with NN3044 or NNU4952, this new standard has been in place since the second half of 2011. In January 2013, it will also become effective for single-row cylindrical roller bearings. (During the transitional period, some packaged bearings that are taken from existing stock may still be shipped without measuring reports.)

These reports include data pertaining to the actual dimensions for bore and outside diameter, external and internal enveloping circle diameters and raceway diameter. The radial clearance for the N-type bearings can be calculated from the difference between the actual outer ring raceway and the enveloping circle dimension. For NU-type bearings, this is calculated by taking the difference between the actual dimensions of the enveloping circle and the inner ring raceway. The bearing number along with the manufacturing date are listed on both the bearing and on the report; this ensures that the bearings match the measuring reports. The reports are provided in English and German.

This measurement data can provide significant time savings during mounting. Moreover, the measuring report is a vital contribution to ensuring reliable bearing adjustment and long bearing life.
With this information, mounting becomes especially easy for NU-type bearings with a separable inner ring, such as the double-row NNU49. After measuring the housing bore, the interference can be calculated by comparing it with the actual outside diameter dimension. Recommendations regarding housing fits for super precision cylindrical roller bearings are available on page 174 of the SP1 catalog. The overlap results in the contraction of the outer ring so that the enveloping circle becomes smaller. In most cases, this contraction can be estimated with sufficient reliability with 80 % of the overlap. The radial bearing clearance is reduced accordingly.

The necessary expansion of the inner ring can be calculated directly from the reduced radial clearance after mounting the outer ring in the housing. Using the actual dimensions of the inner ring's raceway that are provided in the measuring report, it is possible to derive the target value for the raceway diameter after mounting. At this point, the inner ring only has to be pushed up the tapered shaft until the desired raceway diameter has been achieved.

For N-type bearings with a separable outer ring, such as the double-row NN30, the contraction of the outer ring due to overlap in the housing and the resulting reduction in radial clearance can be calculated in the same way. However, the enveloping circle of the inner ring and rollers cannot be measured directly. Another option is to measure the rib diameter prior to mounting. Then the target value for the rib diameter after mounting will result from the expansion of the inner ring that is required to achieve the required radial clearance, which can be checked while the inner ring is being pushed up. Alternatively, the required drive-up distance of the inner ring can be determined using the factors listed on page 61 of the SP1 catalog.

Messprotokoll für Lagertype:
MEASURING REPORT FOR BEARING TYPE

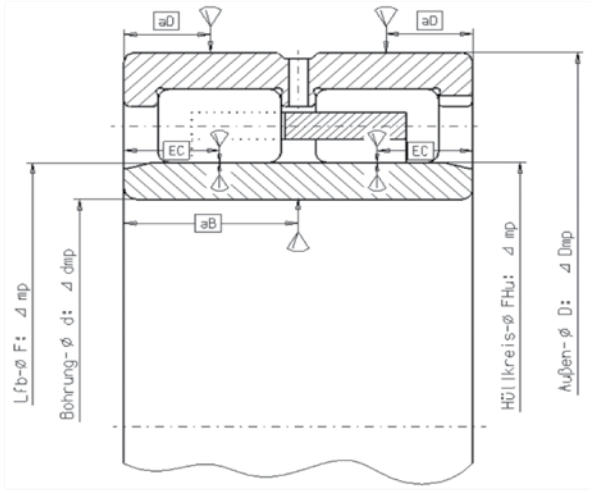
SCHAEFFLER

FAG **NNU4980-S-M-SP**

			lfd.Nr. CONT. NO.	
Maß DIMENSION	Mess-abstand MEAS. DIST.	Sollwerte NOMINAL VALUES		Abweichung vom Nennmaß DEVIATION OF NOM. SIZE
Ø d: Δdmp	aB = 70,0	400,0	0,000 - 0,023	
Ø D: ΔDmp a)	aD = 33,0	540,0	0,000 - 0,028	
Ø F: Δmp a)	EC = 38,0	446,0		
Ø FHu: Δmp a)	EC = 38,0	446,0		
Lagernummer BEARING NUMBER				
Fertigungswoche PRODUCTION WEEK				
Herstellungszeitpunkt (Jahresbuchstabe) TIME OF MANUFACTURE (YEAR CODE)				
Abteilung DEPARTMENT		Datum DATE	Unterschrift SIGNATURE	

Radial-Zylinderrollenlager mit Radialluft C1 (NA)
CYLINDRICAL ROLLER BEARING WITH RADIAL CLEARANCE C1 (NA)

Istwerte gemessen am Einzelteil;
ACTUAL VALUES MEASURED ON SINGLE PART;
a) Mittelwert aus zwei Messungen;
a) MEAN VALUE RESULTING FROM TWO MEASUREMENTS;



FAG **NNU4980-S-M-SP**

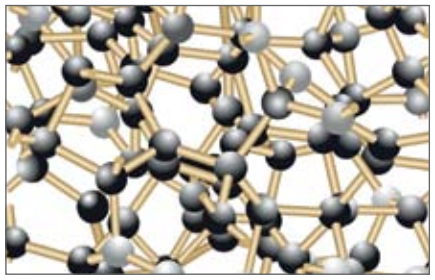
Example of a measurement report

Investing in Surfaces as Design Elements

“Surface Technology” Competence Center further expanded

Triondur® coated bucket tappet for automotive valve trains: reduces fuel consumption and emissions

Cylindrical roller bearing with Durotect® B coating: Lower wear and friction levels, for example in wind turbine gearboxes



Molecular structure of Triondur® coating

Triondur® coated barrel rollers in spherical roller bearings used, for example, in paper machine calenders and hydraulic motors

The Schaeffler Group has increased its capacities in R&D and the application of coating technology by investing in the expansion of its Surface Technology Competence Center at the Herzogenaurach headquarters. The new coating and R&D facilities offer more development capacity for customized solutions. At the same time, Schaeffler has also expanded its volume production capacities in order to be able to rapidly meet the rising demand for high-quality coated components. Opened in 2007, the Surface Technology Center has been extremely successful. By the end of 2011, sales of coated components had increased by over 50 percent and this tremendous demand is ongoing. Today Schaeffler offers a comprehensive range of coatings designed to optimize the surfaces of components and systems in accordance with customer requirements, used either individually or in different combinations. These coatings extend the operating life of components and offer protection against fretting corrosion, corrosion and the passage of electric current, for example. Moreover, they can minimize friction, slippage-related damage and wear.

Surfaces as design elements: A trend towards multifunctional and sensor coatings

“There is a noticeable trend towards multifunctional and sensor layers that are developed individually to match the specific needs of our customers”, says Dr.-Ing. Tim Hosenfeldt, Director of the Surface Technology Competence Center. This applies equally to relatively small batch sizes for industrial applications and to components produced by the millions for the automotive industry. Examples of the latter include, for instance, tappets with Triondur® coating developed for Nissan that ensure a significantly reduced friction in the valve train of car engines. Schaeffler has been supplying millions of these components annually for over ten years now. Back in 2005, the company received the Nissan Innovation Award in recognition of this component. After ten years of zero-defect delivery quality, Nissan granted its Quality Award to Schaeffler Japan this summer.

Higher performance and downsizing options

Triondur®, a coating system developed by Schaeffler, is produced with the help of state-ofthe-art vacuum technology, using the particularly environmental friendly PVD and plasmaaided CVD processes. Due to very high hardness values even with low coating thicknesses of approx. 2 µm, Triondur® offers excellent protection against wear combined with reduced friction. This makes it possible to optimize components and systems for a specific application without changing their dimensions or designs. They can therefore be used for downsizing purposes, which means that the components offer even better performance with unchanged dimensions. Alternatively, smaller and therefore more cost-effective versions can be used when loads remain unchanged.

In 2010 alone, Schaeffler supplied over 70 million parts with Triondur® coating. One specific type is Triondur® C. This carbon-based adamantine coating system offers an extremely high level of protection against abrasive and adhesive wear, while reducing friction to a minimum. Dry friction against steel is up to 80 percent lower. Even if only one friction surface is coated, the operating life of the entire tribological system is increased significantly. Due to its special coating structure, Triondur® C can withstand the high contact pressures that occur in rolling bearings. Typical applications include spherical roller bearings for paper machines and gearbox bearings used in wind turbines. Production machines too feature an increasing number of coated components. Among them are, in particular, track rollers used in the food and packaging sectors as well as in the printing and textile machinery industries.

Razor-Sharp Resolution That’s Also Maintenance-Free!

Digital press manufacturer HP Indigo relies on Schaeffler’s new Motion Guard LUB-X relubrication system

HP Indigo 10000 digital press

The renowned printing machine manufacturer introduced its all-new HP Indigo 10000 Digital Press at the DRUPA 2012 trade show in Düsseldorf, Germany.

Impressive in every sense of the word, this compact system can print virtually anything printable onto just about anything that can be printed on – in highest quality. Minimal maintenance costs and maximum equipment availability were two of the primary objectives during development, and Schaeffler Technologies was instrumental in ensuring that these goals were met. In addition to designing custom rolling bearings for the printing cylinders, Schaeffler engineers also focused on the lubrication of the printing cylinders’ drive gears.

These cylinders are the heart of the machine and play an extremely important role with regard to quality and reliability. Until now, this press had to undergo a complex, 8-minute relubrication procedure after 300,000 sheets.

Continued on Page 6

Continued from Page 5

This created eight long minutes of unproductive and costly downtime, during which nothing could be printed. Also adding to the comparatively high maintenance costs was that the machine required very expensive special lubricating grease – which then ended up being flung off the gearing under difficult operating conditions. With the new machine, HP wanted to offer its customers uninterrupted printing operations and lower maintenance costs. Schaeffler Industrial Aftermarket came up with just the right solution: an integrated system consisting of a newly developed automatic lubricator, a new type of adhesive oil with innovative additives and a lubrication pinion that was specifically adapted to the gearing. This innovative approach produced the necessary technical breakthrough that has since provided the HP Indigo 10000 digital printing press with some extremely compelling sales arguments:

- No more downtime due to relubrication,
- Substantial reduction in lubricating costs
- Increased operational reliability thanks to reliable lubrication of the gearing
- Greater productivity and increased print output for the end user.

HP Indigo is so impressed by this solution that it plans to use it in future digital printing presses as well.

Ultimately, this was a wonderful success story for all of the parties involved: HP Indigo was able to present a true innovation at the quadrennial DRUPA 2012 trade show, while for the Schaeffler Group, this partnership led to the development of a new, highly efficient series of lubrication devices that are available in various designs under the Motion Guard LUB-X product family designation. Finally, of course, the end user benefits from even better performance. An impressive result indeed: a razor-sharp snapshot of the benefits of an “added competence” business relationship.

FAG LUB-X lubricator

I-D-E-A-S System Solution from INA Linear Technology

High-precision handling of sheet metal parts for transformer cores

Handling extremely large sheets of electrical/transformer steel with repeatable accuracy and agility requires both rugged machines built to a massive scale as well as high-performance components.

Tuboly-Astronic AG supplies a relatively large system that is used for providing electricity to customers on a regional and national scale. The Dottikon, Switzerland-based company is considered one of the world’s leading suppliers of machinery and equipment for efficient manufacturing technology in the electrical industry. While the production of transformer-core sheets certainly incorporates standardized subassemblies and subsystems, at its core, each project represents a customer-specific solution with a correspondingly high proportion of specialized machinery. This is particularly evident in the machine being presented here, which is used to manufacture transformer-core sheets. The tool consists of a cut-to-length line as well as a handling and positioning system for stacking sheets of electrical steel. The sheets are fed from the coil into several workstations, where they are cut to length and mitered. A handling and stacking machine is then used to place the sheets in layers into the so-called e-stacking unit. This is done in such a precise manner that the trimmed edges of the sheets cannot be offset by more than 0.5 mm.

Inside the transformer sheet handling and positioning system from Tuboly-Astronic, AG, including a total of nine INA linear and tandem actuators

Transverse adjustment unit of the linear transport system for eccentric yoke sheets with one of two MKUSE-25 linear actuators from INA

Swivel arm drive and guidance system for yoke sheet I for rotating and positioning the yoke sheets by 90° from the longitudinal to the transverse direction using an MDKUSE-25 tandem actuator from INA

Extreme demands

Depending on the size of the transformer, the five sheets that make up a transformer-core sheet assembly are between 650 mm and 3,500 mm wide and, once cut into individual pieces, up to 6,000 mm long. With a sheet-thickness ranging from 0.2 mm to 0.35 mm, the cut parts can weigh as much as 50 kg. Because the relatively fragile sheet metal parts are subjected to highly dynamic conditions – reaching travel and positioning speeds of up to 3 m/s – they require numerous magnetic gripper systems that must be extremely stable and rigid. Consequently, the combined weight of the gripper systems and the sheet metal parts that are to be stacked can reach 500 kg – a factor that must be taken into consideration when constructing the handling system as well as when selecting and designing the drives, guidance systems and machine elements.

High-precision tandem linear actuators with an effective stroke of more than 10,000 mm

For the AF-1000-ET5500, a machine developed for the flexible fabrication of transformer-steel sheets in widths ranging from 80 mm to 1,000 mm, the handling system for positioning the layers must be designed to be able to precisely stack panels with a 5,500-mm yoke length and a side length of up to 4,000 mm. At the same time, however, the parts-handling process cannot impair the production and/or cutting process. Accomplishing all this requires extremely high-performance linear axes and guidance systems. Therefore, after specifying its requirements and analyzing the available solutions, Tuboly-Astronic AG decided on several standard-series MKUSE-25 linear actuators and MDKUSE-25 tandem linear actuators from INA. The MKUSE-25 linear actuators have an effective stroke of up to 7,600 mm, while the MDKUSE-25 tandem actuators were able to achieve an effective stroke of as much as 10,200 mm.

Depending on the design of the particular transformer core, the individual sheets have 90° cuts as well miter cuts in order to use as little material as possible and minimize scrap. Therefore, each sheet needs be handled separately and aligned precisely in the stacking position. This is achieved by swiveling or rotating and traversing in the X and Y directions. The sheet metal parts, especially those with miter cuts, must be positioned according to the “step lap principle”, which means that they have to be offset by several millimeters (max. 5 mm) from the sheet metal parts’ pre-programmed machining process in order to prevent any electromagnetic short-circuits. Consequently, it is not only imperative that each part be manufactured to the exact dimensions and oriented properly, but also that it ends up being precisely stacked. The space between the sheets must not exceed 0.5 mm.

I-D-E-A-S system solution:

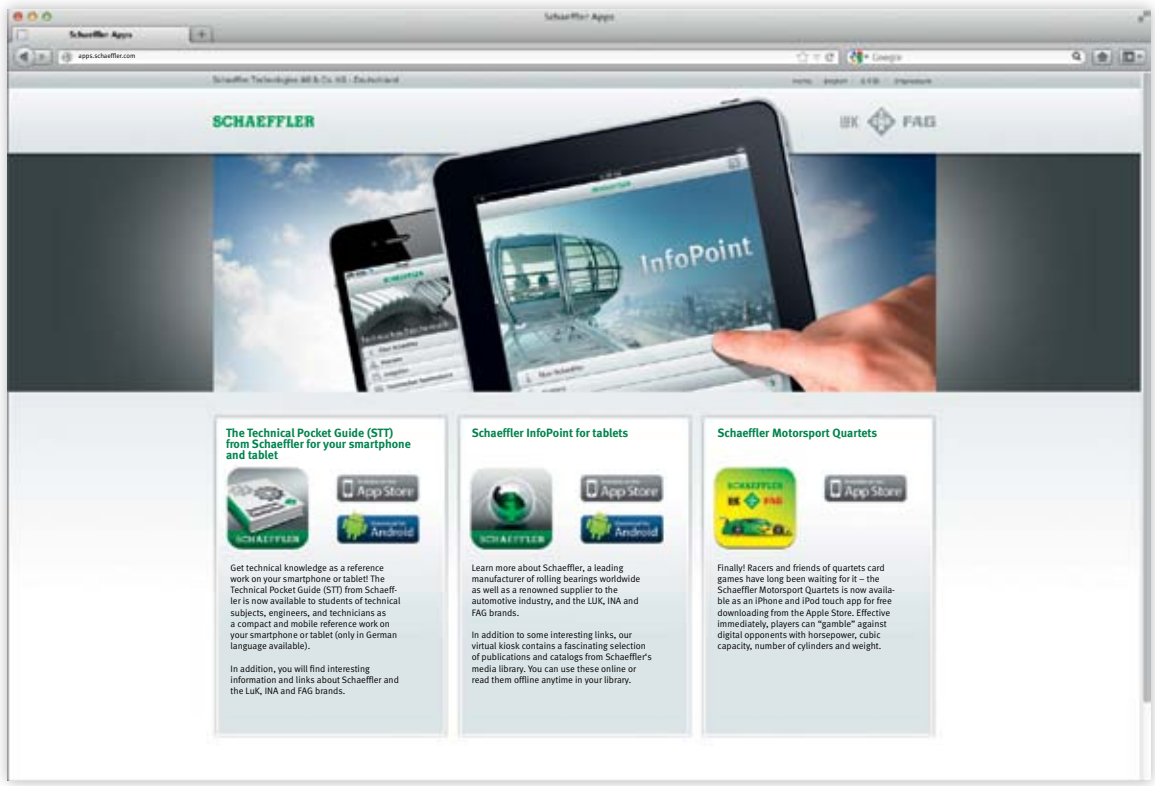
In order to meet the high standards for traversing speeds and dynamic characteristics as well as to ensure reliable handling of the mass moments of inertia that occur at very different loads, Tuboly-Astronic AG uses only selected products with a proven track record from experienced suppliers. The Swiss firm relies on INA Linear Technology – not only because of the high degree of mechanical stability and lasting precision while the machine is in service, but especially because the company also requires long-term technical support. The INA linear actuators are delivered as complete, ready-to-fit units. Absolutely no adjustments are required. I-D-E-A-S encompasses everything, from the customer’s specifications to project planning to implementation to the production and delivery of the products to after-sales service. In the case of the AF-1000-ET5500, INA Linear Technology supplied not only the products, but also the design calculation as well as a traversing diagram – all according to the customer’s specifications, of course. In addition, INA provided comprehensive handling instructions with regard to tribology and the associated maintenance and lubrication cycles.

Ingenious Solutions for Your Smartphone

www.schaeffler.com/apps

Schaeffler Apps offer a wide range of useful features, such as:

- ☑ Easy-to-read e-books
- ☑ Full-text search feature (PDFs)
- ☑ Table of contents with links to chapters
- ☑ Bookmark feature (onboard version)
- ☑ Zoom feature for graphics and technical drawings
- ☑ Swipe feature
- ☑ Thumbnail previews for quick searches
- ☑ Notepad (onboard version)
- ☑ Scientific calculator
- ☑ Screenshot capture with mail option (share with friends)
- ☑ Online search on the Internet
- ☑ Link to career opportunities at Schaeffler
- ☑ Function for contacting Schaeffler



Encyclopedia of Rolling Bearings

The Basics of Failure Analysis

Material Fatigue – Part 2: "Microspalling"

The second part of our series focuses on two mechanisms: surface-induced fatigue (also known as microspalling or gray staining) as well as wear and its indicators.

Material Fatigue – Part 2: "Microspalling"

Having previously discussed "rolling contact fatigue" (see the 2011/2012 issue of added competence), we will now turn our attention to surface-induced fatigue. Gearbox manufacturers are very concerned about microspalling, which they refer to as "gray staining", especially when it occurs on the gears.

This type of damage is caused by near-surface tensile stresses that are the result of sliding motions (slippage). These lead to damage patterns similar to those observed in classic rolling contact fatigue, although the resulting chips have a depth of only a few µm. Such chips are responsible for the dull gray appearance. This can only be remedied by reducing friction at the corresponding contact points, either by improving lubrication or by applying a suitable coating.

Microspalling (SEM image)

Wear – Part 1: "Abrasive Wear"

"Wear" is a much more common damage mechanism in rolling bearings. It can occur in two different characteristic forms: as abrasive and as adhesive wear (although the latter is not discussed here).

First up is the so-called "third-body wear", also referred to as "abrasive wear". This designation is derived from the theoretical minimal rolling contact between raceway and rolling element. Abrasive wear involves the presence of another, unwelcome guest: the third body, a foreign contaminating particle. Depending on the application, this can be manifested in the form of metal chips, dust and textile fibers. These particles, depending on their characteristics, are ground up during the rolling contact and are then introduced into the lubricant in the bearing. Over time, this becomes increasingly like an abrasive grinding paste, which causes the bearing material to wear. The steel particles that break off accelerate the wear process even more. If the resulting abrasive particles are very fine, then shiny, mirror-like areas will develop.

Under certain conditions, foreign particles can destroy the lubricant film that normally acts as a barrier, which leads to further abrasion.

Depending on the application and the bearing type, wear can adversely affect the bearing's operating life, since abrasion changes the once optimal contact geometry. This causes increases in pressure, especially on the ends of the rolling elements. As described in our first chapter on damage analysis, such an increase in pressure can lead to spalling (material fatigue) along with the corresponding damage patterns. In the final stage of deterioration, it then becomes virtually impossible to definitively identify the primary damage.

Wear involving high gloss finish as well as material fatigue as secondary damage in the area of the roller ends

For this reason, a bearing with a shorter service life is sometimes requested in order to determine the primary cause of damage. Abrasive wear can be detected at a very early stage, even before any significant dimensional changes set in.

WIN!!!

Win an iPad 3!

Contest:

What is the designation of the high-speed rotary table bearing that Schaeffler presented at EMO 2011 for the first time?

Please enter the correct answer on the coupon shown on the right. Complete the form and return it to:

Schaeffler Technologies AG & Co. KG
Production Machinery division
IEBSWE-SM
Georg-Schäfer-Strasse 30
D-97421 Schweinfurt

Fax: +49 (0) 9721 911 435
Closing date: September 30, 2013

There is no legal recourse. Employees of Schaeffler Technologies AG & Co. KG and trading partners are not permitted to take part.

Yes, I would like to take part in the prize drawing to win an iPad 3!

SOLUTION:

☐☐☐☐☐

Last name, first name: _____

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We would appreciate your responses to the following questions:
Did we get your address right? Please let us know of any changes we need to make. (Please print letters)

_____

Who else in your company should receive “added competence”?

_____

What improvements would you like to see in the Production Machinery business unit of Schaeffler Technologies AG & Co. KG?

_____

PREVIEW of Issue 2013

1. EMO Highlights 2013
2. Technical Conference, Issue 9

Congratulations to the Winner of Our Quiz in Issue 1/2011

Hansjürg Hurni, Product Manager at Step-Tech-AG in Luterbach, Switzerland, is the lucky winner of a Blu-ray player! Hansjürg was awarded his prize by Chris Reller, Hydrel GmbH, on June 29, 2012. (Hydrel GmbH is a wholly owned subsidiary of Schaeffler KG, Herzogenaurach.)

+++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER

You will find Schaeffler Industrial at **CIMT in Beijing** from April 22-27, 2013 and at **EMO in Hanover** from September 16-21, 2013.

CIMT

EMO Hannover

+++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER +++ NEWSTICKER

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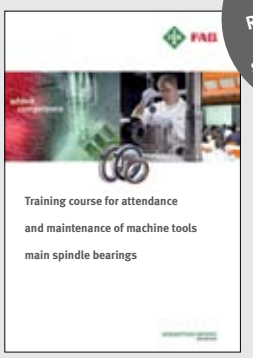
E-Mail: pmsales@schaeffler.com
www.schaeffler.com

LAST BUT NOT LEAST

The Schaeffler Group will once again be offering training sessions in Schweinfurt related to the maintenance and servicing of main spindle bearings. These all-day sessions are made up of theoretical and hands-on units. During the theoretical part, participants are taught basic knowledge of bearing types, performance characteristics, machining tolerances, lubrication and the monitoring of super precision rolling bearings. The hands-on unit includes mounting exercises, the handling of measuring equipment and the assessment of rolling bearing damage. All participants will receive detailed training documents. On-site training sessions for main spindle bearings can also be scheduled any time with machine tool and spindle manufacturers, repair centers and rolling bearing distributors. Your contact partner:
Karin Morgenroth
Tel.: +49 (0) 9522 71 503
E-mail: Schulungszentrum@schaeffler.com

The next spindle bearing training session will take place in Schweinfurt on:
Feb. 7, 2013
May 8, 2013
Sep. 26, 2013

Tip
Register quickly! These training sessions are much sought after!



About added competence

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