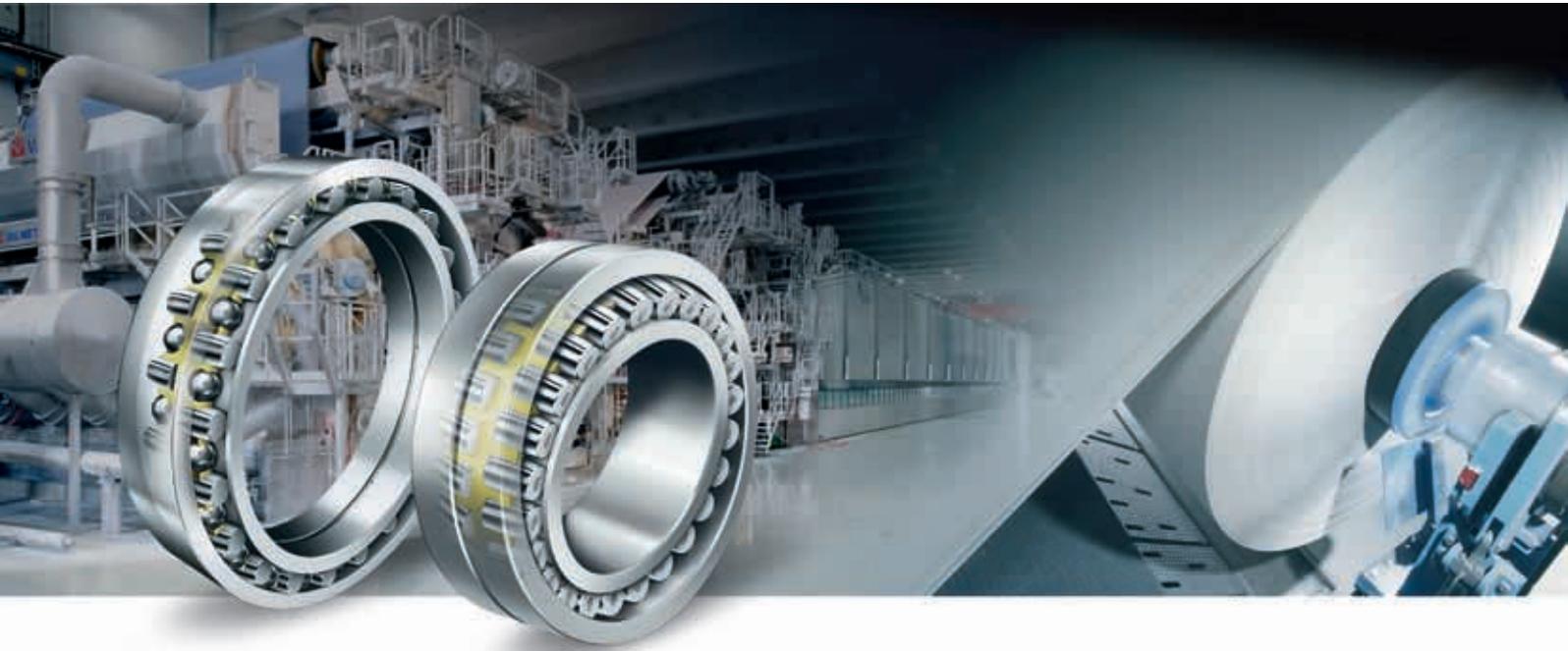




FAG



Optimal Paper Production Full-Service Bearing Technology

SCHAEFFLER GROUP
INDUSTRIAL

Expertise Through Knowledge and Experience

FAG Kugelfischer is the pioneer in the rolling bearing industry. In 1883, Friedrich Fischer designed a ball grinding machine. This idea is regarded as the historic beginning of the rolling bearing industry. INA's success story began in 1949 with the development of the needle roller and cage assembly by Dr. Georg Schaeffler, an ingenious idea that helped the needle roller bearing achieve an industrial breakthrough. With its strong brands, INA and FAG, Schaeffler Group Industrial not only has a high-performance portfolio of rolling bearings, but also products and services of unsurpassed quality due to the joint research and development activities of both brands.

For applications in "Heavy Industries", INA and FAG have consolidated their bearing technology and services for customers in the paper and cellulose industries in the "Pulp & Paper" segment. As a result of their cooperation over many decades with reputable paper machine manufacturers as well as with maintenance and production departments, the Pulp & Paper segment has gained a great deal of expertise. Many paper mills worldwide have benefited from the quality of customized solutions, through which we achieve ever increasing production speeds.

Pulp & Paper has more to offer

- Expert support by experienced engineers
- Services for all rolling bearing products and applications
- Efficient product support and development
- Higher cost-effectiveness and operational reliability with X-life
- Optimized bearing, material and seal combinations
- Specially designed products for various operating conditions
- General and customer-specific training programs
- Compulsory quality and environmental policies worldwide (ISO 9000/QS 9000, ISO/TS 16949:2002, ISO 14001)
- BEARINX® calculation software for the best possible product selection
- Comprehensive product range of peripheral equipment for paper machines and for auxiliary equipment



Complete Solutions and Service from One Source



- Coatings that offer corrosion protection (Corrotect®) or for improving the wear and friction behavior (e.g. Triondur®)



- Spherical roller bearing E1 with superior load-carrying capacity, low operating temperature and very long operating life
- Split spherical roller bearings for quick bearing replacement in hard-to-reach locations



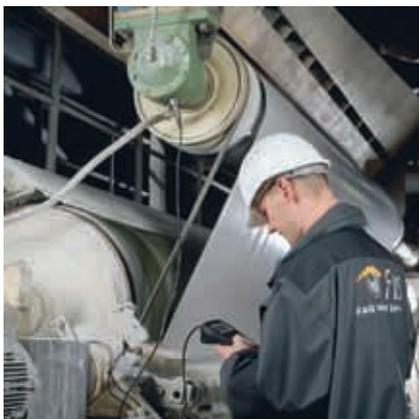
- Self-aligning or conventional cylindrical roller bearings for easy expansion compensation
- Hybrid deep groove ball bearings (steel/ceramic) with very long operating life for spreader rolls



- Triple ring bearings with very high load carrying capacity
- Bearing housings with improved seal system and new type of locknut



- Maintenance-free spherical plain bearings with ELGOGLIDE® sliding layer for anti-deflection rolls
- Roller and ball type profiled rail units for tensioning rolls and training rolls

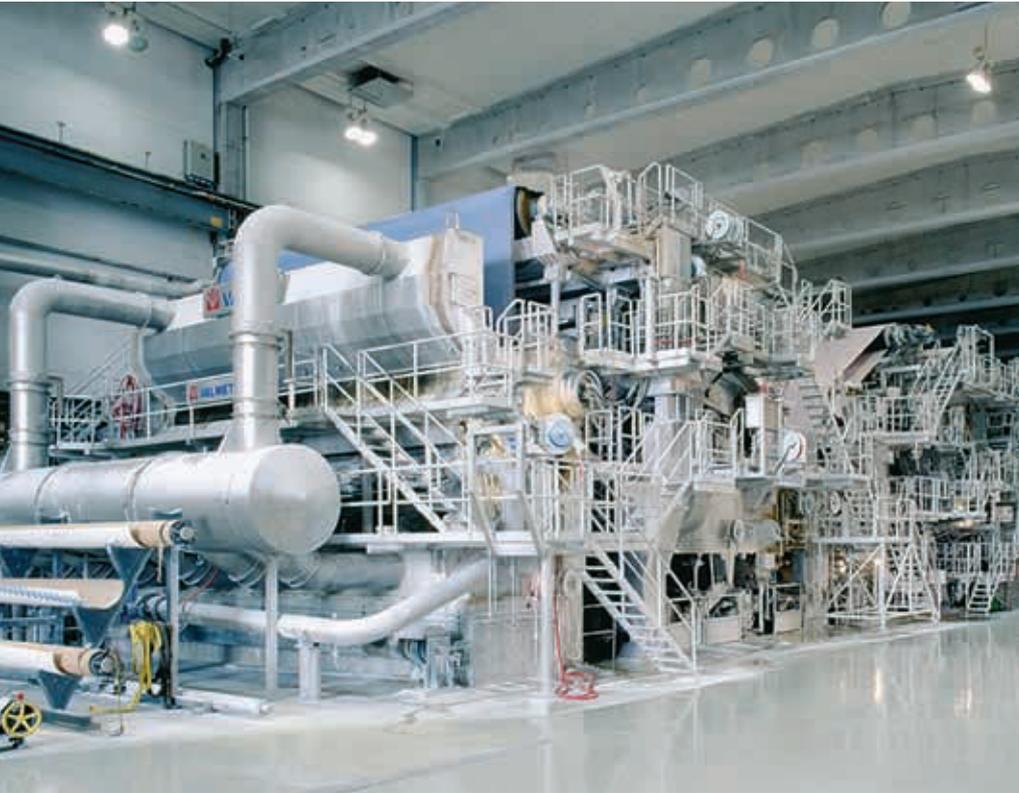


- Product and service training
- Condition-based maintenance
- Monitoring and remote diagnosis
- Spare parts management
- Maintenance contracts, all inclusive or individualized

- ASSR bearing (Anti Slippage Spherical Rolling Bearing) for preventing slippage in CD-profile control rolls



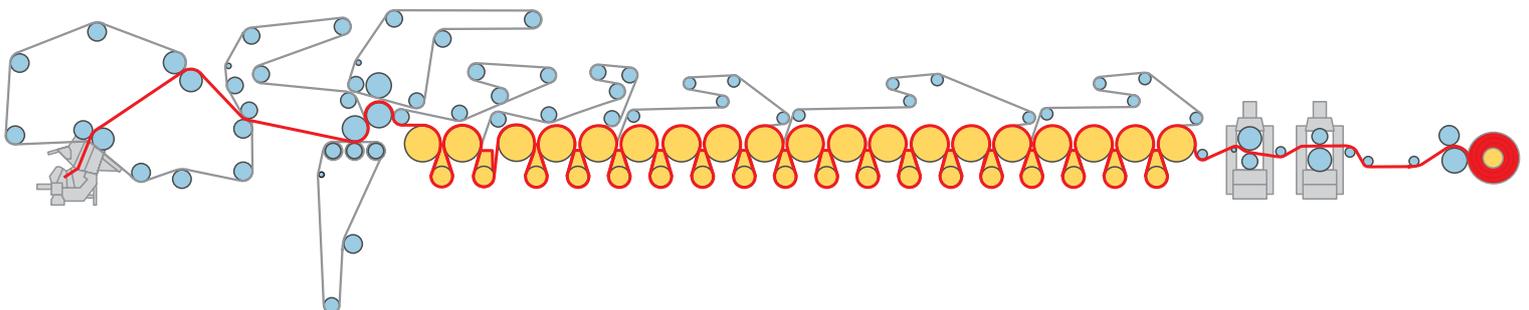
Designed Specifically for Smooth Pulp and Paper Production



Paper lines must operate without failures and problems, ideally round the clock, 365 days a year. Depending on the machine used, paper sections that are 2,000 meters long and over 10 meters wide are produced from cellulose or wastepaper within minutes.

This is extremely tough on cylinders, rolls and, of course, rolling bearings. They must work smoothly together and harmonize with each other. INA and FAG rolling bearings in paper machines are characterized by excellent design and top quality. In spite of ever increasing

speeds, extreme moisture and high operating temperatures, extending the service life has top priority. Only rolling bearings that can continuously withstand shaft deflections, moisture and high temperatures ensure long-term smooth operation.





static load ratings, based on improved roller quality and optimized roller geometry. Significantly longer bearing service life is achieved for the same operating conditions. On the other hand, the previous operating life is achieved even with considerably increased loads. In new designs, smaller bearings reach the performance of larger bearings with the previous design. Reducing size helps achieve more cost-efficient bearing arrangements (smaller design envelope, less friction, less lubricant required, higher speeds).

Lower operating costs are the result of improved bearing kinematics and better roller quality which keep friction and bearing temperatures at low levels. For this reason, there is also less strain on the lubricant.

Spherical roller bearings

These bearings play a dominant role in paper machines. The “Pulp & Paper” segment provides an appropriately large product range and excellent options. Typical variants include bearings with cylindrical or tapered bores, with increased radial clearance and running accuracy, with case-hardened inner rings, with lubrication holes in the inner rings or with split design for timesaving installation in hard-to-reach locations.

Improved performance, X-life quality spherical roller bearings E1

Up to 70 % longer basic rating life results from a 17 % increase in dynamic load ratings. The increased static load safety for these bearings is the result of increased

Quality has a name: X-life

X-life stands for premium products made by INA and FAG, that is products with an optimal operating life that goes far beyond previous known parameters. All of the factors necessary for smooth operation and for making investment decisions easier were considered and put into practice:

- Optimized product characteristics, low-noise and easy-maintenance solutions with high load-carrying capacity meet and often exceed previous requirements
- Improved price-performance ratio, faster payback through reduced downtimes and increased productivity
- Training programs, the basic requirement for error-free mounting and dismantling as well as for meeting correct maintenance intervals and for selecting and using the appropriate lubricant.



Higher Operational Reliability Through Innovative Solutions



Increasingly complex bearing requirements make it necessary to blaze new trails. Through continuous product support and development, Schaeffler Group Industrial is able to meet new challenges by offering functionally reliable and efficient solutions.

Hybrid deep groove ball bearings

Hybrid ball bearings with steel rings and ceramic balls have proven effective for spreader rolls with high speeds. To reduce the amount of rotating masses (ball and cage assembly), only half the number of balls are installed. The risk of slip decreases as a result of the higher load on each ceramic ball. Compared to the conventional steel-steel design, the operating life is two to three times longer.



Self-aligning cylindrical roller bearings

When drying cylinders are heated, the long cylinders expand lengthwise significantly. In addition, misalignment occurs between the two bearing positions.

The solution:

Self-aligning cylindrical roller bearings. They are most often used in the dry end and frequently replace the previous solution that involved rocker block housings. These housings can still be used, while length changes are easily compensated in the bearing. The spherical sliding surface of a self-aligning plain bearing ring compensates potential deflections or alignment inaccuracies of the cylinder journals.



ASSR bearings

Varying load phases occur in the CD-profile control rolls of calenders in paper machines. During production, the gap between the rolls is closed, which means a certain pressure is created between the two rolls. Both the nip load and the weight of the roll shell are supported by hydrostatic control elements. This means that only very low loads act on the rolling bearings and there is a risk of slippage, which can lead to premature bearing failure.

The solution: ASSR bearings

In cooperation with a customer, the Schaeffler Group developed an innovative bearing concept for preventing slippage – the ASSR bearing (Anti Slippage Spherical Rolling Bearing).

Our customers benefit from a long bearing life and reduced maintenance expenditures. While standard bearings reach an operating life of about one year because of smearing marks on the raceway surfaces caused by slippage, the expected operating life of the ASSR bearing, having eliminated slippage damage, is at least ten years.

This means longer rolling bearing operating life, lower maintenance requirements and therefore higher potential for saving costs.



This “spherical rolling bearing” consists primarily of the rings of a standard spherical roller bearing. In each of the two rows of rolling elements, barrel rollers alternate

with balls. In the low-load phase, the balls ensure slippage-free operation.

The barrel rollers support the loads in the high-load phase.





Rolling bearing coatings

Coatings are applied on rolling bearings or components to improve the run-in behavior and dry-running characteristics or to optimize wear and friction behavior. Bearings subject to high loads and stresses in paper machines are coated with a tungsten carbide/carbon layer (Triondur®). This layer is characterized by high hardness and a low friction coefficient. Wear resistance increases, and as a result of the low friction coefficient, adhesive wear in particular is minimized. This offers significant benefits for mixed friction or problems resulting from slip stress.

If particularly effective corrosion protection is a priority, Corrotect® electroplated cathodic rust protection is used. On heavily loaded bearings, PTFE coatings on the external circumference of the outer ring ensure good sliding behavior



with a very low friction coefficient. This means that bearings coated with this material can be used effectively as non-locating bearings, thereby minimizing the axial displacement forces caused by friction.

Bearing housings

Together with FAG bearings, our housings form extremely reliable functional units. The dimensions correspond to current shaft diameters and bearing sizes of the 31.. series for drying cylinders in paper machines.

Manufacturers are constantly striving to provide even longer availability for new paper machines with higher speeds and increased efficiency. Since the quality of raw materials is often poor, the dryer fabric must always be kept clean. This also increases requirements for the housing seal design. Reliable seal oper-

ation has a positive effect on the bearing operating life. FAG's newly designed housing seal meets these challenging requirements. This has been verified in numerous test runs under harsh conditions with extreme impacts of water.

Triple ring bearings

Triple ring bearings are ideal for the high-performance roll on the drive side of conventional anti-deflection rolls. The rotating center ring is guided by the specially designed barrel or cylindrical rollers on both sides. The selection and combination of these rollers are based on the specific requirements. Brass cages are designed in a way that enables them to support the rolling elements securely and ensure optimum oil supply.



Expert Consultation and the Right Software for Your Application



Expert technical consultation

The “Pulp & Paper” segment of the Schaeffler “Heavy Industries” Branch Management offers technical consultation for all aspects of the life cycle of rotating components as part of the TCO (Total Cost of Ownership). Our experts possess outstanding knowledge of bearing technology as well as comprehensive know-how of paper and pulp industry applications. Customers can expect expert consultation and support with bearing design and product selection.

BEARINX®

BEARINX® can be used to perform detailed analyses on rolling bearings including individual rolling contacts in order to calculate their suitability for each application. Rolling bearing loads in complex machine systems can be calculated, displayed and documented, while taking a large number of ambient conditions into account. The same applies for natural

frequencies, natural vibration forms, critical speeds and out-of-balance responses for shaft systems.

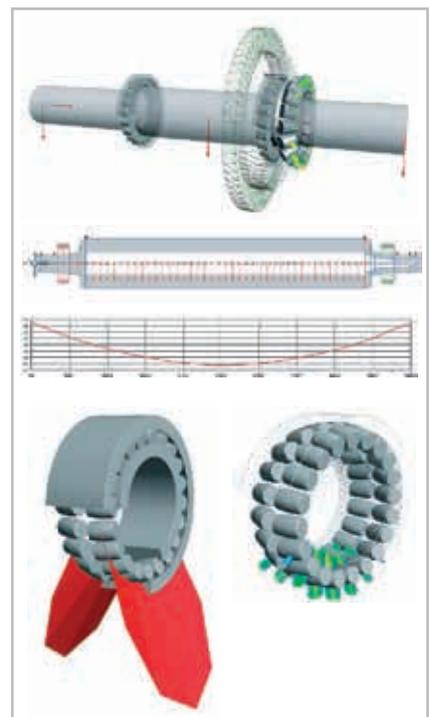
medias® professional

Our electronic support and selection system *medias® professional* provides information on more than 40 000 standard products for approximately 60 industrial sectors. For INA and FAG bearings, *medias® professional* enables you to calculate the modified rating life according to DIN/ISO 281. In addition, a comprehensive database simplifies the selection of appropriate lubricants. With just a few mouse clicks, you can access Schaeffler Group Industrial’s entire range of products and services.

Request a CD-ROM or go to the online version at <http://medias.ina.com>. In addition, you can also access *medias® campus* and *medias® interchange* on the Internet.

Our online training courses at *medias® campus* provide you with the rolling

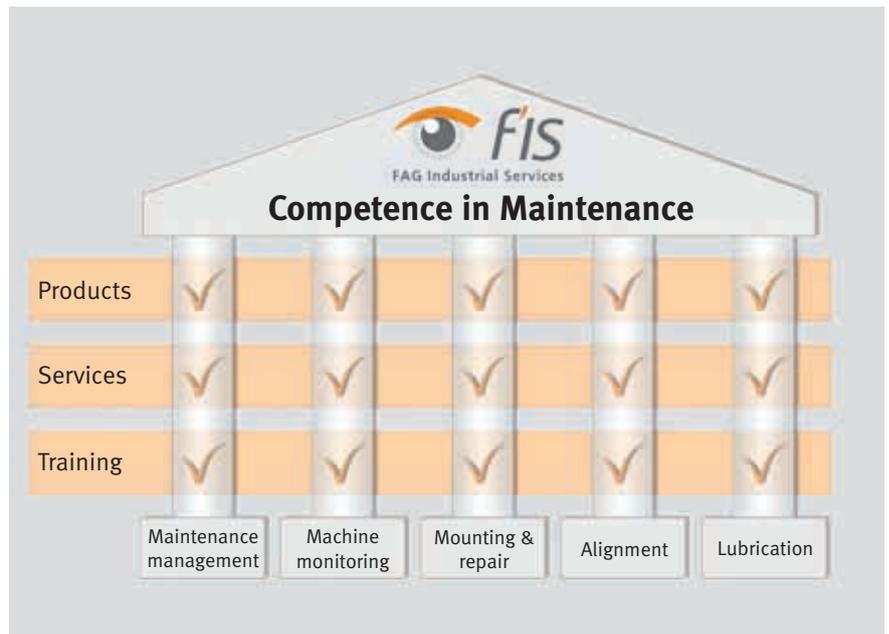
bearing know-how you require in short learning units. *medias® interchange* enables you to find the correct INA and FAG bearings using the designations of other manufacturers.

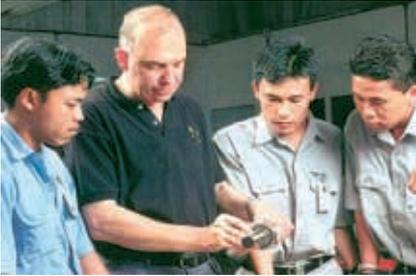


Services Relating to Rolling Bearings

Capital-intensive paper lines require permanent availability, which can be achieved through top quality equipment and an intelligent lifecycle service that leaves nothing to chance. This requires reliable products and services for the mounting, lubrication, alignment and condition monitoring of rolling bearings used in pulp and paper applications worldwide.

INA and FAG meet this challenge with the help of their independent service company, FAG Industrial Services GmbH (FIS).





FIS defines itself as an independent full service provider for maintenance and quality control with services ranging from mounting through plant monitoring to introduction and implementation of preventative maintenance measures. For instance, the reconditioning of rolling bearings another service offered by FIS, enables short delivery times, contributing significantly to ensuring permanent availability.

A wide range of mounting and alignment tools, measurement devices and lubricants

as well as training facilitates maintenance work and helps create efficient work processes. Thanks to many years of experience and highly qualified experts, FIS is the professional partner for customer-focused solutions relating to the life cycle of rolling bearings.

Fast and flexible

Special monitoring systems for the paper industry detect machine defects at a very early stage. This means unplanned down-times can be prevented and bearing replacements can be scheduled in advance.

FIS experts support paper production processes worldwide using state-of-the-art technology, including remote diagnosis via Internet or GSM. Whenever required, highly-qualified technicians and engineers provide assistance on site. Individualized service agreements, based on customer and machine requirements, ensure the highest possible machine availability.

FIS would be glad to assist you.

www.fis-services.com
info@fis-services.com

Success Through Collective Competence



Fulfilling requirements quickly and efficiently as well as optimizing processes is an important challenge for us. With innovative products and solutions relating to rolling bearings as well as a global network of manufacturing and technical services, we support companies in becoming even more successful. The Smart Performance Program was created to fulfill this demanding task. As part of this concept, we support our customers worldwide with our Field Service Engineers (FSE). These engineers are highly-qualified experts with excellent market sector knowledge.

FSEs have a comprehensive level of rolling bearing know-how, extensive knowledge of processes as well as expertise in condition monitoring and the maintenance of plants and machinery. Thus they assist the customer in increasing production efficiency and generating competitive advantages. Since the FSEs work with all

areas of the Schaeffler Group, customers benefit from the broad knowledge of a global company – without the need to change contact persons.

- Access to a wide range of products and services relating to rolling bearings
- Despite the wide variety – everything from a single source
- Cost Reductions (TCO – Total Cost of Ownership) due to an overall approach to machinery and components for the entire life cycle
- Increased plant availability with reduced maintenance costs
- Prevention of unplanned downtimes by means of proactive maintenance
- Support with purchasing spare parts
- Optimized delivery times due to stock management of sector-specific special bearings

Services for the paper industry

- Cost savings by installing FAG X-life spherical roller bearings which have extremely long operating life
- New bearing arrangement concepts for drying cylinders
- Increased machine availability through permanent condition monitoring of paper machines
- Identification of vibration problems in gearboxes and motors by using modal analysis

More information about the Smart Performance Program is available on the homepage

www.smartperformanceprogram.com



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