



Bearing Technology for Compressors, Fans and Centrifuges

Expertise through knowledge and experience

FAG Kugelfischer is a pioneer in the rolling bearing industry. In 1883, Friedrich Fischer designed a ball mill that allowed machines to be used for the first time to produce steel balls with high precision and in large volumes. Historically, this idea is regarded as the beginning of the rolling bearing industry. Today, FAG is a member of the Schaeffler Group. FAG's range of products and services complements INA's in an ideal way. Not only do both companies have

high-quality rolling bearings, they also supply products of unrivaled quality as a result of joint research and development activities.

For applications in the heavy industries sector, INA and FAG have consolidated their comprehensive air handling product lines for compressors, fans and centrifuges. Bearings and components for these demanding applications have to meet stringent requirements regarding functional reliability and efficiency.

The air handling group meets these requirements by providing individual, customer-specific developments and sophisticated standard bearings.

Air Handling – Your quality partner for compressors, fans and centrifuges

- Expert support
- Complete bearing product range
- Customized bearing systems and tighter tolerances
- Extended service life
- More efficiency and operational reliability through X-life
- Optimized bearing, seal and material combinations
- Binding worldwide quality and environmental protection policy (ISO 9000/QS 9000, ISO/TS 16949:2002, ISO 14001)
- BEARINX® calculation program for best possible product selection
- Good availability
- Services for all rolling bearing products and applications



Spherical roller bearing

Product range



• Deep groove ball bearings



• Angular contact ball bearings



• Four point contact ball bearing



• Cylindrical roller bearings



• Tapered roller bearings



• Self-aligning ball bearings



• Needle roller bearings



• Thrust spherical roller bearings



• Inner rings



• Radial insert ball bearings

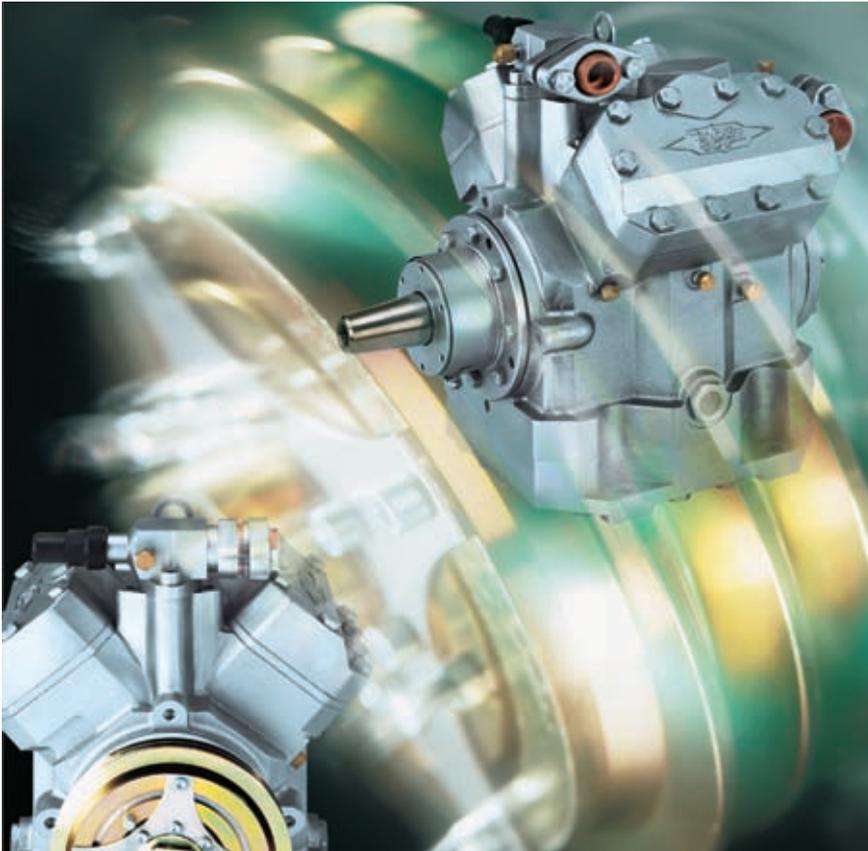


• Bearing housings



• Fineblanked parts

Condensation and cooling



Photograph courtesy of Bitzer, Sindelfingen

Compressors are used in nearly all industrial sectors: in manufacturing companies, in environmental protection, in building and air conditioning technology, on ships and in medical applications. They serve an important function, condensing and transporting air, gases or air/gas mixtures continuously and efficiently.

To increase the efficiency in rotary compressors it is necessary to have a very small gap between the rotors and the housing. Therefore a tight guide clearance is required for the rolling bearings. Condensation is often performed at very

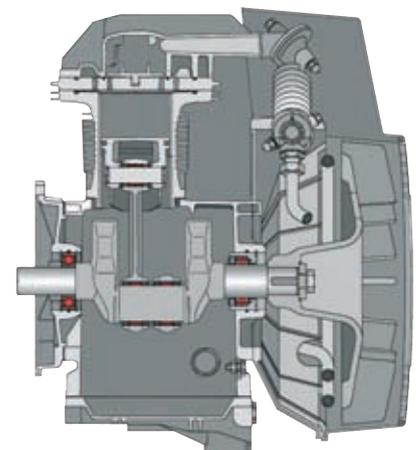
high speeds, therefore the bearing speed suitability has to be increased. These requirements are primarily met by four point contact ball bearings, cylindrical roller bearings, angular contact ball bearings and needle roller bearings.

The Schaeffler Group's Industrial division develops and manufactures rolling bearings and components for

- Screw compressors
- Piston compressors
- Root blowers
- Vacuum pumps

Benefits

- High degree of operational reliability due to durable, efficient standard bearings and/or modified bearing solutions developed in cooperation with our customers
- All bearing variations from a single source
- Optimal design using BEARINX[®] calculation software
- Easy to handle and install thanks to customized bearing units with defined axial clearance
- Higher compressor efficiency due to precise guidance of rotors
- Very high speeds are manageable as a result of new developments in bearing and lubrication technology
- Proven and tested bearing cages, including cages made from materials for aggressive pumped media

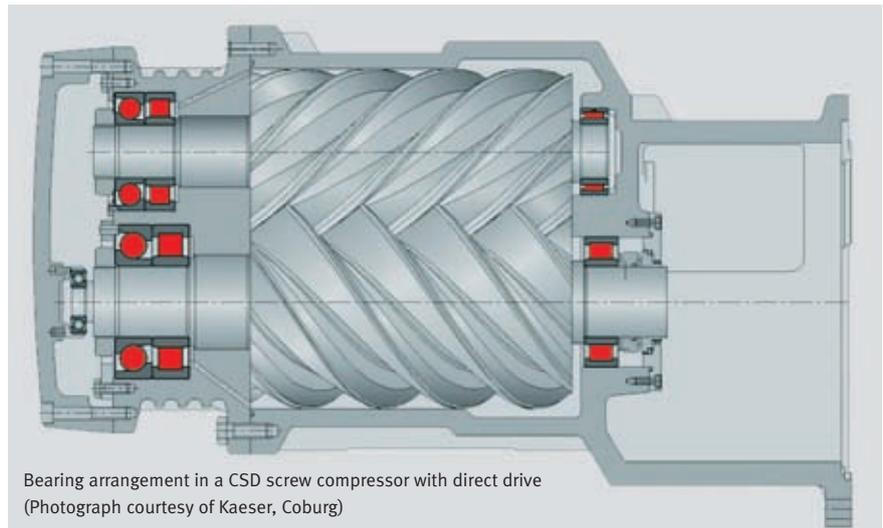


Piston compressor with deep groove ball bearing, cylindrical roller bearing and needle roller bearing

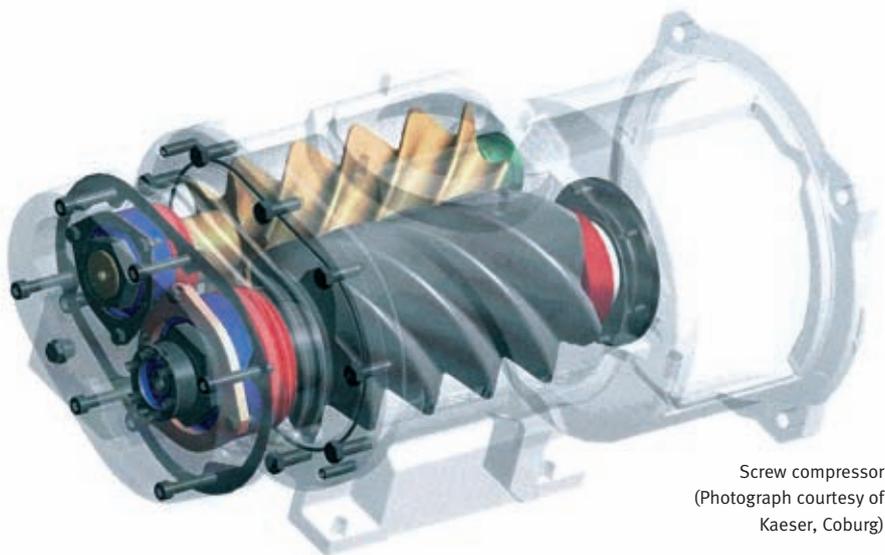
Example: Screw compressor

The screw compressor pumps and condenses air through two rotors running in opposite directions. The smaller the gap between the rotors and the housing, the higher the degree of efficiency. This is why bearing manufacturers are expected to dimension radial and axial clearances as small as possible. Generally bearings must provide reliable support for the axial and radial forces resulting from pressure buildup.

The example shown here includes three FAG cylindrical roller bearings, one INA needle roller bearing and three FAG angular contact ball bearings. The axial load present on one side is supported by the large angular contact ball bearings. On the main rotor, axial counterforces may be generated by the coupling on start and switchoff. These counterforces are supported by an additional, small angular contact ball bearing that is spring preloaded to prevent slippage.



Bearing arrangement in a CSD screw compressor with direct drive
(Photograph courtesy of Kaeser, Coburg)



Screw compressor
(Photograph courtesy of Kaeser, Coburg)



Four point contact ball bearing



Inner ring with ceramic coated seal surface

Circulation and ventilation

Fans, also called ventilators or blowers depending on their function, are used in nearly all industrial sectors. Depending on the direction of the stream of air or gas, a distinction is made between radial and axial fans. One of their features is that they improve the climate in a room and ventilate shop floors, tunnels and mines. They accelerate combustion, extract exhaust fumes or start process engineering facilities and use gas mass flow to keep them in operation.

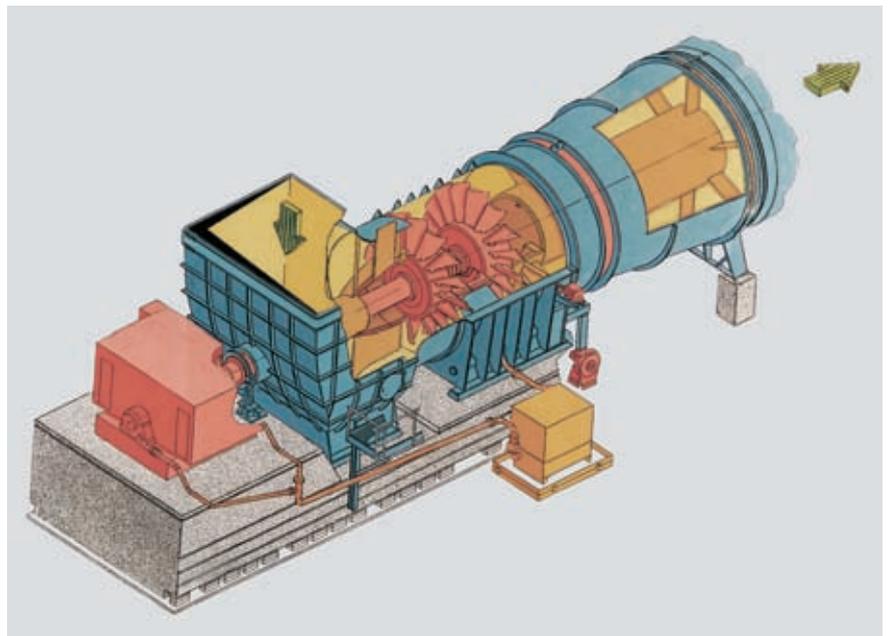
Safety with the right bearing

Fans require quiet rolling bearings having a long life and offering easy maintenance due to their continuous operation.

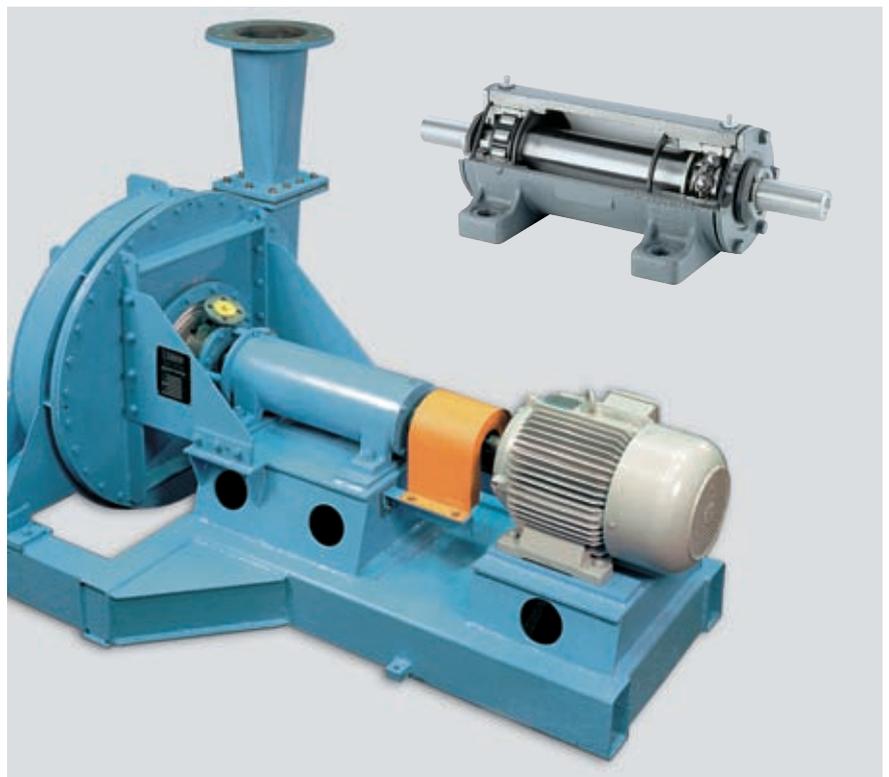
Pumped media such as hot gas or coal dust must be taken into consideration in advance.

Our wide range of bearing designs and housings makes planning easier and ensures operation. Small fans with higher speeds are usually equipped with deep groove ball bearings and angular contact ball bearings as well as cylindrical roller bearings in two-bearing housings (VR, VO) or radial insert ball bearing units.

In large ventilators and blowers, proven products include spherical roller bearings and self-aligning ball bearings, and in pillow block housings, SNV, LOE or LOU. Operating conditions determine whether grease or oil lubrication is used.



Axial fan (Photograph courtesy of TLT-Turbo, Zweibruecken)



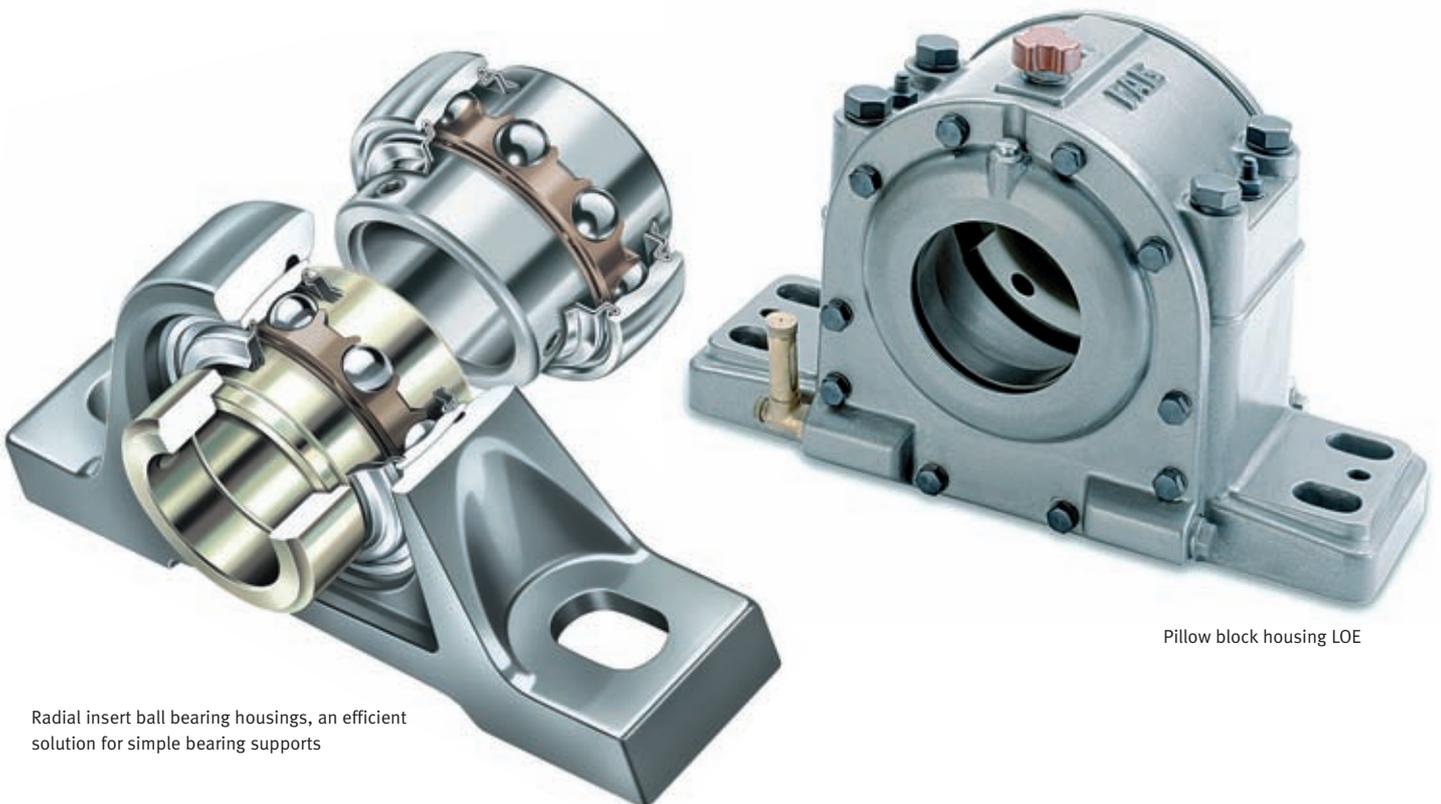
Radial fan with two-bearing housing (Photograph courtesy of KK&K, Frankenthal, SCHIELE design)



Roof fans (Photograph courtesy of TLT-Turbo, Bad Hersfeld)

Benefits

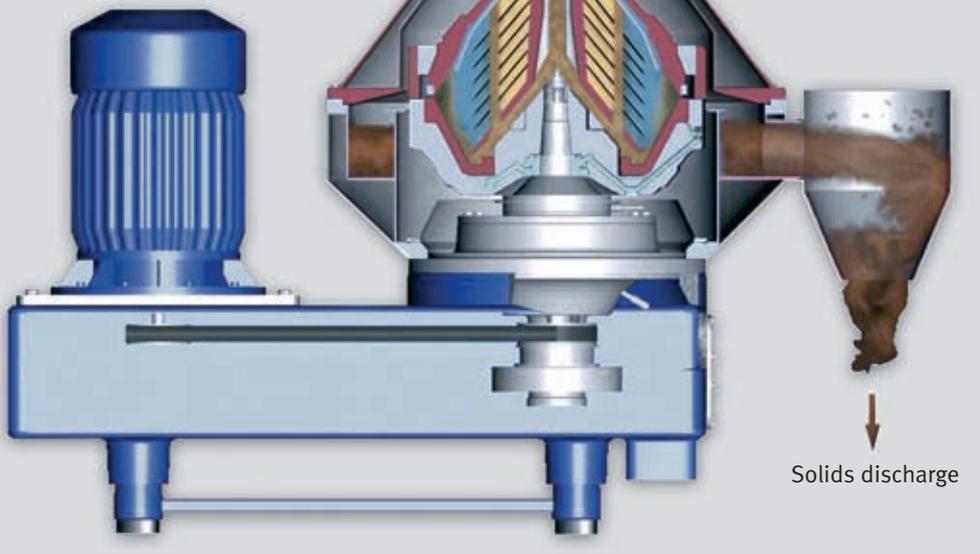
- Efficient thanks to sophisticated standard bearings and housings can be supplied quickly
- Suitable bearing, seal and housing combinations for every application
- Design using BEARINX® software
- Housings with optimized stability made from various cast materials, marked connections for lubrication and bearing monitoring systems



Pillow block housing LOE

Radial insert ball bearing housings, an efficient solution for simple bearing supports

Separation and clarification



Separator (Photos courtesy of Flottweg, Vilsbiburg)

Separators and decanters are centrifuges used to separate solids and liquids or to separate liquid mixtures while simultaneously extracting solids.

Centrifugal separator and decanter technology performs key functions in many industrial sectors:

- Food, beverages
- Chemicals/pharmaceuticals
- Biotechnology
- Base material recycling
- Environmental protection

Decisive criteria for selecting the proper rolling bearing

- Load spectrum
- Minimum load specifications
- Load type
- Out of balance, vibrations and oscillation
- Speed ranges
- Ambient temperature effects
- Special lubrication requirements
- Shaft deflection



Angular contact ball bearing with sheet metal cage



Cylindrical roller bearing with sheet metal cage

Benefits of INA and FAG bearings

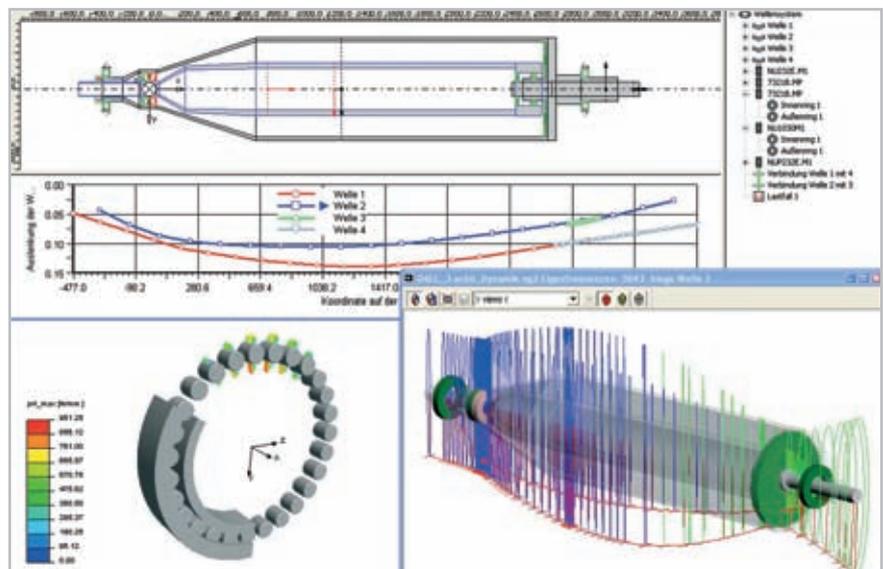
- Cost effective standard bearings that can be supplied quickly
- Extreme operating conditions are manageable thanks to optimal product selection using BEARINX® calculation software
- High degree of functional reliability, even for very high acceleration forces
- Challenging tasks are solved in cooperation with our customers



TRICANTER® (Photograph courtesy of: Flottweg, Vilsbiburg)

BEARINX®

BEARINX® can be used to perform detailed analyses of rolling bearings – including individual rolling contacts. Rolling bearing loads in complex machine systems can be calculated, represented 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.



Decanter calculation model

Information and quality

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 the calculation of the modified rating life to DIN/ISO 281.

In addition, a comprehensive database simplifies the selection of adequate lubricants.

In just a few mouseclicks, you can access the Schaeffler Group Industrial division's entire range of products and services. An expanded tutorial provides step-by-step navigation and guides users through the program quickly.

- Detailed product information
- Comprehensive design and safety tips



- Details on bearing design
- Representative mounting examples
- CAD downloads
- Tables with accuracies, tolerances and bearing clearance
- Bearing seals

If required, data sheets can be prepared online and printed. Just ask for our CD-ROM or go to <http://medias.ina.com>.

Quality has a name: X-life

X-life stands for premium products made by INA and FAG. Products with an optimal service life that goes far beyond known indicators. All of the parameters that are necessary for trouble-free operation and processes and that make investment decisions easier have been taken into account and put into practice:



- Optimized product characteristics, low-noise and easy-maintenance solutions with high load-supporting capacity meet and often exceed requirements
- Improved price-performance ratio, faster payback through minimized downtimes and increased productivity
- Training programs, the basic requirement for error-free mounting and dismantling and meeting correct maintenance intervals all the way down to selecting and using the appropriate lubricant



Services for all rolling bearing products and applications

FIS – INA and FAG customer service

Reduce maintenance costs, prevent unplanned downtimes and increase machine availability – these are the goals of the professional maintenance solutions provided by FAG Industrial Services (FIS).

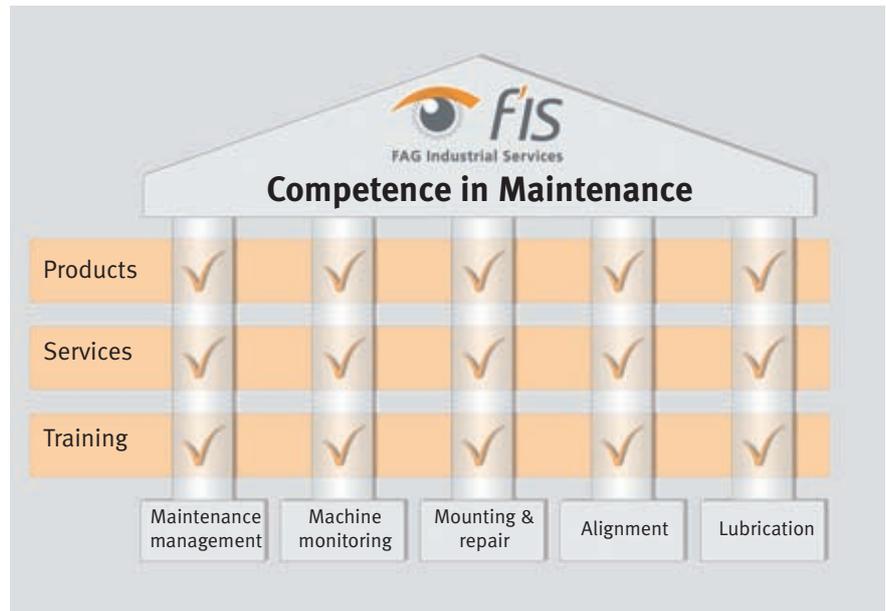
Products, services and training offered by FIS are integral components of a rolling bearing's life cycle and experience has shown that these are vital elements of reliable operation.

Our products and services include:

- Technical and organizational support on all maintenance issues
- Selection, implementation and customizing of maintenance scheduling and control systems
- Vibration analyses (condition monitoring) in the form of periodical measuring, trouble shooting and remote service and support for machines for the early detection of damage to rolling



Easy Check – our small device for monitoring vibrations and temperatures



bearings and gear teeth, out of balance and misalignment

- Individual customer training, including vibration analysis, rolling bearing technology and mounting and dismantling
- Reconditioning of large bearings
- Lubricants and assistance with lubricant selection
- Tools for mounting, dismantling and measuring rolling bearings
- Laser alignment devices
- Mobile and stationary machine diagnosis systems

We consistently train, certify and audit our employees and partners to ensure the highest possible service quality.

info@fis-services.de

www.fis-services.de



Automatic lubricator CONCEPT6

Schaeffler KG

Georg-Schäfer-Strasse 30
97421 Schweinfurt (Germany)

Internet www.fag.com

E-Mail air_handling@schaeffler.com

In Germany:

Phone 0180 5003872

Fax 0180 5003873

From Other Countries:

Phone +49 9721 91-0

Fax +49 9721 91-3435

Every care has been taken to ensure the correctness of the information contained in this publication but no liability can be accepted for any errors or omissions.

We reserve the right to make changes in the interest of technical progress.

© Schaeffler KG · 2006, December

This publication or parts thereof may not be reproduced without our permission.

WL 22 102 EA