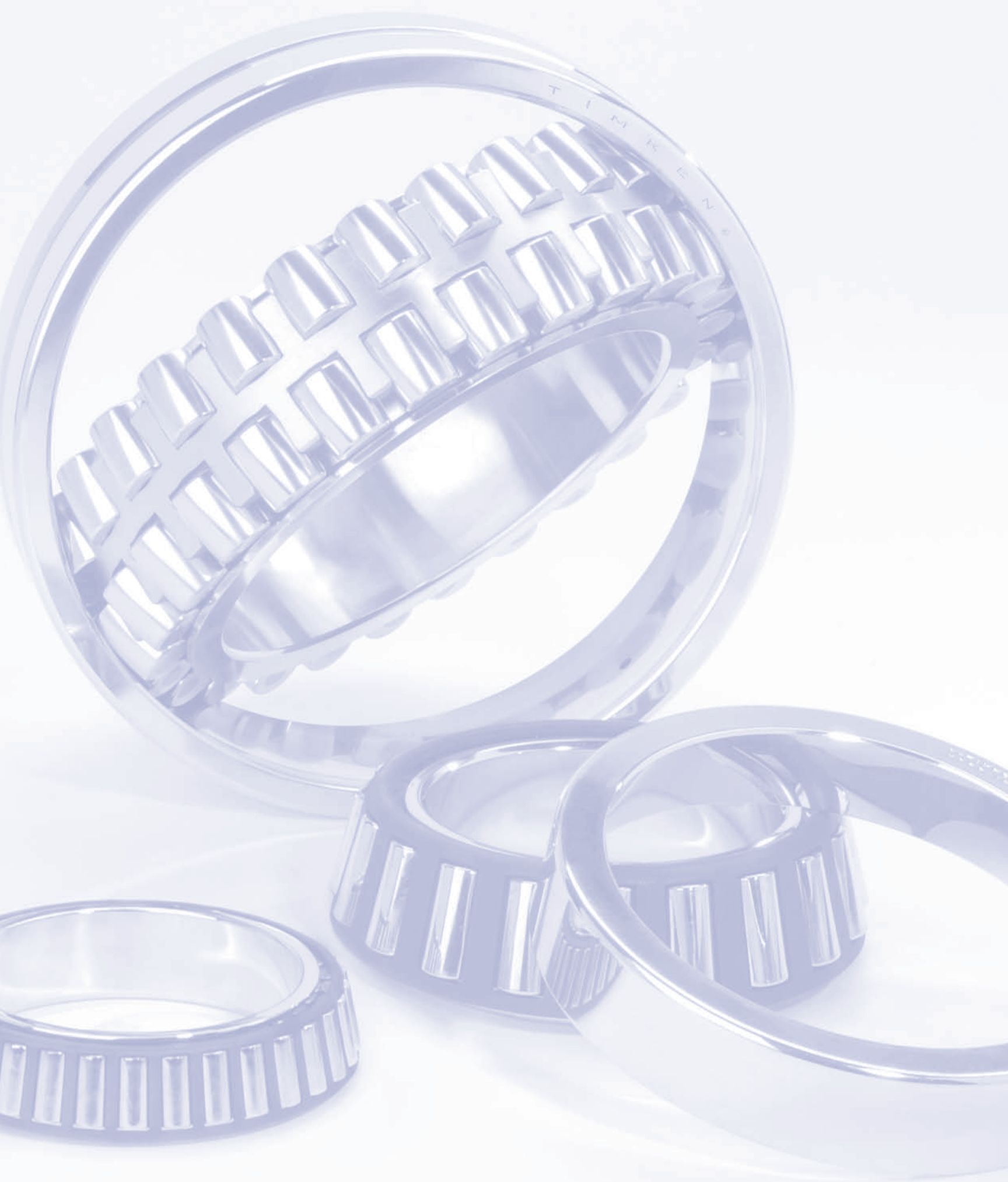


TIMKEN
Where You Turn

Friction Management Solutionssm for Power Generation





Knowledge

Why do power generation customers continue to turn to The Timken Company? Reliable products. Collaborative services. Proven successes. Timken helps equipment makers and maintenance crews alike improve productivity and minimize downtime through bearings that have withstood the test of time and services that respond to this industry's need to reduce overall costs.

Power generation customers seek products that perform better and last longer. With the acquisition of The Torrington Company and a continually expanding array of products and services, Timken is better positioned than ever to meet the needs of coal-fired power plants.

Value-added Products

More than a century of knowledge and experience in design, application and process engineering is integrated into every Timken® tapered, spherical, cylindrical and ball bearing. The result is a high level of durability and extended performance within bowl mill journal wheels, gear drives and other power generation equipment.

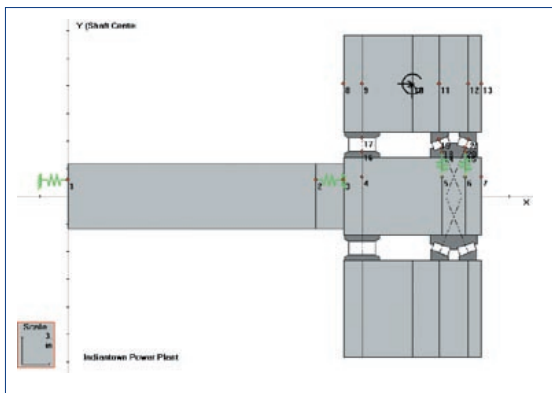
Reliable products start with reliable materials. Timken is the world's largest producer of bearing steel. Our standard bearing steel minimizes the impact of debris in most industrial environments. In fact, in controlled laboratory tests under identical debris conditions, Timken standard bearings consistently equaled or outperformed competitors' "debris-resistant" bearing lines (see chart at right).

In environments where debris is a constant issue, Timken offers a more advanced level of protection and performance. Timken debris-resistant bearings are available in a wide variety of sizes, bearing types and quantities. Our Debris Analysis Program evaluates bearing and component performance within systems, models debris damage and helps engineers identify the most appropriate debris-resistant bearing solutions.



Sophisticated computer modeling and system analysis tools allow Timken engineers to accurately evaluate the complete bearing, shaft and housing system – including how it will react in operating conditions – and, therefore, recommend enhancements to increase bearing life.

Timken® debris resistant bearings are designed for difficult operating environments, such as coal-fired power plants.

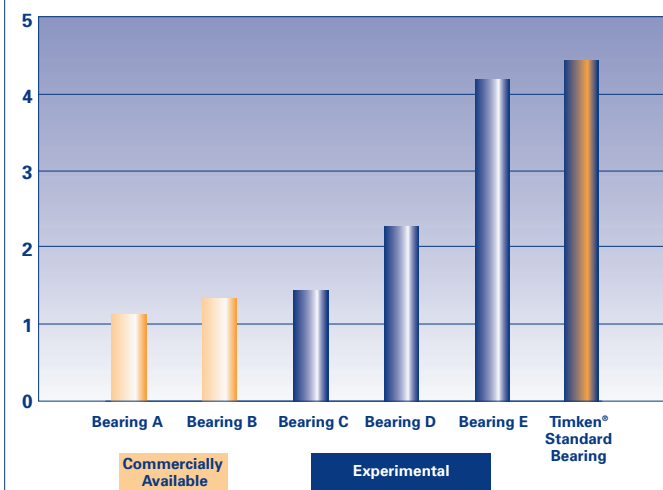


New bearing configuration, debris-tolerant steel yield substantial savings

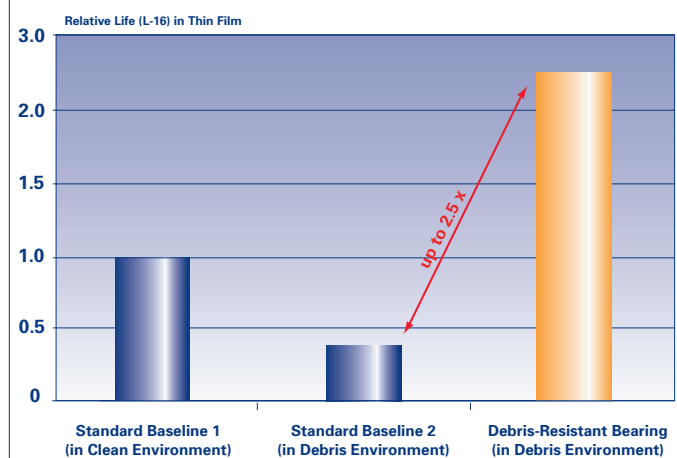
Every three months, Pacific Gas & Electric (PG&E) of Indiantown, Fla., was experiencing severe bearing damage in its pulverizers. PG&E contacted Timken to help identify a remedy.

Engineers from both organizations spent nearly a month researching and developing a solution: a tapered/cylindrical bearing combination, made with debris-tolerant steel, which replaced the standard spherical/cylindrical bearing configuration. The new bearing design fits in the existing envelope and has extended life by five times the previous design. When PG&E spherical/cylindrical configurations fail, they now are replaced with the new tapered/cylindrical combination. This Timken-inspired solution may save PG&E more than \$300,000 by preventing multiple failures.

Comparison of Fatigue Life Performance with Contaminated Lubricant



Fatigue Test Results – Moderate Debris Timken® Standard vs. Timken “Debris-Resistant”



Debris resistance affects bearing life

Incorporating coatings and finishes that deter debris can significantly extend bearing life and lengthen maintenance cycles. In independent studies, Timken standard bearings perform as well or better than competitor debris-resistant brands. In this study (above left), bearings A through E are manufactured by competitors – A and B are commercially available, while C, D and E were experimentally developed to promote debris resistance. The Timken bearing is a standard, commercially available tapered roller bearing. This data was derived from "Influence of Contaminated Oil and Bearing Materials on Bearing Life in Automotive Transmissions," which appeared in the Honda R&D Technical Review, Volume 5. Timken also has developed a debris-resistant product line for extended life in challenging operating conditions (above right).



Solid lube – created from polymers, oils and other additives – can be incorporated into tapered, spherical and cylindrical roller bearing designs.

Solid lube extends pulverizer journal life

The first solid-lube bearing made its debut more than 20 years ago. Today, these bearings are used in unloading stations, pumps, pulverizers, bottom-ash handlers and conveyors. Some customers have reported a 75-percent reduction in labor and material costs related to reduced maintenance intervals.

One southwestern U.S. power utility company saves hundreds of thousands of dollars annually – and avoided journal failures – by replacing traditionally lubricated bearings with solid-lube varieties. Instead of replacing hundreds of sets of bearings each year, with lifespans of one to three years, this facility is replacing less than 50 sets a year and experiencing five-to six-year bearing lives.

Application-specific Solutions

A combination of durable steel, tailored design geometry and proper lubrication can yield impressive performance results. Consider Timken® Fafnir® soot-blower ball bearings, which feature high-temperature seals and expanded radial-internal clearance for easier turning. The addition of a high-temperature grease allows the bearing to adjust to heat increases in this environment. These three characteristics can extend bearing life up to two to four times traditional soot-blower bearings and reduce downtime associated with slag build up and boiler breakdowns.

The correct type and use of lubricant can significantly extend bearing and component life by deterring system failures. Timken has applied its knowledge of bearing operations to its line of lubricants, which includes:

- **Timken all-purpose industrial grease.** This lithium complex lubricating grease offers high-temperature resilience and contains extreme-pressure, anti-wear additives and corrosion inhibitors.
- **Timken grease featuring heavy duty moly.** This grease is ideal in environments when resistance to water washout and broad operating temperatures exist. It provides resistance to extreme pressures and corrosion and maintains mechanical stability, even in the presence of water.
- **Timken single-point lubricators.** G-Power and M-Power chemical- and power-driven lubricators provide a consistent application of oil or grease to bearings, gears, chains and other system components. Canisters can be filled with one of more than 200 types of lubricants.
- **Solid lube.** By filling the air space between rolling elements and raceways with solid lubricant, bearing life can be doubled and maintenance intervals lengthened. The lubricant retains oil in the pores while preventing debris and other foreign objects from entering the bearing raceway.

Through its offering of bearings, components and lubricants, Timken is well-positioned to proactively help customers reduce downtime, maintain or improve overall system performance and lengthen maintenance intervals.

Timken® Fafnir® ball bearings reduce maintenance costs associated with Diamond Power I/R soot blowers.



Service

The Timken portfolio of integrated industrial services offers power generation customers ways to monitor and improve overall system performance – broadening the focus from bearings to the many operations they influence. One example is our line of condition monitoring equipment, which continuously evaluates bearing condition, lubrication quality and machine vibration, and is aimed at identifying potential system issues before failures occur.

Our broad line of condition monitoring products includes portable instruments, continuous monitoring devices and online systems. We can help you maximize uptime with the development of a cost-effective program to achieve maximum output and reliable service – ensuring maintenance personnel are properly trained to receive maximum benefit from the technology. A comprehensive condition-monitoring program can help you:

- Increase productivity and equipment uptime.
- Reduce capital expenditures by maximizing the useful life of machinery.
- Reduce maintenance costs by planning and scheduling needed repairs.
- Improve workplace safety.

Timken offers a portfolio of condition monitoring devices, including online and handheld systems.



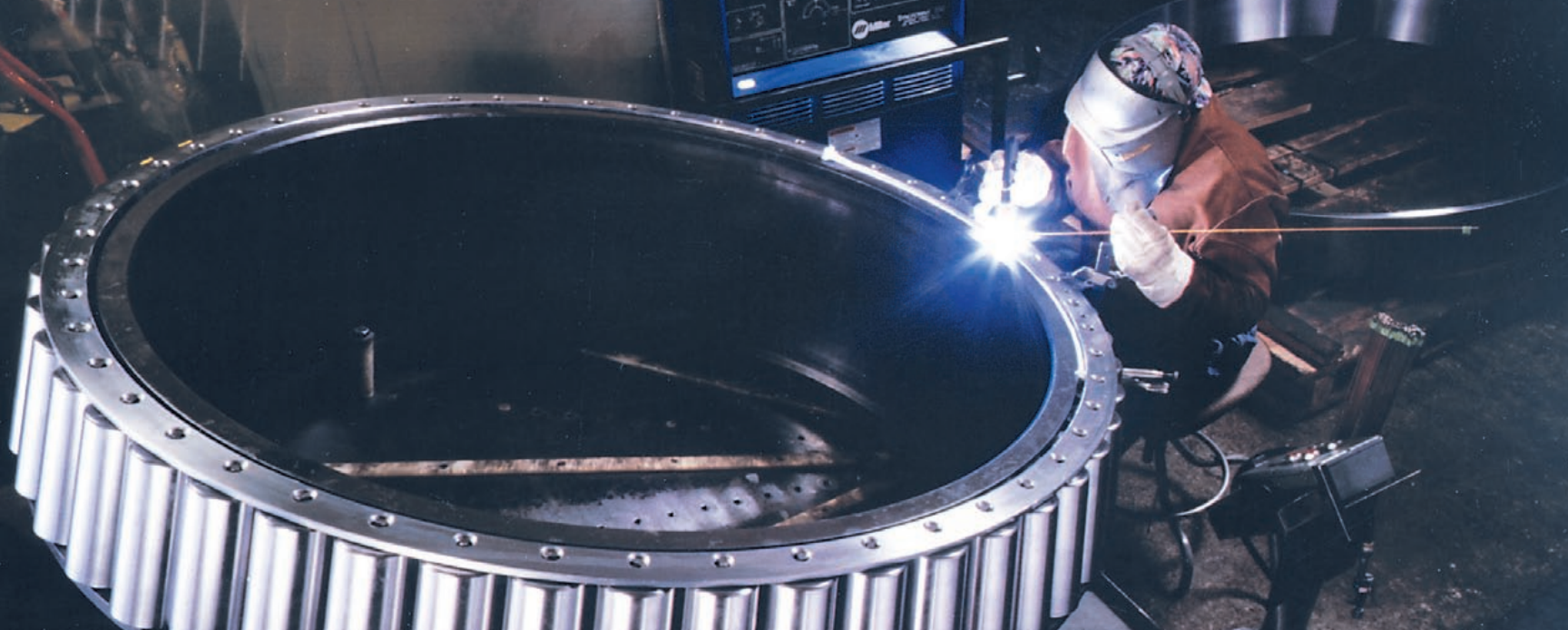
Great River Energy saves thousands per journal assembly

After years of replacing worn journal roller bearings from a variety of suppliers, Great River Energy's Coal Creek Station in Underwood, N.D., desired a more economical approach to journal bearing maintenance. Timken and its local distributor developed a three-year plan that delivers a steady supply of bearings, including the review of in-service bearings for possible refurbishment.

Since agreeing to the plan, Coal Creek Station has saved more than \$30,000 annually on bearing replacement – \$2,500 per journal assembly and \$7,500 per pulverizer overhaul. Timken engineers also helped facilitate a bearing setting change that has increased productivity. Plant leaders have been pleased with the detailed documentation it receives regarding bearing inspections and repairs and the ability to send all of its bearings to one location.

"Coal Creek Station has found a dependable, affordable three-year journal bearing repair and replacement program and Timken has gained a long-term customer," said Steve Richter, boiler core manager.





Bearing Repair

Timken's bearing repair program helps customers save thousands of dollars in bearing replacement costs and maintain a steady supply of bearings to facilities. Remanufactured or repaired bearings can be returned to their original specifications for less time and money than purchasing new bearings. In fact, by opting for remanufactured bearings, some customers can save 50 to 90 percent of the cost and time of purchasing new parts without sacrificing performance.

While a thorough bearing inspection is the best method for determining whether a bearing can be adequately reconditioned, bearing repair can be considered an option when:

- bearings exceed their suggested length of time in service
- bearings have exceeded maximum operating temperatures, typically 200 degrees Fahrenheit (93.3 degrees Celsius)
- bearings produce excessive vibration or
- a system has experienced a sudden drop or gain in lubrication.

Bearing repairs can be made on a variety of bearing types and sizes up to 84-inch (213 cm) outside diameters and 21,000 pounds (9,526 kgs). How confident are we in our repair accuracy? Confident enough to provide the same limited warranty we offer for new bearings. And remanufacturing is available for any bearing type or brand – even competitor brands – providing a single source for all bearing repairs.

The most effective approach to remanufacturing is developing a maintenance program where an inventory of Timken refurbished bearings are kept on-site at customer locations or a nearby distributor and rotated into operation as older bearings are removed and sent to Timken for repair.

Bearing repair is an economical, reliable opportunity for customers to keep systems running smoothly while reducing maintenance costs.

Timken engineers collaborate with customers to identify ways to enhance bearing – and overall machine – performance.

Collaboration

Bearing Certification

One of the best ways Timken helps customers keep systems running smoothly is by equipping customers with the knowledge to install and maintain bearings. Bearings are critical to pulverizer, gear box and conveyer performance. The Timken Bearing Certification Program empowers maintenance teams. The result is the ability to proactively respond through improved knowledge about how bearings operate, how they interact with other system components and how to troubleshoot potential problems by analyzing modes of bearing damage.

Bearing certification, tailored to the power generation industry, can be facilitated at Timken locations or at customer sites. During the course, maintenance associates learn:

- proper bearing handling and installation
- bearing maintenance procedures
- bearing damage analysis
- bearing design differences and
- the effects of metallurgical changes on bearing performance.

Participants are tested and facilities are audited to earn the “Timken bearing certified” designation. Periodically, Timken will recertify team members through refresher courses and audits. Bearing certification is more than training – it is a means to become a world-class maintenance team by learning and implementing the best practices.



Employees at PPL Montana are now better equipped to spot bearing issues before unscheduled downtimes occur.

PPL Montana relies on Timken for on-site training

As one of the United States' largest power generators, PPL Montana, a subsidiary of PPL Corporation, needed a program that would help maintenance employees learn techniques to extend bearing life, reduce maintenance costs and improve equipment reliability.

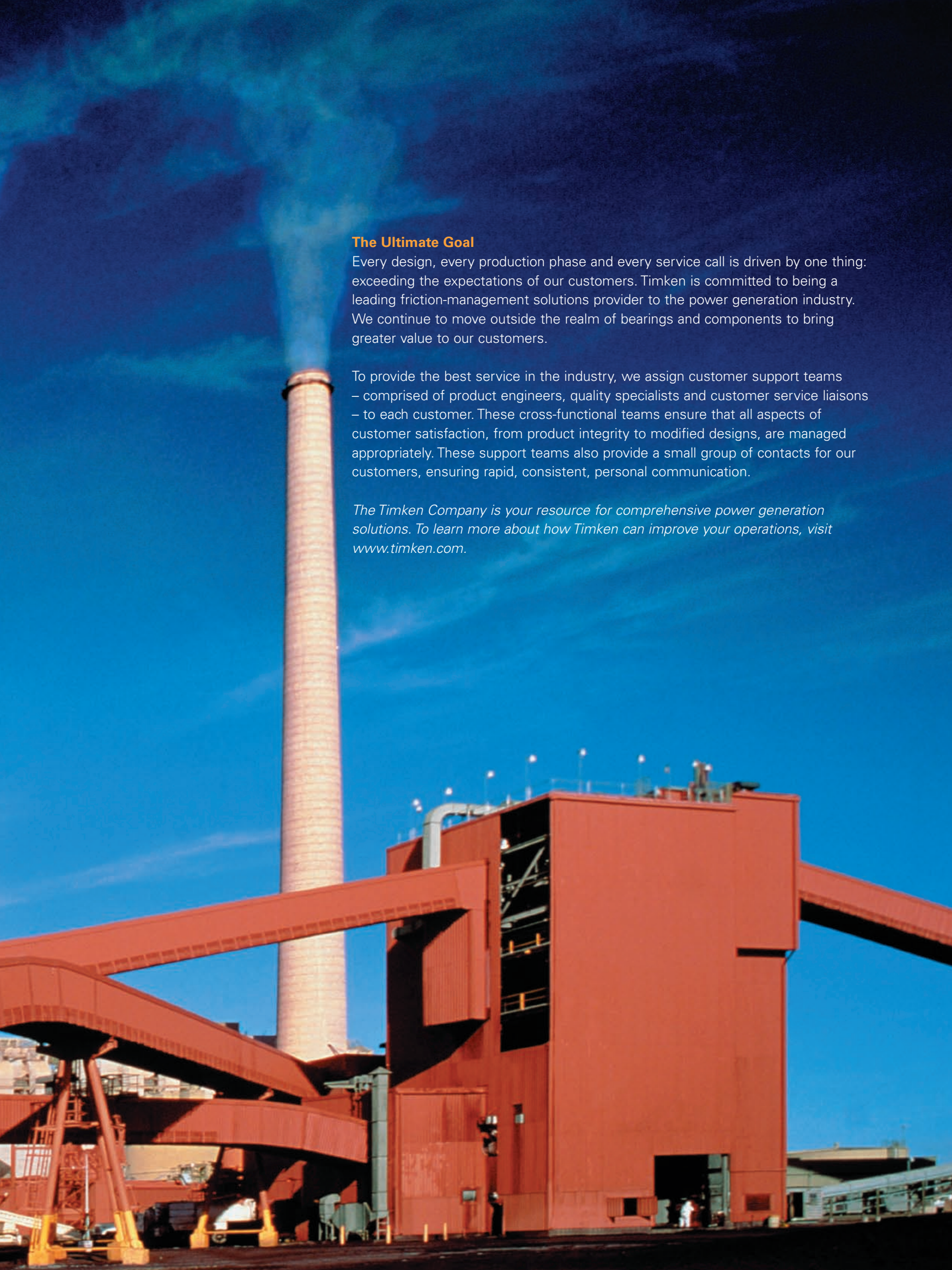
Following the training, Maintenance Training Instructor Hank Coffin saw immediate benefits.

"I realized that all of our team members did not have the same level of training and knowledge," he says. "Today, our mechanics, engineers, apprentices and management have learned from the program and are operating on the same page."

The facility received certification and has since increased uptime and decreased maintenance costs. The training program also introduced PPL to the benefits of bearing repair versus bearing replacement. Understanding bearings and their environments helped the company recognize the need for scheduled repairs before breakdowns occurred.

"This has not been a stand-alone training, but an all-encompassing program," says Coffin. "Timken didn't come in, make the sale and then never return. We continue to stay in touch for a number of reasons, and the training program continues to be a worthwhile investment of time and resources. We've learned that anyone can benefit from it, whether provided for new or older plants."





The Ultimate Goal

Every design, every production phase and every service call is driven by one thing: exceeding the expectations of our customers. Timken is committed to being a leading friction-management solutions provider to the power generation industry. We continue to move outside the realm of bearings and components to bring greater value to our customers.

To provide the best service in the industry, we assign customer support teams – comprised of product engineers, quality specialists and customer service liaisons – to each customer. These cross-functional teams ensure that all aspects of customer satisfaction, from product integrity to modified designs, are managed appropriately. These support teams also provide a small group of contacts for our customers, ensuring rapid, consistent, personal communication.

The Timken Company is your resource for comprehensive power generation solutions. To learn more about how Timken can improve your operations, visit www.timken.com.

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Precision Components • Lubrication •
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