TIMKEN®

mining

THE TIMKEN COMPANY

Whether in the original

application design or **on-site** in the pit,

Timken leverages its **experience**

to drive **innovation** and **solutions**

to the **global** mining industry.

experience

Mining machinery faces some of the toughest terrains and operating conditions of any industry. Heavy loads, debris, severe misalignment and wide variances in speeds are some of the challenges faced by bearings in the excavating, loading, hauling, and processing equipment found at a mine site.

The Timken Company has invested heavily in gaining a better understanding of the challenging conditions found in mining in order to develop solutions that make sense for the industry. Building on a century of bearing manufacturing, Timken has become a trusted resource for mining customers – from original equipment makers like Bucyrus, P & H, Komatsu and Caterpillar to the maintenance teams that keep equipment running in coal, copper, gold, phosphate and iron mines, to name a few.

Mine operators share similar performance goals: maximizing uptime, reducing maintenance and replacement costs, and improving productivity. For more than a century, Timken has responded to these challenges by making products – including tapered, needle, cylindrical and spherical roller bearings and ball bearings – that are designed to exceed performance expectations.

Timken® bearings are designed for the harsh conditions of underground and above-ground mining, including draglines.

The internal geometry, surface finishes, rollers and cages of our Timken®- and Torrington®-branded bearings are engineered to combat debris and contamination, as well as manage heavy and unpredictable loads. We apply our knowledge of metallurgy and experience in manufacturing to develop mining-related solutions for customers around the world.

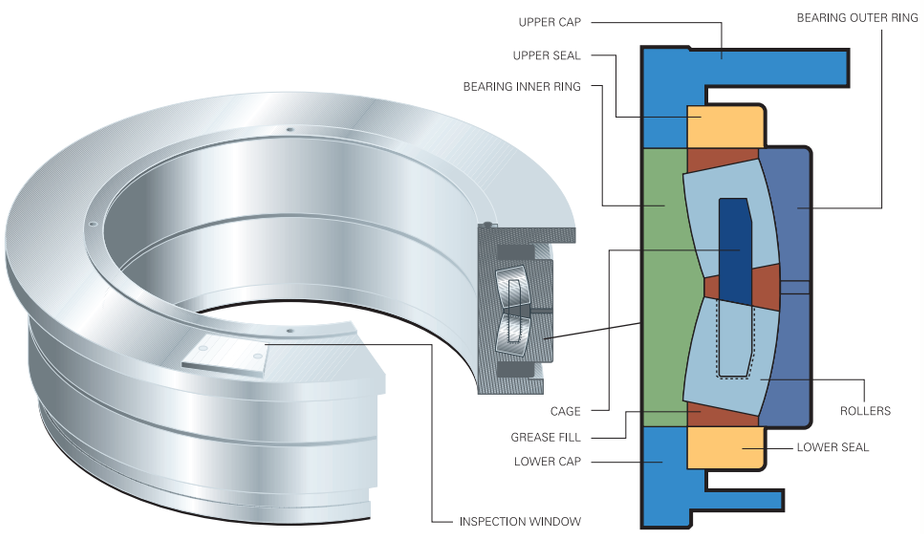
We build on that foundation by collaborating with original equipment makers and working hand-in-hand with mine maintenance personnel to recommend the best products for specific equipment within the given environment. Draglines, for example, require a combination of tapered, cylindrical and spherical bearings to withstand the massive loads and shocks they manage. From a maintenance perspective, condition monitoring equipment and Timken industrial greases can help draglines stay in operation – even in harsh conditions – thus reducing costly downtime.

Whether it's a shaker screen or a 400-ton haul truck, Timken applies its history of providing quality bearings for mining equipment, large and small, throughout the world.

rolling up our sleeves

Making quality products is just the beginning. Timken field sales and service engineers spend time with mining customers to see operations firsthand and equip employees with the tools they need to install, monitor and replace Timken products. Timken Bearing Certification Training is available onsite and can be tailored to customers' needs. Our on-location commitment to mine operators is unparalleled in the industry. Simply put, you can trust our products and our people.

Haul trucks can carry heavier loads longer with Timken wheel bearings.



Modified design extends bearing life in Kennecott Energy dragline

Inside one of Kennecott Energy's 15-million-pound draglines, a lower-swing spherical bearing, affixed to one of six swing shaft pinions, needed to be addressed due to costs associated with relubricating and cleanup of lube that was weeping out of the bearing.

Kennecott shared its dragline blueprints and details regarding the bearing with members of Timken's application and service engineering team, who quickly collaborated on a new sealed spherical bearing prototype for the application.

The new design saves thousands of dollars a year in reduced maintenance and grease disposal costs and dramatically improves productivity and uptime. The sealed spherical bearing is now Kennecott's standard for this dragline position.

"They were aggressive in the redesign and delivery schedule," said Kelvin Kennedy, dragline and shovel maintenance coordinator for Kennecott. "Not only has this work improved installation and operations, but our relationship with Timken has also led to better handling and assembly techniques overall."

Wheel bearings carry heavier load

Made from super-clean, air-melt steel, Timken wheel bearings for mining trucks offer increased load-carrying capacity, debris resistance and longer bearing life. Cups, cones and rollers undergo proprietary finishing processes to provide enhanced fatigue performance in the thin-lubricant-film environments, such as those prevalent in mining.

Surface coatings and finishes on Timken bearings deter abrasive damage, bruising, pitting and grooving that can lead to component wear, loss of system rigidity, increased system deflections, loss of bearing setting and reduced bearing life.

Timken wheel bearings also can be made with high-performance options. Customized rolling surface profiles are manufactured to combat misalignment and load-induced edge stresses.

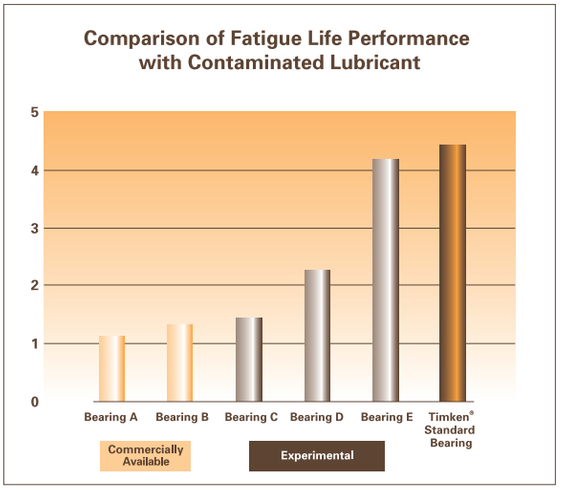
innovation

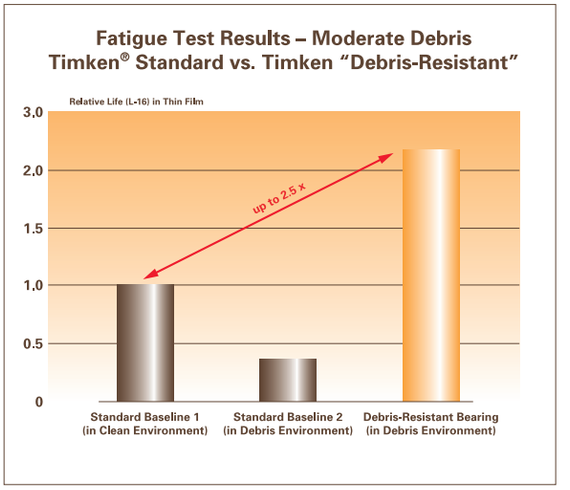
In leveraging our years of experience, Timken continues to introduce new technology to our customers. Many of these ideas are inspired by our onsite visits, and often a one-time solution becomes an answer to a universal problem.

Debris and contamination are constant issues in mining. While Timken standard bearings are durable in difficult mine conditions, we continue to create new weapons in the form of engineered surfaces, heat-treating processes and surface finishes. These modifications enhance life and minimize raceway and roller damage.

When standard bearings need to be enhanced, our sales associates diagnose the situation and relay the data to our team of research and service engineers who modify designs, oversee prototype production and testing, and ensure delivery and performance.

Many of our comprehensive friction management solutions were born out of our response to customer-generated requests. After years of providing recommendations regarding lubrication, Timken has developed a portfolio of greases that are specially





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), 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 (at right above).

formulated for bearings. For example, Timken construction and off-highway grease has been created for bearings used in mining and construction equipment. Our tribological engineers developed a recipe that resists extreme pressures and corrosion and maintains mechanical stability, even in the presence of water. Our all-purpose greases offer reliable lubrication in a wide range of industrial applications, from conveyors to electric motors.

We continue to introduce new grease formulas for specific operations in a variety of sizes that are delivered through traditional grease guns and new delivery methods like Timken G-Power and M-Power single-point lubricators. These devices save maintenance time by delivering consistent lubrication to bearings, chains, guideways and other moving parts. Rather than manually lubricate these parts, maintenance teams can install the automatic units and forget about them for up to a year.

Another way we help maintenance teams combat marginal lubrication in mining applications is by offering bearings packed with solid lubrication, which keep raceways lubricated and contaminants out. Some customers have reported a 75 percent reduction in labor and material costs related to reduced maintenance intervals. Solid lube can be incorporated into tapered, spherical, cylindrical roller bearings and ball bearings.

Our objective is to supply customers with the level of innovation and combination of products and services needed to keep equipment in service as long as possible. From the world's biggest draglines, shovels and wheel loaders to underground machinery, mine operators turn to Timken to keep key equipment running productively, shift after shift.

Condition monitoring helps Cargill Fertilizer prevent unexpected failures

Using shock-pulse monitoring equipment, Timken is helping Cargill Fertilizer save tens of thousands of dollars each year by preventing costly equipment failures. Timken sales engineers analyzed Cargill's dragline operations and predictive maintenance practices, and identified bearing positions that were difficult to monitor. Because of the inaccessible locations of these bearings and the high value the customer places on productivity, these failures cost thousands of dollars in repair and lost production.

Timken applied a proven shock-pulse sensing technique, along with proprietary signal conditioning software and expert interpretation of the bearing condition. The result is a turnkey monitoring system that provides a qualified assessment of bearing health. This allows the mine to optimize their maintenance planning, lower their repair costs and maximize production.

The system output is integrated seamlessly into the data management system in the mine, providing real-time indication of bearing health on the maintenance manager's desktop.

This approach is being implemented on all of the critical bearing positions on the dragline and can be applied to the mine processing plant as well. In fact, any position that operates at low or variable speeds – or is difficult to access – now can be monitored remotely and continuously through Timken's proprietary new technology.

"Teaming with Timken has allowed us to increase our machine reliability," said Karen Mikkola, engineering manager – mining operations for Cargill Crop Nutrition. "It gives us greater peace of mind today, and allows us to capitalize on opportunities to reduce emergency maintenance and decrease costs."

Applying Timken condition monitoring solutions to Cargill operations has improved maintenance practices.

solutions

Less Friction. More Solutions

So what do experience and innovation produce? Comprehensive solutions. You have access to comprehensive friction management solutions that extend beyond traditional bearings. We consider your entire system and your production goals, then recommend products and programs that will improve uptime and keep moving parts running at peak performance. In many instances, we utilize a number of different friction management components to address the unique needs of mine operators and maintenance managers.

Less Friction, More Solutions describes Timken's approach to offering the products, programs and support that help you succeed. Extending beyond the bearings, these solutions include related products and accessories, expert sales and service support and integrated logistics.

Our field teams are prepared to help today's smaller, more-focused maintenance teams identify ways to drive cost savings and increased efficiencies. Service engineers can assist by auditing maintenance practices, while also providing on-site bearing damage analysis.

integrating condition monitoring programs

For direct operating benefits, Timken's expanded condition monitoring capabilities now include easy-to-use portable instruments and online systems. These flexible early warning systems provide immediate, accurate feedback that indicates component condition, temperature and vibration levels during operation.

Using shock-pulse, infrared and probe technology, Timken can assess – or teach your teams how to assess – potential bearing and component damage mode conditions and develop scheduled maintenance intervals. These time-saving, cost-saving programs free up your valuable resources and can help prevent expensive unplanned catastrophic failures.

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

easing installation, replacements

Among our friction management solutions are powerful new tools for removing and installing bearings and other machine components. Timken's line of impact fitting tools, induction heaters and mechanical and hydraulic pullers help installers mount bearings, bushings, wheels and other parts quickly and safely, minimizing downtime and lowering operating costs.

And just as we have mastered the art of making high-quality bearings, we have also become leaders in rebuilding and reconditioning bearings to like-new condition. By opting for remanufactured bearings, customers can save up to 50 percent of the cost and time of purchasing new parts without sacrificing performance. Reconditioning is available for any bearing type or brand, even in bearings with 84-inch (2,134 mm) outside diameters. Typical repair candidates include: large tapered, cylindrical and spherical roller bearings in shovels, draglines and haul trucks.

We continue to build upon our portfolio of products and services to help you maximize your return on investment and keep your mine site productive and profitable. With Timken as your source for friction management solutions, you can trust our experience to create ongoing innovative alternatives that will enhance your operations.

Mine maintenance personnel can rely on Timken for quality bearing repair services.

EMS turns to Timken for training, bearing repair and service

Equipment Maintenance Service (EMS), a mining equipment repair company, relies on suppliers like Timken that maintain a commitment to quality, innovation and service. Since 1984, EMS has turned to Timken for much more than bearings.

"The biggest benefit is that Timken has field associates that are readily available to assist us," said Todd Colbrese, operations leader of the electrical rotating department at EMS. "They also have other technical service people – along with our Timken authorized distributor – that can easily be contacted by phone."

Timken supplies EMS with a variety of bearings and parts, thanks to an unwavering commitment to quality. The result is a tailored bearing repair program for EMS that includes monitoring bearings and scheduling repairs before they break down and cause delays.

Through Timken's Bearing and Training Certification Program, EMS employees have fine-tuned their bearing maintenance practices, including proper storage, handling, inspection, installation and removal. After an advanced training session, Timken associates audited EMS' Gillette, Wy., shop, which earned a platinum rating – the highest in Timken's auditing system.

"We've built and maintained a two-way trust level with Timken," said Colbrese. "They have provided us with a valuable training program and we've reciprocated by specifying Timken products."

the ultimate goal

Our years of experience and our focus on innovation continue to produce solutions for a host of mine applications and environments. Timken has never lost sight of its foundational strengths – designing and manufacturing the best bearings in the world – but it now offers the products and services that enhance the performance of our bearings. We consider your overall system performance, adding value to your investment.

Every design, every production phase and every service call is driven by one thing: exceeding the expectations of customers. You can rely on Timken for products, technical analysis and ongoing condition monitoring to help maximize uptime, streamline maintenance and solve production issues. Timken is committed to being a leading friction management solutions provider to the mining industry.

The Timken Company is your resource for comprehensive mining solutions.

To learn more, visit www.timken.com/mining or call one of our global locations –

330.438.3000 (Canton, Ohio, USA), 86.1064106490 (Beijing, China),

33.389214444 (Colmar, France) or 91.805529234 (Bangalore, India).

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