

# TIMKEN



TIMKEN SOLUTIONS FOR ABOVE GROUND MINING

TECHNOLOGY TO MINE MORE

# SHOVEL

Timken shovel solutions simplify maintenance and operation with a wide variety of roller bearings used in the sheave, propel, hoist, crowd and swing drive positions. In one case, Timken improved the performance of swing gear drives by extending the lower swing shaft service life. Without changing the housing dimensions or overall package width, Timken designed a bearing that allowed a larger shaft diameter to reduce stress concentrations and improve shaft life. Customers report 1.5 to 3 times increase in shaft life.

With an abundance of bearings and gears in a shovel, predicting problems prior to catastrophic failure is critical. The Timken Online Intelligence System helps detect potential issues so they can be fixed before they lead to costly downtime and repairs.



Boom Point Sheave .....  
Two-Row Tapered  
Roller Bearing

Swing System  
Tapered, Cylindrical and Spherical  
Roller Bearings

Hoist and Crowd Systems  
Tapered, Cylindrical and Spherical  
Roller Bearings

Propel System  
Tapered and Cylindrical Roller  
Bearings



Online Intelligence System



Tapered Roller Bearings



Cylindrical Roller Bearings



Spherical Roller Bearings

## TIMKEN SOLUTION SUCCESS:

### *Higher Intelligence Increases Quadra Mining's Uptime*

Quadra FNX Mining Ltd. has a smart, flexible monitoring solution that reduces its maintenance spending and lowers its cost of operation. That system, the Timken® Online Intelligence System, measures and analyzes data from various application points to detect potential problems before they cause a failure. The system is backed by highly trained Timken specialists who analyze the data to determine and address the root causes of problems.

At Quadra, the Online Intelligence System identified an issue with a boom point sheave bearing shortly after the bearing was replaced during routine maintenance. Data analysis and follow up by Timken experts confirmed damage and determined it was due to improper bearing storage before installation.

“Even though the bearing was removed early, it still proved that

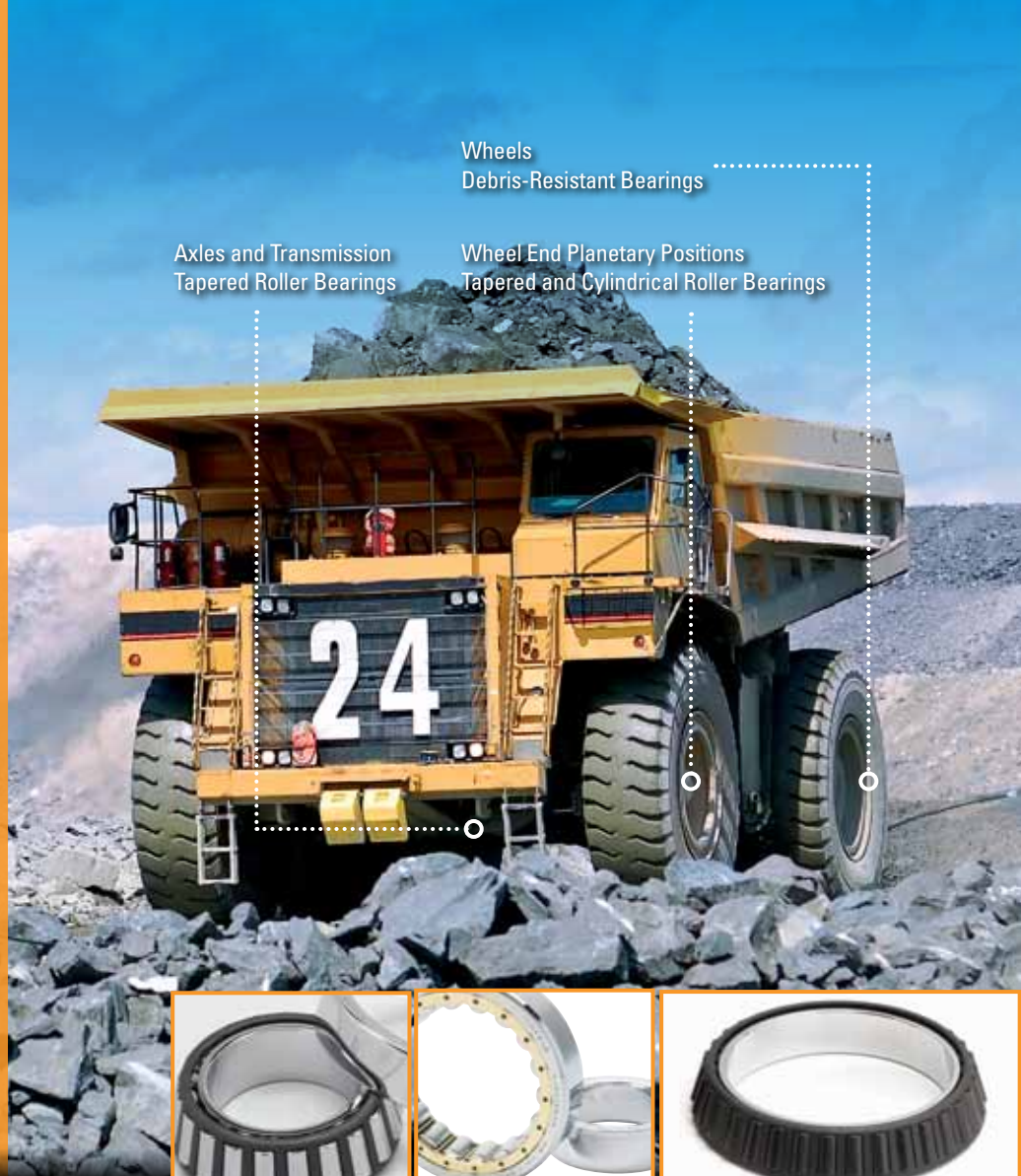
we can see anomalies in bearings at a very early failure stage,” said Cary Brunson of Quadra Mining. “Where I see value in this find is the identification of a storage problem that we have since revised, which will save money for the life of the project.”

# HAUL TRUCK

Haul trucks are the work horses of above ground mining. They must withstand heavy debris, high operating temperatures and extreme loads, day in and day out.

Haul truck wheel ends benefit from Timken® tapered roller bearings, which offer high load-carrying capacity in a compact envelope. Through advanced surface coatings and finishes, these bearings also provide greater debris resistance and longer bearing life.

Many mine operators choose Timken debris-resistant bearings, which last up to 3.5 times longer than Timken standard options.



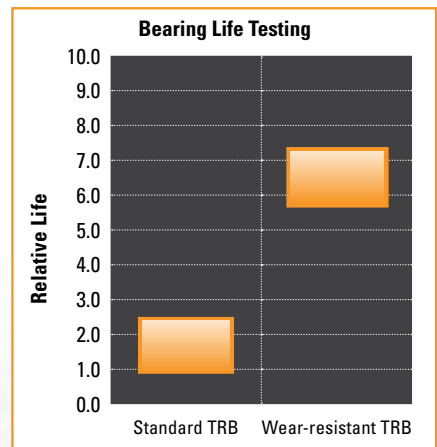
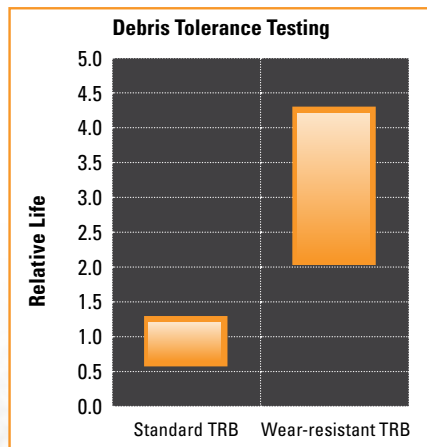
Tapered Roller Bearings

Cylindrical Roller Bearings

Debris-Resistant Tapered Roller Bearings

## DEBRIS RESISTANCE AFFECTS BEARING LIFE

Standard tapered roller bearings were tested against wear-resistant tapered roller bearings for debris tolerance and bearing life. Testing showed wear-resistant bearings to be more debris tolerant and have up to 3.5 times longer life in low lubrication conditions compared to standard bearings.



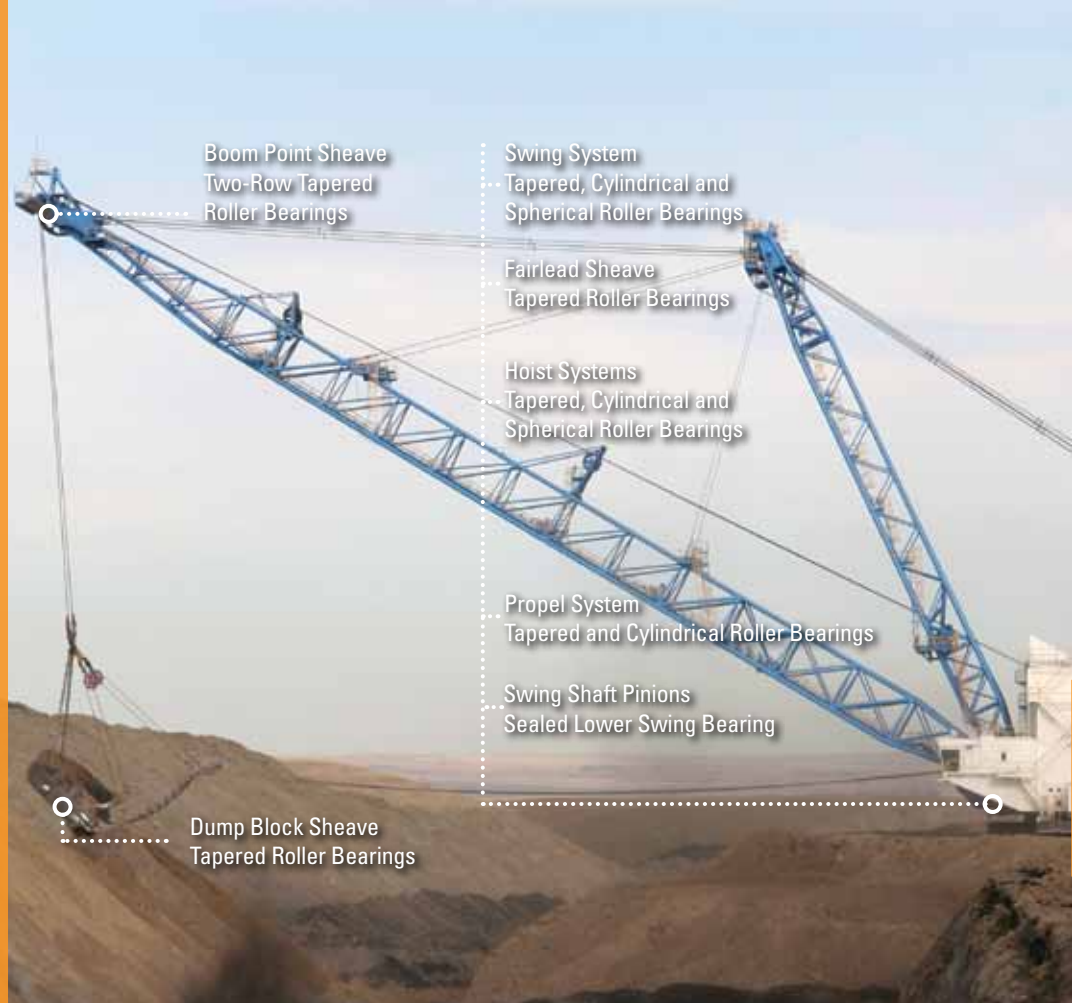
\*Standard product performance has been made relative to 1.0.

**SOLUTION  
SUCCESS**

## DRAGLINE

Timken® tapered, cylindrical and spherical roller bearings reduce friction for greater operational efficiency in up to 200 positions, including critical locations like the swing system. Our innovative sealed lower swing bearings provide integral seals and features to reduce the time to assemble and set the spherical roller bearing package.

In high-speed or reversing applications for input positions in hoist, drag, swing or propel drives, Timken cylindrical roller bearings with one-piece brass cages resist bearing fatigue experienced by traditional two-piece designs. That leads to greater uptime and reduced maintenance costs.



Tapered Roller Bearings



Cylindrical Roller Bearings



Spherical Roller Bearings



Sealed Lower Swing Bearing



Two-Row Tapered Roller Bearing

### TIMKEN SOLUTION SUCCESS:

#### *Lower Swing Bearing Saves Cloud Peak Mine Money, Improves Productivity*

Cloud Peak's mine in Gillette, Wyoming, saves more than \$35,000 a year in maintenance and grease disposal costs thanks to Timken® sealed lower swing bearings. The bearings also improve dragline uptime and productivity.

Plagued by lower swing bearings that were leaking lubrication, the mine's maintenance team asked Timken for help. Timken engineers discovered that the leaking was causing three other problems –

premature bearing damage, risk of damage to the swing rack and greater grease usage and disposal costs.

Timken developed its sealed lower swing bearing to address the problem. Designed specifically for the lower swing position of the CAT 8750 dragline, it fits into the space occupied by standard bearings and labyrinth seals without any retrofitting. A seal and spherical roller bearing are integrated into a single unit and

use special all-purpose grease. This patented technology keeps lubrication in the bearing cavity without requiring frequent lubrication.

"They were aggressive in the redesign and delivery schedule," said Kelvin Kennedy, independent dragline and shovel Consultant for Cloud Peak. "This work improved installation and operations, and our relationship with Timken also led to better handling and assembly techniques overall."

SOLUTION SUCCESS



Spherical Roller Bearing Housed Unit

Tapered Roller Bearing Housed Unit

Split Spherical Roller Bearing Housed Unit

Spherical Roller Bearing

Thrust Bearing

## CRUSHING, SCREENING AND CONVEYING

Above ground material handling equipment must withstand changing weather, extreme temperature fluctuations, heavy loads and large amounts of dust, mud and grime. These challenges are quickly defeated with the full line of solid block and split block housed units from Timken. The durability of our tapered roller bearings, spherical roller bearings and ball bearings combined with innovative housings and seal design provide reliability and performance to improve productivity.

### TIMKEN SOLUTION SUCCESS:

#### *Out-of-the-Box Solution Improves Boxley's Conveyor Performance*

In Mill Point, W. Va., Boxley's maintenance team doesn't have to worry about unexpected conveyor stoppages caused by premature bearing damage. That's because the quarry switched to Timken® Type E tapered roller bearing housed units after having trouble with a competing product.

"The old housed units lasted an average of six to nine months in

our tougher applications," said Howard Walker, Mill Point quarry superintendent. "We wanted to lengthen that time and reduce the amount of unplanned downtime."

The Mill Point maintenance team installed Timken Type E housed units in the positions experiencing the most frequent failures. The conversion was easy since Timken Type E housed units are interchangeable

with other brands. After testing the initial units, the quarry switched exclusively to Timken Type E housed units for its entire conveyor lineup.



## TRAINING & SERVICE ENGINEERING

Timken engineers eagerly share what they know with customers. When they do, mine operators and maintenance crews discover new ways to get more from their equipment.

### Timken Bearing Certified

Companies committed to training and following proper bearing practices may become Timken Bearing Certified. This distinction demonstrates a customer's quality and commitment to industry best practices. Organizations that successfully complete advanced training and undergo an audit of their maintenance practices and facility may become Timken Bearing Certified.

### More Training Options

For the mining industry, Timken conducts a special bearing maintenance training seminar of both classroom instruction and hands-on modules. Core curriculum focuses on the basics of antifriction bearings as well as bearing fundamentals, bearing mounting and adjustment training. Other topics include bearing damage analysis, lubrication basics and seal fundamentals.

### TIMKEN SOLUTION SUCCESS:

#### *Back to School with Timken Bearing Certified*

Understanding how to properly maintain mining equipment can mean the difference between gaining and losing time and money. Take the word of Marty Brown, maintenance training supervisor at Cloud Peak's Cordero Rojo Mine in Wyoming.

"Education is an invaluable investment," he said. "Without it, you are forced to learn from your

mistakes, rather than avoiding them altogether. If you understand how a product or piece of equipment operates, you can keep it working instead of being on the clean-up crew."

Cloud Peak Energy participates in the Timken Bearing Certified Maintenance Program. Each year, Timken service engineers conduct a performance audit. Facilities that meet the criteria

earn the Timken Bearing Certified designation, and additional training is provided where gaps are apparent.

All Timken maintenance seminars are customized for each facility's requirements. Half-, full- or two-day seminars are created from an extensive list of topics and conducted on site or at a nearby location.



## BEARING & GEARBOX REPAIR

Highly-engineered, massive mining equipment components like bearings and gears are expensive to replace. Why not save on lead times and budget by repairing and reusing existing components?

In the process of remanufacturing and repairing bearings, Timken can increase the life of the original bearing by up to three times and save you up to 60 percent off the cost of buying a new bearing. We perform repairs on any brand and type of bearing up to 2134 mm (84 in.) outside diameter.

With the acquisition of Philadelphia Gear® products and services, Timken also provides gearbox solutions used in coal, copper, iron ore and precious metals mining. That includes gearbox repairs and rebuilds by gearbox experts who have the same mission you do – to maximize your uptime and increase profits.



**PHILADELPHIA  
GEAR** © A Timken Brand

### TIMKEN SOLUTION SUCCESS:

#### *Repair Saves Time, and Time is Money*

In steep angle slope and overland conveyors, an instantaneous reverse of tension can be fatal to the belt. Constantly replacing those belts is frustrating, time consuming and very expensive. Using its vast engineering expertise, Philadelphia Gear® – a Timken brand – improved belt reliability on the highest tension, steepest angle slope belt conveyor in the Americas.

Flywheels are typically used to prevent belt failure in the event of a power or prime mover failure. By mounting the flywheel on the high-speed shaft behind the first stage pinion, the gear services team was able to reduce the flywheel mass compared to those mounted to the intermediate or low-speed shaft.

In addition to improving belt reliability, this reconfiguration reduced the amount of required maintenance in two ways. First, it eliminated the need for another assembly to be mounted on its pillow block bearings. Second, the change eliminated a coupling connection and a set of support bearings, dramatically reducing the complexity of equipment alignment.

# TIMKEN BEARING SOLUTIONS FOR ABOVE GROUND MINING



## Tapered Roller Bearings

Timken is the industry standard for tapered roller bearing quality and performance. Benefits include:

- Reduced energy consumption through enhanced surface finishes and optimized internal geometry
- Longer bearing life and greater reliability due to positive roller alignment
- Optimized bearing performance through application-specific endplay and preload conditions
- The industry's broadest range of sizes and configurations

*Applications: haul trucks, shovels, gear drives, draglines*

## Debris-Resistant Bearings

- Timken debris-resistant bearings extend bearing life up to 3.5 times and are ideal for tough, dirty conditions
- Proprietary alloy heat-treatment modifications and diamond-like coating technology interrupt adhesive wear and can self-repair any microcracking
- Advanced manufacturing processes allow Timken to offer these bearings economically in both large and small quantities

*Applications: haul trucks*



## Cylindrical Roller Bearings

Our full range of Timken® cylindrical roller bearings includes single- and double-row configurations. Our EMA series offers greater performance than the leading high-performance industry designs.

- Designs provide option to manage axial loads in either one or both directions, or permit axial float in two directions
- Surface finishes on the EMA series nearly double the operating lambda ratio, resulting in 1.5 times increase in predicted bearing life
- Timken EMA series cylindrical roller bearings feature a one-piece brass cage that minimizes drag on the rolling elements reducing heat and improving bearing life
- Improved lube flow due to open pocket cage design, as well as lubrication holes and grooves
- For mining, Timken offers a complete line of caged and full complement CRBs in single- and double-row designs
- Size ranges available: 60 mm ID – 1,800 mm OD

*Applications: shovels, haul trucks, draglines, crushers, gear drives*



## Spherical Roller Bearings

Timken® spherical roller bearings manage high radial loads even when misalignment, marginal lubrication, contamination, extreme speeds or critical application stresses are present.

- Higher-load and speed ratings allow for enhanced performance levels due to optimized internal geometry and improved surface finishes
- Slotted cage made of hardened steel improves lubrication flow for lower temperatures and increased bearing life
- Timken spherical roller bearings offer a 17 percent increase in average thermal speed ratings over previous designs
- Available with rugged steel (EJ series) and machined brass retainers (EM or EMB series)
- Size ranges: 25 mm ID to 1,800 mm OD

*Applications: shovels, conveyors, draglines, crushers, screens, gear drives*





### Timken® Type E Tapered Roller Bearings Solid Block Housed Units

Timken Type E tapered roller bearing housed units are built for rugged applications.

- Enhanced surface textures and profiles on the Type E bearing insert provide 55 percent increased life over industry-standard housed units equipped with Timken bearings
- Significantly reduced contamination ingress and improved grease retention are the result of double lip seals featured on the Type E
- Better corrosion resistance for both the collar and housing from the use of Electro-Coat
- Available in a full range of housed units, including pillow blocks, flanges and take-ups. Shaft size ranges: 1-3/16" thru 5", 35 mm - 125 mm

*Applications: conveyors*



### Timken® Spherical Roller Bearing Solid Block Housed Units

Timken spherical roller bearing housed units combine cast steel housings with

high performance spherical roller bearings for outstanding reliability and durability in rugged conditions.

- Get multiple layers of protection with primary and secondary sealing options, as well as steel covers in sizes to fit all units
- Timken spherical roller bearing housed units run efficiently on misaligned shafts up to + or -1.5 degrees without a reduction in life expectancy
- Spherical roller bearing housed units have 15 sealing and four locking collar options
- Multiple sizes available to accommodate shafts from 1-7/16" to 7", 40 mm to 180 mm

*Applications: conveyors*



### Split Block Housed Units

Timken split block units include a wide range of tough housing designs, seals and accessories for outstanding performance in a compact package.

- Units contain Timken spherical roller bearings with a unique design allowing them to run cooler and more efficiently
- Wide range of options provide effective sealing and lubrication for different operating conditions and speeds
- Readily convert the block from fixed to float by removing the stabilizing ring

- Choose from standard shaft sizes, ranging from 1-3/8" to 19-1/2" bore, 35 mm - 495 mm

*Applications: conveyors, crushers*



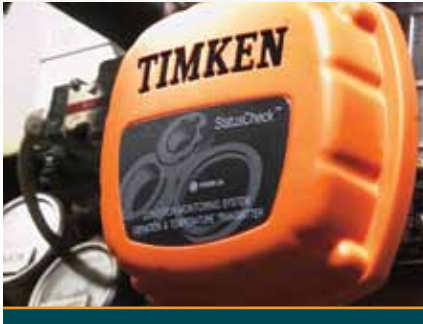
### Ball Housed Units

Timken® ball bearing housed units feature robust housings, bearings and seals designed to offer you a rugged, reliable product.

- Housings are wider along shaft axis and 30 percent heavier than previous designs to offer better bearing seat strength
- Corrosion resistant housings coated with black powder epoxy offer superior performance
- Timken problem solver series offers solutions for the most challenging environments
- Available in many configurations including wide and narrow inner rings, stainless steel housings and a variety of locking systems including eccentric locking collars, concentric locking collars or set screws
- Size ranges: 1/2" to 3" shaft bore, 17 mm - 75 mm

*Applications: conveyors*

# TIMKEN SOLUTIONS FOR ABOVE GROUND MINING



## Condition Monitoring

Identify potential system issues before failure occurs with Timken condition monitoring solutions, which evaluate bearing condition, lubrication quality and machine vibration. Customized programs reduce maintenance and capital expenses while increasing productivity, uptime and safety. Products include a variety of handheld devices and online systems for periodic or continuous monitoring.



## Bearing Repair and Remanufacture

Timken remanufacture and repair can return any brand of bearings to like-new condition, increasing life by up to three times and saving customers up to 60 percent off the cost of buying new. Repairs are possible on a variety of bearing types and sizes up to 2134 mm (84 in.) outside diameter. For the above ground mining industry, Timken repairs tapered, cylindrical and spherical bearings, shafts and housings used in haul trucks, shovels, draglines and conveyors.



## Service Engineering

Timken service engineers bring their expertise to you, ensuring that your equipment is installed properly and operates effectively. They also deliver customized training for your maintenance team.

## Training and Certification

Timken Service Engineering provides the premier bearing maintenance training programs in the mining industry. Timken maintenance training covers all bearing types, is 100% technical in scope and includes both pretests and post tests to assure that students understand the concepts presented. Timken training is modular, thus it can be customized to fit the students needs precisely. Seminars range from two hours to three days in length.



## Reliability Services

Highly trained Timken technicians can evaluate your machine and component conditions – then recommend ways to maximize equipment uptime. To ensure uninterrupted operation, most diagnostic testing is performed without taking equipment offline. When combined with Timken condition monitoring solutions, reliability services offer above ground mining operations a total-system check for the entire operation.



## Gearbox Repair

Philadelphia Gear®, a Timken brand, has long been known for its dedication to quality and its commitment to providing the longest lasting gearboxes in the industry. With expansive knowledge that covers a vast area of the industrial gearbox realm, including crusher drives and variable speed drives, the team has the experience necessary to assist you with your mechanical gears, industrial gearboxes, and gearbox leaks.

When Timken training is followed at a later date by a Timken Bearing Certified Shop Audit, mine maintenance shops can be assured that students not only passed the seminar testing but retained the material for the long term.



### Couplings

Timken elastomeric couplings operate in harsh environments providing you durability while requiring minimum maintenance.

- Elastomeric couplings are easy-to-install, can handle up to 2 degrees of misalignment and require no lubrication
- Reduce downtime and replacement cost by replacing inserts without moving or disassembling the driving or driven equipment
- Elastomeric couplings are interchangeable with most other comparably-sized couplings, regardless of type
- Elastomeric couplings have four insert choices for varying torque needs and temperature ranges
- Timken also offers cast steel couplings. They are an excellent choice for joining shafts of the same size



### Chain

Timken manufactures chains that will stand up to any environment. Timken chains are built to precise specifications for strength and maximum wear life.

- Offering includes a complete line of roller chains, attachment chains and engineered conveyor chains available in a variety of designs to solve the toughest challenges
- Feeder breaker chain is engineered for optimum wear life while handling highly abrasive conditions and heavy shock loads



### Seals

Our complete line of Timken seals keep contaminants out and lubrication in. Suitable options are available for a range of applications and include grease seals, oil seals and advanced bearing isolators in imperial and metric sizes.



### Lubricants

Timken developed its line of application- and environment-specific lubricants by leveraging our knowledge of tribology and anti-friction bearings and how these two elements affect overall system performance. High-temperature, anti-wear and water-resistant additives offer superior protection in challenging environments.

### Lubrication Systems

Timken G-Power and M-Power single-point lubricators, C-Power centralized multi-point lubricators and our global offering of lubrication products consistently distribute grease into machine operations. These canisters can be filled with Timken lubricants or many other types of commercial lubricants and mounted into place with a full line of Timken accessories.

### Maintenance Tools

Timken maintenance tools make installation, removal and service safer and easier. Choose from a variety of induction heaters, impact fitting tools, and hydraulic and mechanical pullers. Timken field specialists are available for training on proper tool usage and maintenance procedures.



Above ground mining customers bring Timken their greatest challenges, and we deliver. The global Timken team leverages our engineering expertise and draws on our field experience to provide solutions that help you move mountains.

# TIMKEN

Bearings • Steel •  
Power Transmission Systems •  
Precision Components • Gears •  
Chain • Augers • Seals •  
Lubrication • Industrial Services •  
Remanufacture and Repair

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