

FINDING A BETTER SOLUTION

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DEMONSTRATES HOW BETTER BEARING SOLUTIONS
CAN MAKE CEMENT PLANTS MORE PRODUCTIVE.

Introduction

Industry consolidation and competition are putting cement plants under intense financial pressure. Today, the cement industry is looking closely at ways to operate heavy equipment such as vertical roller mills, conveyors, fans and blowers, bucket elevators, crushers, and kilns at lower costs.

In many machines, upgrading standard bearings to those specifically engineered for harsh environments can greatly improve Mean Time Between Failure (MTBF). There are also housed units with secondary seals that better prevent against damage and debris. When used throughout a plant, these friction management solutions can save companies hundreds of thousands of dollars a year or more. And at other times, repairing bearings or stocking spares can dramatically reduce total costs.

The know-how to tackle tough environments

Exposure to severe shock loads and contamination makes cement equipment among the toughest applications for precision components, particularly roller bearings. Keeping machine availability high and cost of ownership low in harsh conditions requires specialised engineering and materials knowledge from the bearing supplier. The standard bearings found on many types of

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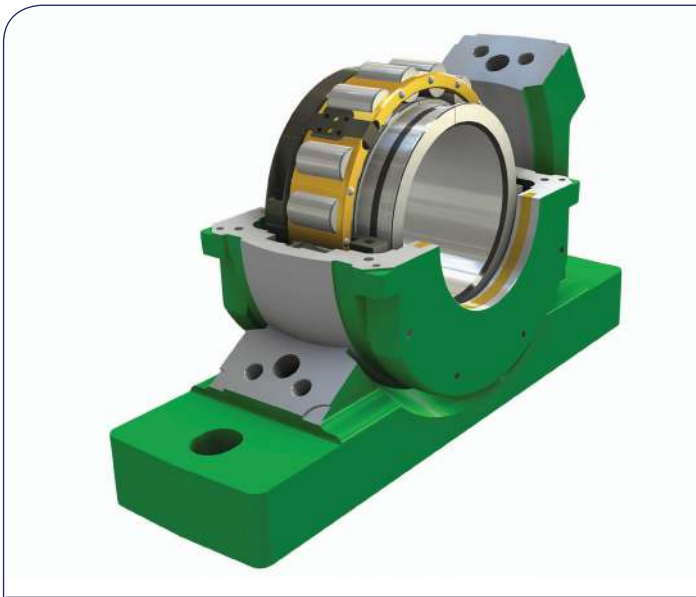


Figure 1. Split-block housing allows easy bearing change-outs without removing the shaft.



Figure 2. Cast steel solid-block housed unit with high-performance spherical roller bearing.

equipment can show signs of failure after just a few months of service, often due to damage caused by dirt, water and other debris. The problem is that most customers expect between three to five years of consistent performance before needing to replace critical bearings, and many do not budget for repairs.

By collaborating with OEMs and working hand-in-hand with plant personnel in all parts of the world, Timken is able to recommend specific steps to improve equipment performance where cement production makes the reliable operation of roller bearings a constant challenge.

Common challenges and solutions

From material prep, grinding and mixing to clinker production and finishing, the cement process is demanding at every step. While each machine has its

own considerations, there are some commonalities to keep in mind when assessing the performance of roller bearings.

Vertical roller mills

Vertical roller mills and gear drives are subject to high temperatures, slow rotational speeds, extreme debris and high moment loads. These strenuous conditions can quickly reduce bearing life and increase cost of ownership.

Many times, tapered, cylindrical and spherical roller bearings with optimised surface finishes and internal geometries can be incorporated throughout a vertical roller mill and its gear drive. These bearings, engineered specifically for difficult applications, can operate at lower temperatures than standard bearings, meaning better efficiency and longer life in most machines.

Over time, the cost of an upgraded bearing solution can be significantly less than taking machines offline to make unplanned repairs.

Hydraulic roller press

Common application challenges for a roller press include high roller contact stress and extreme debris. In addition, presses are subject to high temperatures and heavy loads. Here again, an upgraded spherical or cylindrical roller bearing solution can support multiple needs in most facilities.

At one Southeast Asia cement plant, the company was dissatisfied with its through-hardened bearings, so Timken offered case-carburised bearings as an alternative. Case-carburised bearings have a tough, ductile core combined with a hard, wear-resistant outer surface. The core enhances the ability to endure heavy shock loads without damage. It also improves the bearing's ability to operate where dirt and debris are present.

During initial use, the new case-carburised bearings lasted an additional 18 to 24 months and were better able to withstand the shocks that the hydraulic roller press in the finishing mill constantly undergoes.

Bucket elevators

Bucket elevators encounter moderate bearing loading and slow speeds, exposure to external temperatures and weather conditions, abrasive dust contaminants, and frozen clumps of material that can create impact loads.

These elevators tend to use tapered and spherical roller bearing housed units (bore sizes: 100 – 200 mm) and can likewise benefit from improved designs having more robust seals.

Often, bearing life can be improved by using spherical roller bearings in split-block housings to support the pinion shafts and drive systems. Many

Quick-fit housing restarts cement plant in hours

Hubert Roth, a Timken service engineer, stood on a platform high above ground, bracing himself against cold temperatures, wind and rain. He was at a cement plant in Belgium to replace a housed unit located between the bucket elevator and the gearbox/motor assembly. Production was at a standstill until the new unit could be installed.

Replacing the old unit with a new split-block cylindrical roller bearing housed unit took just one-sixth of the usual installation time. The split-block unit's precisely angled support pedestal eliminated the need to dismount the motor and gearbox from the shaft (usually two workdays) and avoided rental of a crane to lift the shaft (usually one workday).

"We simply cut the old housed unit off the shaft, and slid the new quick-fit unit into position in just a half day's work," Roth said. "Because we were able to avoid moving the shaft, we didn't need to realign the motor and gearbox. By reducing downtime and eliminating crane rental fees, that added up to about €300 000 in savings for our customer."

split-block housings combine rugged cast-iron or cast-steel construction with a high-capacity roller bearing. The convenient split housing design greatly simplifies assembly and service by allowing the bearing and housing to be assembled around the shaft, as shown in Figure 1.

Conveyors

At the heart of material handling are conveyors, which must run safely and reliably while withstanding tough indoor and outdoor conditions. Heavy loads, excessive debris, temperature fluctuations and weather all create an operating environment that requires a proven bearing solution.

Today, equipment operators can take advantage of a full range of tapered and spherical roller bearing housed units that are specially designed for material handling applications. Popular choices for meeting the rigorous requirements of cement production include Type E tapered roller bearing housed units, SAF/SNT pillow blocks and solid-block housed units with cast steel housings.

For cement plants that have experienced frequent bearing failures due to debris, one option to consider is a spherical roller bearing solid-block housed unit that uses primary and secondary seals to provide greater protection from contaminants. While standard split-block units tend to offer a range of maintenance advantages,

sealing performance can still be an issue in some applications.

Figure 2 shows a cast steel solid-block housing with multiple sealing mechanisms to add layers of protection from harsh conditions. These labyrinth and triple-lip seal options, being made from polytetrafluoroethylene (Teflon®), nitrile or urethane, are impervious to most chemicals and can operate at higher temperatures than standard seals.

In this design, a secondary seal also protects the primary seal, and the space between functions as a fillable grease cavity creating extra protection. The use of a spherical roller bearing, meanwhile, allows the solid-block unit to run efficiently on misaligned shafts up to $\pm 0.75^\circ$ without a reduction in life expectancy. As with most large equipment, the need to manage heavy and unpredictable loads is a critical consideration for conveyors.

Crushers

High temperatures and shock loads contribute to numerous bearing failures in crushers. At one cement plant in Fieni, Romania, the bearings on the motor belt pulley that drives the hammers inside the rock crusher were failing every three months.

Timken engineers studied the system and recommended new spherical roller bearings to replace the previous cylindrical and ball bearings. A lubrication analysis was also conducted to determine the right type and amount of grease, and the proper re-lubrication intervals.

At last report, the crusher had run for more than 18 months without a breakdown – six times longer than with standard bearings. This has allowed the plant to move to an annual maintenance schedule, rather than repeatedly stop production to deal with surprises.

Shaker screens

Fine grained spalling, denting and wear are common problems for spherical and cylindrical bearings in shaker screens. A better solution can save on routine maintenance and replacement. For instance, optimised bearings can last years longer than ordinary, off-the-shelf bearings that were not originally designed with the unique demands of a cement plant in mind.

OEMs may choose to build their machines with the best bearings available for the job, while other times a 'suitable' solution is specified because of cost considerations. If you are at all unsure about what is inside your equipment, schedule time to tour your plant with an expert who can make recommendations about the relative fitness of the roller bearings operating in your facility.

Many more cement plant applications including kilns, pumps, fans and blowers can take advantage of an improved bearing arrangement that offers longer life in rugged environments. Tapered, spherical

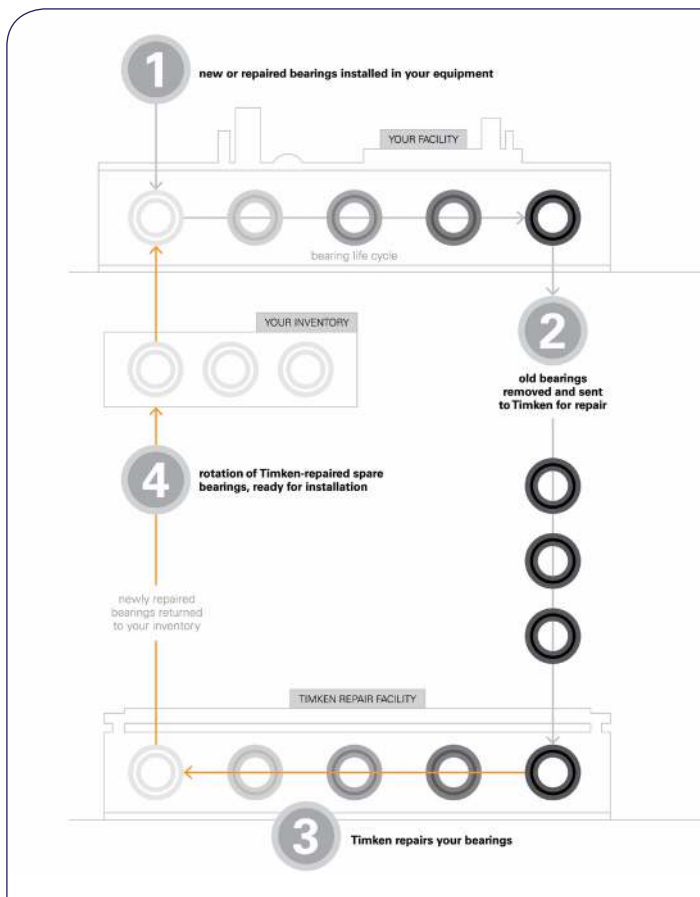


Figure 3. With each repair cycle, you could save up to 60% of the cost of replacing the bearing; repair the same bearing twice, and you could cover the cost of a new bearing.

and cylindrical roller bearings optimised for severe duty are a good place to start, as are housed units that work harder to keep harmful materials from damaging sensitive roller and raceway surfaces.

When to repair bearings

When to repair and when to replace bearings is a decision for the plant owner. There are times when the best option is to repair the bearing you already have. In fact, the cost of a remanufactured bearing can be 20 – 60% less than that of a brand new bearing. It can also take a fraction of the time to get remanufactured components opposed to new components.

Depending on the type of repair, research has shown it is possible to restore the full, useful life of roller bearings.¹ In many cases, a bearing is repairable multiple times without sacrificing quality.

An expert can help you to identify bearings in need of remanufacturing, including the type of damage, the root-cause and the best repair method. Signs or reasons that a bearing may need repair include:

- During routine maintenance it is deemed 'ready for replacement'.

- The bearing exceeds an operating temperature of 200°F (93°C).
- The bearing is exposed to excessive vibration or emits excessive noise.
- There is a sudden drop or gain in lubrication in the bearing.
- The bearing loses seal integrity.

Save with spares

You can further reduce your overall costs by building a critical spares inventory. With new bearings in operation, send the out-of-service bearings to the manufacturer for repair. When it is time to replace bearings, you can install the remanufactured unit from your inventory, avoiding stock-outs and downtime. As this cycle repeats, you continue to lower your costs.

Do not wait until your machine is down

There are many bearing considerations at a typical cement plant. During site visits, Timken often finds multiple occasions of equipment starting to fail. Early detection of these issues can save cement makers considerable time and money in the long run. Plant managers and company executives widely acknowledge that a better bearing solution can pay for itself many times over in the first year when factoring for the cost of:

- Diagnostics/determining what is wrong.
- Replacement materials and parts.
- Purchasing actions to procure replacement materials/parts.
- Analysis of quality problems.
- Planning and corrective actions.
- Supplier corrective actions and change-induced quality costs.
- Sorting/screening out sub-optimal merchandise.
- Carrying extra inventory caused by quality problems.

Choose a knowledgeable partner who will support your plant through any situation to restore equipment to full operation, and who can proactively make suggestions for bearing improvements to avoid problems from the start. The result can be months or years more of trouble-free service.

All Timken friction management and power transmission products and services contribute to the productivity of our customers' operations. Timken engineering allows improvements to both the efficiency and reliability of rotating machinery. This focus on quality can make a critical difference in cement plants where uptime is everything. 🌐

References

1. According to "A Finite Element Model for Rolling Contact Fatigue of Refurbished Bearings" published in Tribology International, Vol. 85, pages 1 – 9.