



TIMKEN®

Debris Solutions

*Addressing Debris Damage
in Operating Systems*

THE TIMKEN COMPANY

A member of the Spexx™ family of performance bearings



Debris is a common cause of premature bearing damage, particularly in harsh industrial environments like mining, construction and rolling mills. The damage that results from debris can significantly deteriorate bearings, which in turn may greatly affect the performance of your equipment.

In many cases, standard Timken® bearings can provide superior performance by minimizing the impact of debris in a given system. In fact, in controlled lab tests under identical debris conditions, Timken standard bearings consistently equaled or outperformed bearings from several major competitors (see Fig. A and B). However, in cases where significant debris problems exist, Timken offers an advanced level of protection and performance – the Timken® debris resistant bearing – available in a wide variety of sizes, bearing types and quantities.

The Timken Company is the industry leader in debris-resistant technology. Years of proactive research and testing have culminated in Timken Debris Solutions, a comprehensive program designed to combat heavy debris damage by bundling a new, high-performance bearing with an innovative, analytical service. This program is designed to boost operating system productivity by reducing downtime and maintenance.

Debris: A bearing's enemy

Contaminants such as sand, dirt, heat-treat scale and metallic wear particles that come in contact with bearing components can reduce fatigue life and ultimately cause bearing failure. Each bearing loss costs money and time in maintenance, replacement parts and diminished productivity.

About our debris-resistant bearings

Timken® debris-resistant bearings are created using proprietary alloy and heat-treatment modifications and hard-film coating technology to optimize their mechanical properties. Timken's debris technology can interrupt adhesive wear and can self-repair micro-cracking, providing customers with reliable, extended life performance.

Head-to-head tests have shown that *standard* Timken® bearings perform at a level that equals or exceeds those of our competitors' bearings claiming *enhanced* debris resistance (see Fig. B).

Furthermore, Timken® debris-resistant bearings, which rely on Timken-engineered technology, have increased performance up to four times that of standard Timken® bearings in a debris environment (see Fig. C).

Fig. A: Fatigue Test Results – Heavy Debris
Timken® Standard vs. Competitor Standard

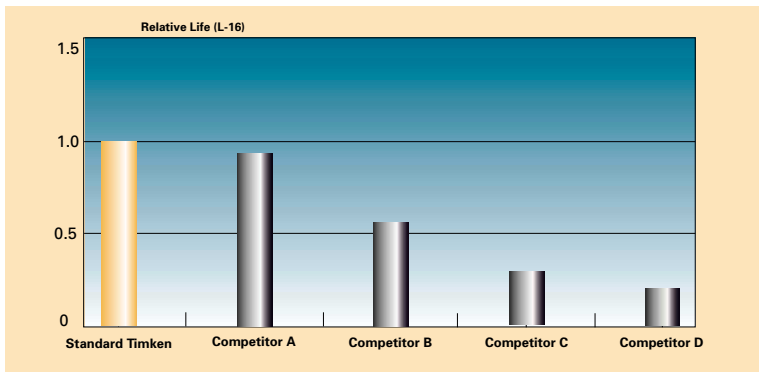


Fig. B: Fatigue Test Results – Various Debris Conditions
Timken® Standard vs. Competitor "Debris-Resistant"

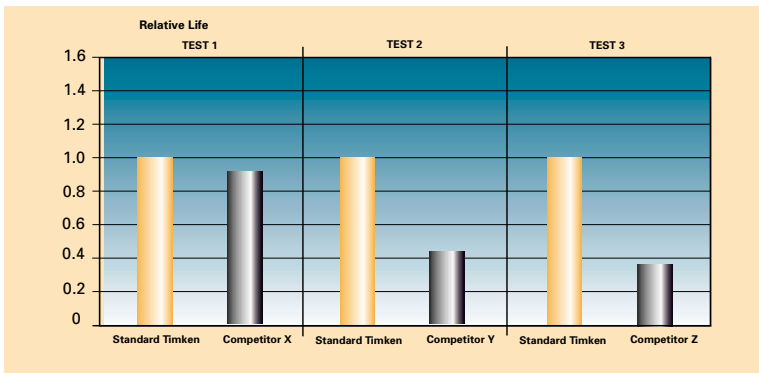
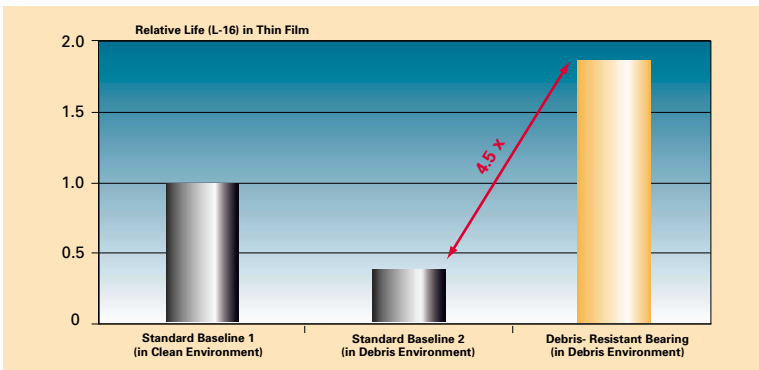


Fig. C: Fatigue Test Results – Moderate Debris
Timken® Standard vs. Timken "Debris-Resistant"



Timken® debris-resistant bearings are available from 8-inch outside diameter (OD) and greater for tapered designs, and 11-inch OD and greater for spherical and cylindrical roller bearings. Our debris-resistant bearings fit into your application's existing envelope size so that costly redesigns are not required. In addition, advanced manufacturing processes allow Timken to offer these bearings economically in both large and small quantities.

With Timken® debris-resistant bearings, you can experience:

- Increased bearing life and productivity without system redesign;
- Reduced operating costs;
- A solutions approach to managing your debris environment;
- Reduced warranty costs; and
- The confidence of knowing your bearings are backed by Timken reliability.

About our debris analysis service

To help determine whether Timken debris-resistant bearings are appropriate for your operating systems, Timken engineers have developed **Debris Signature AnalysisSM**, a viable service that helps quantify the effects of debris in your system.

Using computer-based modeling, Debris Signature Analysis identifies the type and likely source of debris within your system and calculates bearing life reduction for preventive maintenance plans.

Understanding debris damage

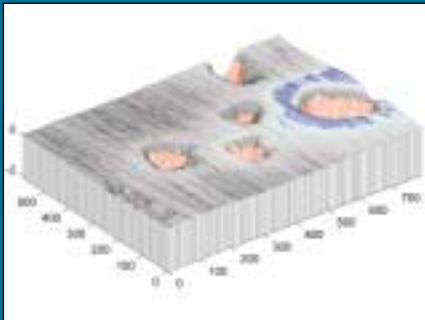
For more than a decade, researchers at The Timken Company have studied debris environments and their effect on bearing systems. Throughout the 1990s, our engineers documented their research in a series of technical papers. Now, those findings have become the foundation for the debris solutions program.

Common sources of debris contamination:

- **External** – dirt, sand, scale and environmental particles
- **Internal** – wear from gears, splines, seals, clutches, brakes, joints and failed or spalled components
- **Latent residue from manufacturing** – metal chips, foundry sand or scale, gear-marking compounds and dirt

Large particles travel through the bearing within the lubrication and bruise the contacting surfaces. The dents form shoulders – some severe – that act as surface-stress risers, causing premature surface damage (see Fig. D) and reduced bearing life. Metallic debris particles can cause the most severe bearing damage for a given particle size and concentration.

Fig. D:
Surface Map of Several Dents



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Turn to The Timken Company

As part of our Spexx™ family of bearings and related products, Timken Debris Solutions is one way to increase bearing life, reduce downtime and enhance productivity in demanding environments. Our Spexx line is rooted in the company's long-standing tradition of quality and engineering expertise by featuring advanced designs made from the best steel and manufacturing processes in the industry. Special coatings, changes in internal geometry and other advancements prolong life and enhance performance in a wide range of industrial settings.

For more information on Debris Solutions, visit timken.com/debris or contact your local Timken sales representative.

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND STEEL