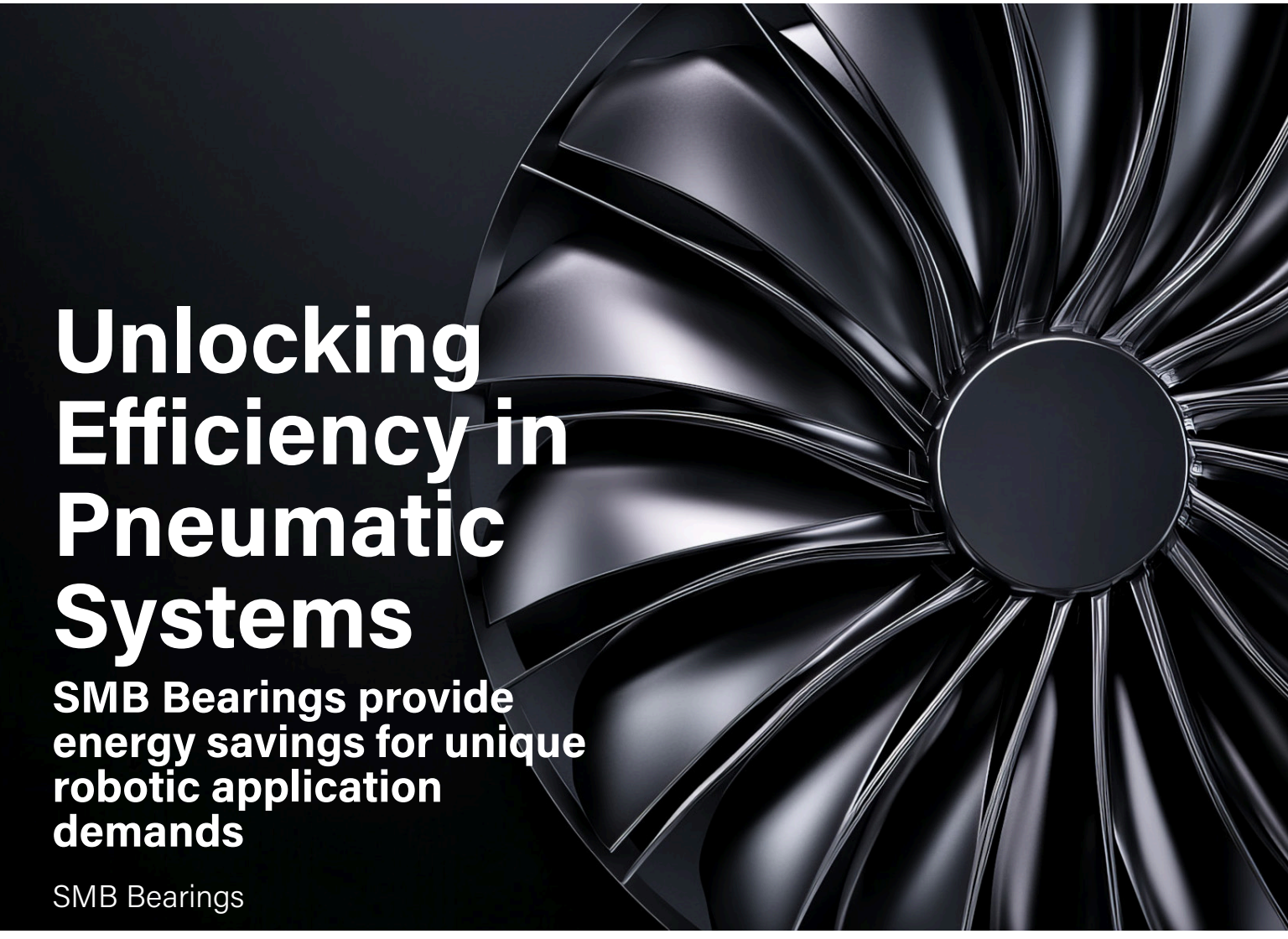

Unlocking Efficiency in Pneumatic Systems

SMB Bearings provide energy savings for unique robotic application demands

SMB Bearings

As industries adopt more automation, the demand for reliable and efficient pneumatic systems, which power everything from robotic arms to air-powered tools, continues to rise. However, despite their widespread use, these systems often suffer from hidden inefficiencies. Here, Chris Johnson, managing director at SMB Bearings—Oxfordshire, U.K.) explores how an overlooked component, industrial bearings, can improve the efficiency of pneumatic technologies.

SMB Bearings originally concentrated on miniature bearings, thin-section bearings and stainless-steel bearings. In response to customer demand, the company expanded the range to include other corrosion resistant bearings such as plastic bearings, 316 stainless bearings and ceramic bearings.

Bearings are essential components in pneumatic systems, responsible for reducing friction between moving parts and ensuring smooth operation. Over time, however, bearings can degrade, leading to increased resistance, higher energy consumption and ultimately, system inefficiency.

In pneumatic applications, even slight increases in friction can result in significant energy losses. For instance, air turbines and expanders used in compressed air energy storage systems rely on bearings to maintain smooth operation. If these bearings become worn or inefficient, the performance of the entire system can suffer.

As industries increasingly rely on automated systems, the demands on pneumatic equipment are becoming more stringent. Bearings that were once considered secondary components are now critical to ensuring efficiency, longevity and cost-effectiveness. Yet, too many companies continue to use bearings that are not suited to pneumatic systems.

Determining the Right Bearing Fit

In this excerpt from the SMB Bearings blog, Chris Johnson, explores why precision fits demand greater attention from engineers and manufacturers:

Determining the most suitable fit begins with evaluating key operational factors. Load and speed are crucial considerations. High-speed applications often require tighter tolerances to minimize vibration and prevent slippage, whereas heavy-load machinery relies on interference fits to secure components and withstand significant forces.

Engineers also need to consider the operating environment. Harsh conditions, such as exposure to extreme temperatures or contaminants, may necessitate precise adjustments to maintain sealing integrity and protect against wear.

Thermal expansion is another critical factor. Material expansion rates must align to avoid performance issues caused by mismatched thermal changes. For example, in applications involving steel bearings housed in aluminum, the higher expansion rate of aluminum must be accounted for to prevent loosening during operation. Similarly, the operating temperature range of the machinery should guide the decision about fits to ensure consistent performance over time.

Maintenance considerations also play a role in fit selection. Bearings that require frequent removal for servicing or replacement benefit from transition fits, which facilitate disassembly without sacrificing operational stability. By factoring in these maintenance needs during the design phase, engineers can achieve a balance between ease of access and reliable performance.

Despite its importance, fit selection often takes a backseat to other design considerations. This oversight may stem from a lack of awareness about the impact of fits or an overreliance on standard configurations that fail to meet the unique needs of specific applications.

Industry standards and guidelines, such as those from The International Organization for Standardization (ISO), offer valuable frameworks but must be applied judiciously to account for application-specific requirements.

Addressing this issue requires a proactive approach. By consulting a bearing specialist early in the design phase, engineers can achieve optimal fits that prolong bearing life, reduce maintenance costs and enhance equipment performance.

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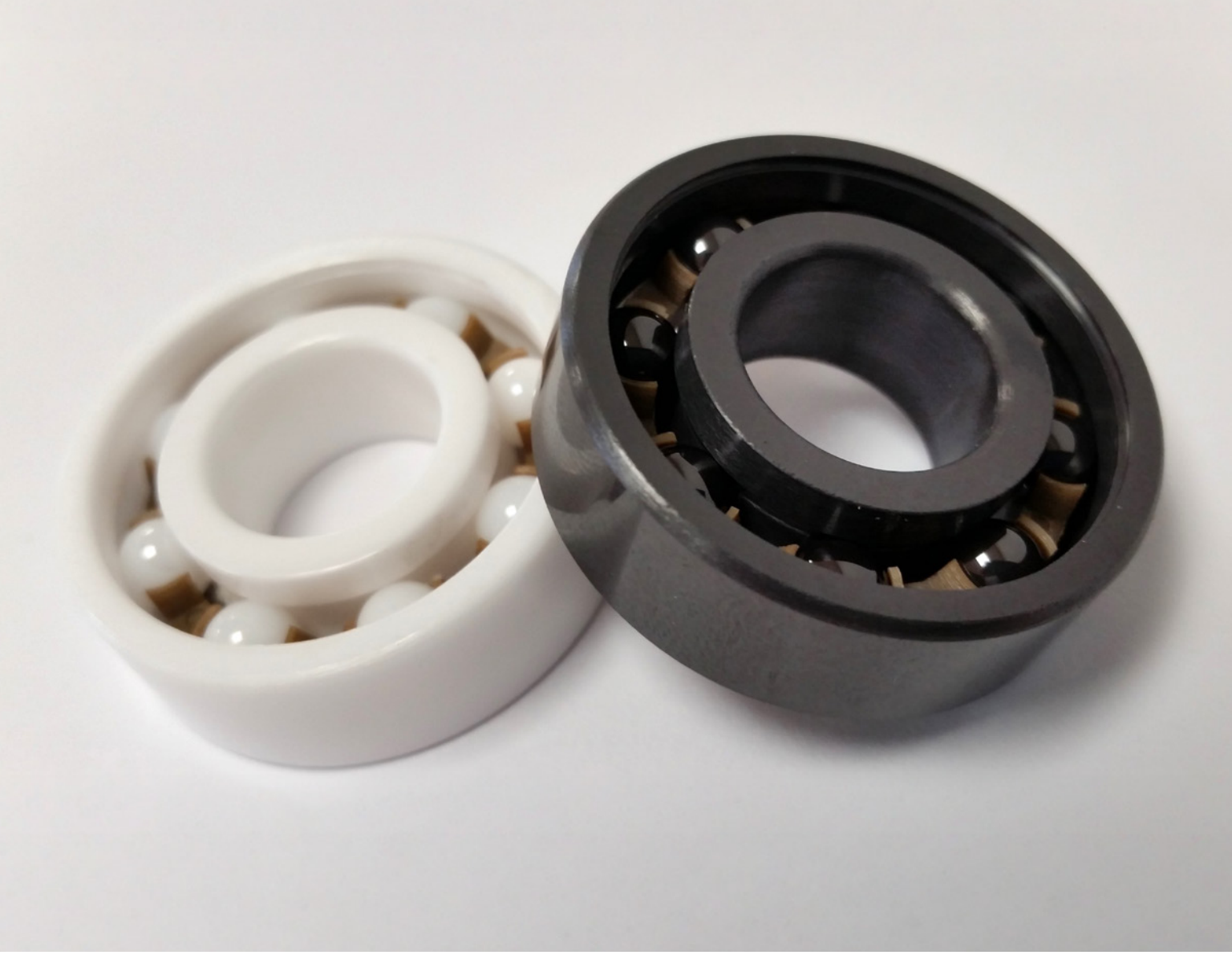
Optimizing bearings for maximum efficiency

To tackle inefficiencies, many industries are turning to more advanced bearing technologies. Traditional metal bearings may not provide the performance needed for modern, high-performance pneumatic systems. The solution? Advanced materials such as ceramic or hybrid bearings, which offer lower friction, better wear resistance and longer lifespans.

Ceramic and hybrid bearings are designed to reduce friction in pneumatic systems, which directly



SMB's EZO thin-type precision bearings are highly accurate due to quality control and advanced manufacturing techniques.

translates to lower energy consumption and improved system performance. These bearings not only reduce the strain on pneumatic systems but also extend the life of equipment, leading to fewer repairs and less downtime.

SMB Bearings, for example, offers a range of miniature, ceramic and stainless-steel bearings tailored to the specific demands of pneumatic systems. These bearings provide reduced friction and enhanced durability, which can help manufacturers cut energy costs and improve overall system efficiency.

The benefits of smart monitoring

In addition to upgrading mechanical components like bearings, manufacturers are increasingly incorporating smart technologies into their pneumatic systems. The Internet of Things (IoT) has allowed for real-time monitoring of energy consumption, enabling more precise control over system operation. Through IoT-enabled sensors and automated adjustments, manufacturers can optimize parameters such as air pressure and compressor operation to reduce energy use.

These smart systems not only improve energy efficiency but also help prevent unexpected failures by providing early warnings of potential issues. By integrating advanced monitoring technologies with high-performance bearings, companies can ensure that their pneumatic systems are operating at peak efficiency, leading to reduced energy costs and improved sustainability.

EZO bearings in robotics and automation

SMB Bearings is already supporting robotic applications. In one case, it collaborated with Shadow Robot Company to supply precision EZO thin-type bearings for its Smart Grasping System. Standard industrial grippers are designed for repetitive tasks, often limited to handling a single object type. However, modern manufacturing demands greater flexibility. Manufacturers now require adaptable tooling capable of handling various object types, making single-use grippers obsolete.

Built by a founder with no tech background and a bunch of hobbyists meeting in an attic, Shadow Robot Company—headquartered in London—was formed in response to receiving its first order and has flourished over the last two decades. The talented engineers continue to be motivated by the challenge of building next-generation robot systems with advanced dexterity to solve problems and enable innovation. The company is courageous enough to pursue world firsts and never relies on off-the-shelf solutions. Each order is custom built to customer specifications

Shadow Robot Company leveraged its expertise in dexterous robotic hands to create a robust and intelligent Smart Grasping System. This system is designed to recognize different objects and select the appropriate grasp for each.

During development, Shadow Robot Company needed bearings with extremely tight dimensional tolerances to ensure precise movements and easy installation. SMB Bearings, known for its high-quality non-standard bearings, supplied EZO thin-type precision bearings tailored to the project's unique requirements.

The EZO thin-type precision bearings are highly accurate due to EZO's advanced manufacturing techniques and rigorous quality control. In particular, the consistency in bearing shape and size is crucial for maintaining precise robot joint positioning and overall system accuracy.

Shadow Robot Company's research and development team tested different grease levels to find the optimal fill percentage, balancing the need for smooth movement with controlled friction. Once the ideal coefficient of friction was determined, SMB Bearings supplied the required bearings to the exact specifications.

The customer reported that the bearings were very easy to install, with consistent quality and tight tolerances that are essential for repeated assembly and high precision across multiple robots. Shadow Robot also expected the bearings to outlast most other components in the system.

Unlocking the full potential of pneumatic systems requires a holistic approach that goes beyond merely upgrading compressors and air lines. By focusing on the performance of critical components like bearings, manufacturers can achieve substantial energy savings, improve system reliability and reduce operational costs. As industries continue to embrace more sustainable practices, the role of high-performance bearings in pneumatic systems will only become more important.

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