Seals, Shields, and Smart Choices: Understanding Bearing Closures

When selecting the right bearing for an application, choosing the proper closure type; whether open, shielded, or sealed; can significantly impact the performance, reliability, and lifespan of the bearing. This article breaks down the differences between these options and offers guidance for selecting the best enclosure for your application.

Open Bearings: A Minimalist Approach

Open bearings, as the name suggests, are produced without any protective enclosure. This design is highly efficient in enclosed systems with well-controlled lubrication and minimal risk of contamination. Open bearings minimize friction and allow maximum rotational speed, making them ideal in clean environments where maintenance and lubrication are managed externally.

However, in most real-world applications, especially those exposed to contaminants or where maintenance access is limited, capped or closed bearings with integrated seals or shields are preferred.

The Purpose of Closures

All bearing enclosures, whether seals or shields, serve three main purposes:

- **Retain lubrication** within the bearing
- **Exclude external contaminants** like dust, moisture, or particulates
- **Protect the bearing** from handling damage before installation

Closures are typically attached to the outer ring of the bearing. Their interaction with the inner ring, either via a narrow clearance or a sliding contact, determines their sealing efficiency and impact on bearing friction.

Choosing between seals and shields involves trade-offs between sealing performance, friction torque, and speed capability.

Shields: Protection Without Performance Penalty

Shields are designed to provide basic protection while maintaining high-speed capability and low friction torque. They are not in contact with the inner ring but instead maintain a narrow clearance; typically, 0.1 to 0.3 mm for small bearings.

Key Advantages:

- Do not increase friction
- Allow full rotational speed
- Offer cost-effective protection in moderately clean environments

Shields are made of low carbon steel or stainless steel; the same materials used in many bearing retainers. They are identified by:

- **Z** (single shield)
- **ZZ** (double shield)
  under CW Bearing's designation system.

Shields are a popular choice in electric motors, clean automation systems, and applications where lubrication is well-controlled.

Seals: Maximum Protection, Moderate Friction

Seals provide higher sealing efficiency by creating a contact or near-contact interface with the inner ring. This direct barrier offers superior protection against contamination and lubricant leakage. But it does introduce a small amount of friction torque, potentially affecting bearing speed.

Seal Design Enhancements:

If space allows, a "T" or "V" groove may be machined into the inner ring shoulder. These grooves:

- Help trap contaminants
- Improve seal lip positioning
- Enhance the sealing effect by creating a longer, more difficult path for contaminant ingress

If a groove isn't feasible due to space constraints, a non-contact seal is extended as close as possible to the inner ring, maintaining a controlled clearance.

Material Considerations:

Seal materials vary in grease resistance, especially for elastomers like ACM and EPDM. Compatibility with your lubricant is critical. Consult with CW Bearing's engineering team for guidance on specific seal material performance.

Summary: Making the Right Closure Choice

Closure Type	Sealing Efficiency	Friction Torque	Speed Capability	Best For
Open	None	None	Highest	Clean, lubricated systems
Shields (Z/ZZ)	Moderate	None	Highest	Moderate protection, low friction needs
Seals	High	Slight	Moderate to High	Contaminated environments, grease retention

The right enclosure protects your bearing, and your system. Whether you're designing for speed, protection, or long service intervals, understanding the differences between seals and shields is key to **precision in motion**.

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