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Technical Article

Why Hygienic Design Matters in Bearing Selection



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Abstract

Food processors must keep contaminants out of product, and hygienic bearing selection is critical to achieve this. This article explains how to minimize physical, chemical, and microbiological contamination by using hygienically designed bearings that are properly selected for the application.

The principles of hygienic design are discussed, including detectable and corrosion-resistant materials, food contact-compliant materials, robust IP69K sealing, maintenance-free features, and housings designed with cleanliness in mind. It also addresses worker safety regarding exposed rotating shafts: why traditional pop-on or locking end covers can compromise hygiene and how pairing an IP69K insert with a slotted end cover separates sealing from guarding for cleaner, safer operation.

Reducing contamination risk and increasing safety through hygienic bearing systems

Keeping contaminants out of product streams is critical for food processors. Nearly all machine and process design is oriented toward this goal, and bearings are no exception. Bearings that are selected without fully considering hygienic principles or application needs can become pathways for contamination such as physical fragments, chemical leakage, or microbiological growth.

Beyond public health risks, the consequences can include scrap, unplanned downtime, and even product recalls. Choosing application-tailored hygienic bearings reduces those risks while often lowering total cost of ownership and downtime through reduced maintenance and more reliable sanitation.

Where Contamination Starts

Contamination generally falls into three categories. Physical contamination arises when foreign particles, such as loose components or flaked coatings, unintentionally fall into product zones. Chemical contamination can include corrosion or lubricant purge in product areas or chemicals migrating from polymers unsuitable for food contact. Microbiological contamination develops when bacteria colonize dead spaces such as cavities, sharp corners, and rough surfaces that are difficult to properly clean.

Since bearings are so pervasive in manufacturing environments, it is critical to select them with hygienic design in mind to reduce the risk of these three potential sources of contamination.

Controlling Physical Contamination

Reducing physical contamination begins by making it more difficult for fragments to enter the food stream and more detectable if they do. Hygienic bearings use either optically detectable components, such as blue polymers, or metal-detectable components to increase the likelihood of fragments being captured by plant detection systems.

To reduce the risk of fragment intrusion, bearing designs can be simplified to reduce the number of components. In certain applications, self-lubricating polymer bushings can replace rolling element bearings to reduce the number of parts that might loosen or break. Ultimately, the best way to reduce physical contamination risk is by selecting the right bearing for the application. Even a hygienic bearing, if not properly chosen to resist application loads, speeds, or environmental conditions, can experience premature damage and increase the risk of releasing foreign particles.

Controlling Chemical Contamination

Lubrication can pose a significant risk of chemical contamination if not properly managed. Where lubricants are necessary, choose NSF H1 food-grade lubricants and set appropriate regreasing intervals to avoid excessive purge. By using a maintenance-free bearing design, such as solid lubricated bearings, polymer bushings, or sealed-for-life IP69K bearings, this risk could be mitigated by eliminating the need for regreasing altogether.

Food processing often has wet, chemical-rich environments, especially during washdown. To reduce the risk of corrosion contamination, bearings use corrosion-resistant materials. Bearing inserts may be made of hardened stainless steel or coated with a corrosion-resistant material. Bearing housings are typically made of either stainless steel or polymer. Polymer is a good economical option, but it may not have sufficient strength in heavily loaded conditions or may suffer from chemical incompatibility with certain cleaners. Stainless steel has greater strength and is more chemically inert for harsher application conditions.

If a bearing could contact food directly, or if it is used over a product area, it is especially important that the bearing material be rated for food contact. FDA 21 CFR 174-177 gives guidance on the composition of food-contacting materials to reduce the risk of chemical transfer. Hygienic bearing materials should be certified to this standard to ensure food safety.

Finally, bearing seals must be robust enough to keep washdown fluids out and lubricant in. For especially harsh areas, IP69K-rated seals can be used as a sealed-for-life solution. These seals are rated to withstand high-temperature, high-pressure water spray while eliminating the need for regreasing, thereby keeping lubricant in and water out.

Controlling Microbiological Contamination

Any hard-to-reach location that traps moisture and contaminants creates the risk of bacterial growth. These “dead zones” need to be reduced to help prevent microbiological contamination. Design principles to decrease this risk are governed by the USDA, which provides certificates of acceptance for hygienic equipment design.

Hygienic bearing housings are designed with solid mounting faces, large radii, and self-draining geometries that decrease potential residue-trapping areas. These housings also have smooth surface finishes for effective cleaning, as rough textures increase the risk of trapping contaminants. Mounting strategies also matter; housings with built-in standoffs at the mounting holes offer increased access for effective cleaning. By utilizing hygienic design principles, the bearings minimize dead spaces, ensure full coverage during sanitation, and prevent liquids from pooling.



Timken hygienic housing with integrated QuiKlean® standoffs



Timken hygienic end cover

Worker Safety and Hygienic Guarding

Hygienic design must protect people as well as product. OSHA 1910.219(c)(4)(i) requires that shaft ends do not project more than one-half the shaft diameter outside the bearing unless guarded by nonrotating safety caps or safety sleeves. To meet this OSHA standard, plants often use either pop-on end covers or locking sealed end covers. However, the type of cover used has direct implications on hygiene and reliability.

Pop-on end covers are attractive because they install quickly and require minimal hardware. However, their holding force is limited. Under high-pressure washdown or accidental collisions, they can detach, exposing the shaft and introducing physical contamination risk. In product-adjacent areas with aggressive sanitation, this vulnerability can outweigh their convenience.

Locking sealed end covers improve cover retention and prevent access to the rotating shaft. However, they create a sealed cavity around the shaft end. A gasket typically seals the interface between the cover and the housing; if that gasket is damaged or experiences high-pressure washdown beyond its rating, fluids can easily get in but cannot easily get out. This enclosed space then becomes a dead zone where contaminants, moisture, and bacteria accumulate.

A hygienic alternative is to decouple sealing from shaft guarding by pairing an IP69K-rated bearing insert with a slotted end cover. In this configuration, the insert itself resists high-pressure spray and keeps fluids out of the bearing. The slotted cover's primary purpose is then to protect workers while also maintaining hygienic principles. Because the cover is open, washdown can flow through, reach critical surfaces, and drain freely. This reduces potential failure points while minimizing the risk of microbiological contamination. The result is better retention than provided by a pop-on cover, less microbiological risk than with a locking sealed cover, easy visual inspection of the bearing, and a design that allows for easy cleaning of all surfaces.

Choosing the Right Bearing

Hygienic bearing design is a system, not a single feature. Materials, seals, geometries, and shaft guarding must work together to reduce physical, chemical, and microbiological risks while meeting performance demands. If you need technical assistance in selecting the proper hygienic bearing for your equipment, please reach out to your local Timken Company representative to speak with an application or service engineer.

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