



**BEARING
SOLUTIONS FOR
MACHINE TOOL
APPLICATIONS**



Emerson Bearing
Service. Inventory. Solutions.

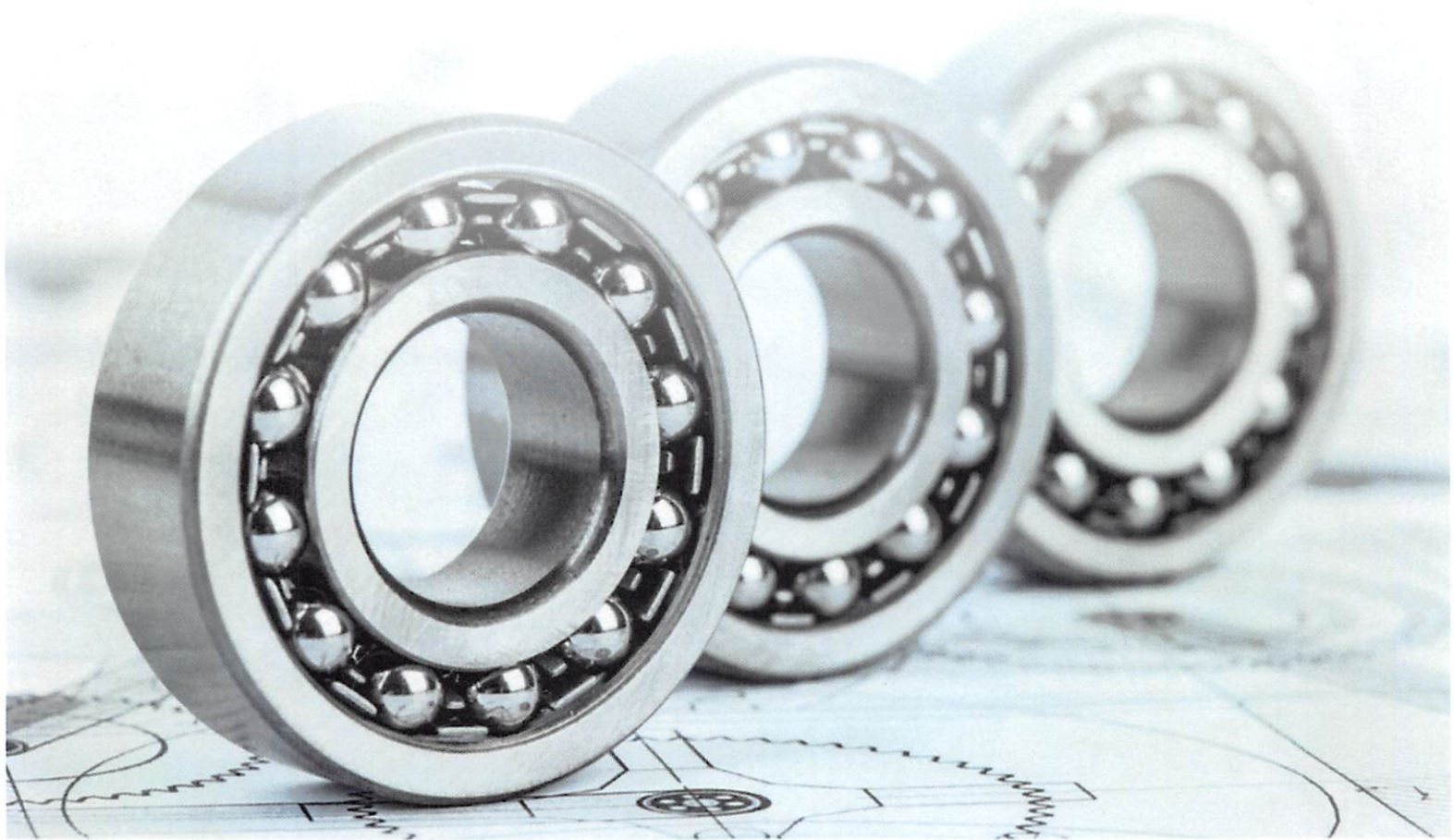


Action Bearing
Service. Inventory. Solutions.

BEARING SOLUTIONS FOR MACHINE TOOL APPLICATIONS

For thousands of years, humans have been using tools for their ability to cut and shape wood, metals, ceramics, and other materials into desired shapes. Compared to modern machine tools, these early tools were relatively straightforward—with simple bearings and guides that utilize direct contact between surfaces. Today, machine tools depend on a variety of high-precision ball screws, roller bearings, and lubricated linear guides to produce quick, precise, efficient results.

A machine's precision relies on the precision of both the bearing and surrounding components. A highly precise bearing must be paired with housing seats and shafts with precise surface quality, roundness, and position. This eBook will go into more detail about the main features of different bearings, their applications, and proper maintenance practices to keep them in optimal condition.



WHAT ARE THE MAIN TYPES OF BEARINGS USED IN MACHINE TOOLS?

The three most important qualities of machine tools are accuracy, speed, and vibration operation. Machine tool bearings are superior to standard bearings in terms of reducing runout and endplay and having a higher limiting speed. These qualities allow machine tools to produce a higher level of precision with tight tolerances. Bearings for standard applications have a designation of ABEC class 1-3, while machine tool bearings are generally ABEC class 5, 7, or 9.

These are the main types of bearings commonly used in machine tools.

Ceramic Hybrid Spindle Bearings

Ceramic hybrid spindle bearings have excellent high-temperature resistance, increased spindle speed, and better stiffness. The ceramic balls run at lower temperatures to help the lubricant last longer. Ceramic bearings also run with less vibration, leading to improved spindle rigidity.

High-Precision Cylindrical Roller Bearings

Often available in single or double row configurations, cylindrical bearings use cylinders as their rolling element. They are designed to handle high-speed applications and large radial loads. These types of tasks require the high running accuracy that these bearings provide.

Ball Screw Support Bearings

Available in high-capacity or high-rigidity versions, these bearings accurately position workpieces or other parts on the machine. Each bearing is specifically crafted for its intended application. Their custom geometries enable them to accommodate axial loads in two directions.

Angular Contact Bearings

Angular contact bearings can handle radial and axial loads at the same time because their inner and outer raceways are designed to offset one another. As the contact angle increases, so does the axial load capacity of the angular contact bearing.

WHAT ARE SOME COMMON APPLICATIONS OF MACHINE TOOL BEARINGS?

Machine tool bearings have unique features, geometries, and materials that are best suited for particular machining applications. Before selecting a bearing, consider your application's expected load pressure, rotating speed, and any temperature fluctuations that may affect the bearing's performance. In general, roller and ball bearings are the most versatile options, used in applications as wide-ranging as medical device and turbine engines.

When you are choosing ball or roller bearings there are four key design factors to keep in mind: **Contact Angle, Preload, and System rigidity, and Speed.**

1 Contact Angle

This is the line of contact along which the ball bearing touches the raceways of the assembly. This line is determined by the thrust loading and radial play. Ideally the contact angle should be 15 degrees. This is the optimal balance between axial and radial capacity and rigidity. A contact angle of 25 degrees will increase rigidity, but also wear.

2 Preload

Preload is a force that holds the raceway and rolling element surfaces under pressure. It's a constant elastic compressive force that stops the parts from moving in an uncontrolled manner, either axially or radially when they under load.

3 System Rigidity

Machine tools generate several different forces that ball and roller bearings have to account for. Factors such as housing and bearing stiffness determine the system rigidity and the ability to produce consistently repeatable precise results.

4 Speed

Higher speeds require higher precision levels for a given shaft diameter. As shaft diameters and speeds increase successively higher precision is required.

OTHER MACHINE TOOL BEARING APPLICATIONS INCLUDE:

Grinding machines

Rotary tables

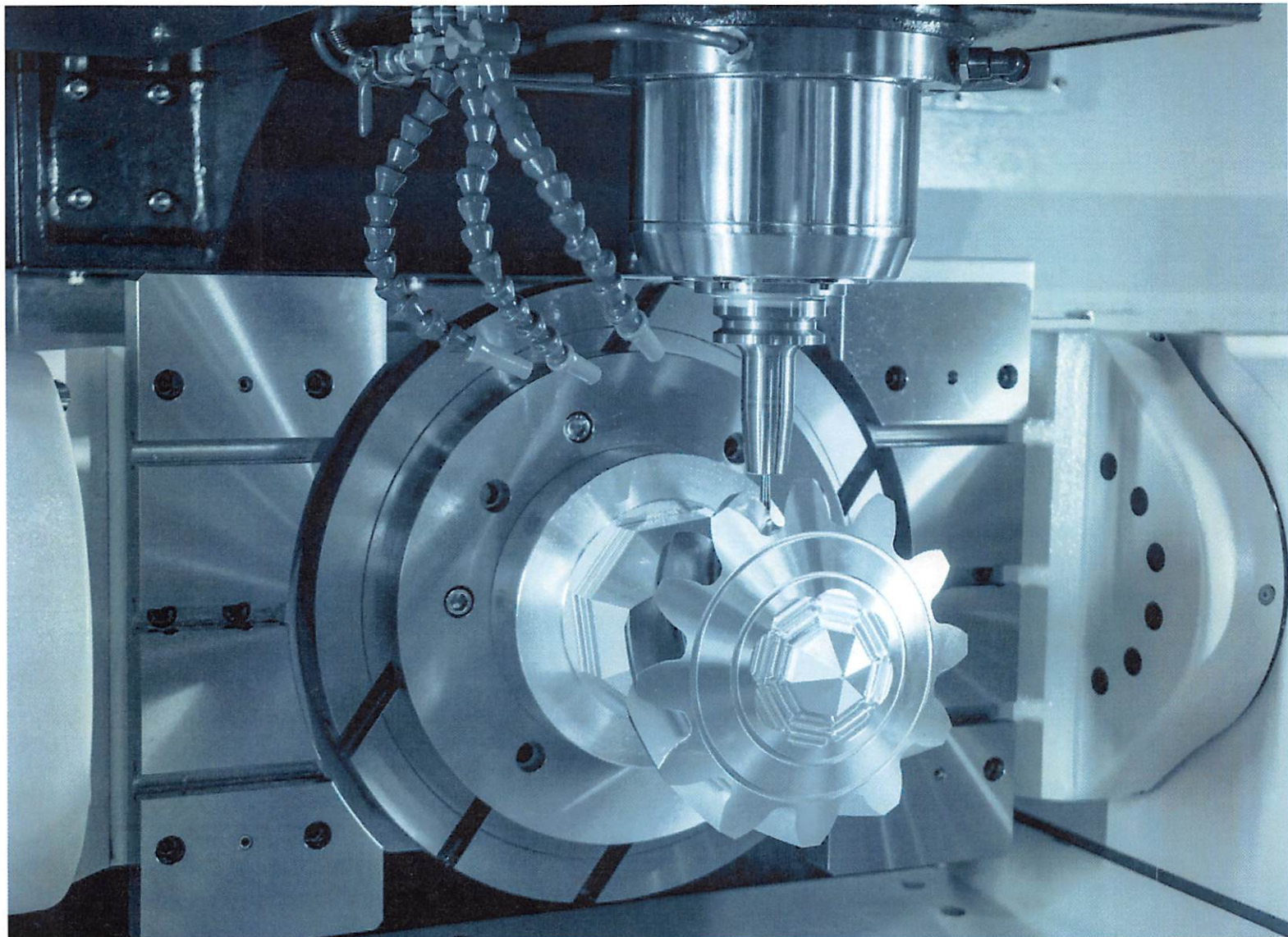
High-speed spindles

Automatic screw machines

Machining centers

Water jet machines

Live and dead centers



HOW TO MAINTAIN PROPER MAINTENANCE AND LUBRICATION

Shafts and housing must be properly matched with the right bearings to achieve ideal accuracy and speed as well as minimize friction-generated heat. A fit that is too tight risks an increase in operating temperatures and premature wear, while an excessively loose fit can cause uneven wear, fretting, and potential overheating issues.

All bearings have a pre-determined life, or a maximum number of rotations it can undergo. These rotations impact the inner rings, outer rings and rolling elements with constant load, which leads to inevitable wear. Factors that can lead to excessive wear and shorten the effective lifespan of precision bearings include:

Inefficient or Full Contact Seals

The more contact a bearing has with a seal the more wear the bearing will undergo. This can wear the sealing element as well as the bearing.

High Speed or Speed Changes

If the bearing is operating at excess speeds, the friction can quickly wear through a bearing. Excess speeds can increase sliding speed, which causes uneven wear. Speed changes can also increase slip and wear.

Poor Environmental Conditions

Dirt, dust and other foreign particles can scratch the running surface and cause wear. The presence of moisture can corrode the surfaces leading to poor performance and shortened life span.

Improper Lubrication

When applied properly, lubrication can reduce heat generation, prevent corrosion and contamination, and prolong the lifespan of the bearings. Lubricants come in either solid or oil/grease formats, and the right selection depends on the intended application. Operators must also follow manufacturers' guidelines and apply the correct type and amount of lubrication—too little and the machine will fail quickly due to metal-on-metal contact, but too much lubrication prevents heat from dissipating and creates buildup that causes bearings to fail as well.

■ CHOOSING AN INDUSTRY LEADER IN EMERSON

Knowing the specialized features of different bearing types is crucial to selecting the right one for your application. Choosing the wrong bearing—or not having it properly maintained or lubricated—can compromise the performance and lifespan of the bearing and your machine. Routine inspections of both machines and bearings are recommended to provide the most accurate information about the health of your machine.

At Emerson Bearing, we are well aware of the increasingly strict industry standards and high demands of today's precision manufacturing machines. With over 50 years of experience, we are a custom bearing supplier serving clients around the world. We have a vast inventory and global sourcing network to meet our customers' timeline, budget, and application requirements. We carry over 20 premium bearing brands—including Nachi, CRAFT, GMN, and OSBORN—and additional products, including couplings, bushings, adhesive sealants, rod ends, and more.

We also provide 24/7 customer service and tailored advice on how to choose the correct precision bearings for specific applications. Our bearing detective services, same-day shipping, online product catalog, OEM expertise, and fixed price program ensure you receive a streamlined one-stop shopping experience.

We carry several brands of Machine Tool bearings that represent many countries of origin and several price points and availability. These include: Barden, EZO, GMN, Nachi, NSK, NTN, RHP and TPI.

[Contact us](#) to learn more about our machine tool bearing solutions.

ABOUT

EMERSON BEARING

For over five decades, the Emerson name has developed and maintained a reputation for high-quality ball and roller bearings. Together, our two companies—Emerson Bearing and Action Bearing—serve the bearing needs of international and domestic customers. The team at Emerson Bearing caters to global niche markets, while the team at our sister company, Action Bearing, specializes in solutions for the OEM and MRO markets in New England.

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