

We pioneer motion

## High-Speed Spindle Bearings

M-series – the all-rounder for machine tools



## Which spindle bearing is the right one for my machine tool?

The very wide range of metal cutting tasks that must now be covered by a single machine tool – especially in the case of milling and turning centers – makes a kind of “all-rounder” spindle bearing support necessary. On the other hand, the market also offers very specialized machine tools for which precisely matched spindle bearing supports are required.

We have therefore developed a very broad spindle bearing portfolio and can offer you an optimum spindle bearing support – from an all-rounder to a specialist – for practically every metal cutting task.

Please remember that a spindle’s performance is only as good as its bearing support. The operating life of spindles is also largely determined by the spindle bearing support. Our goal is to offer you a mechanically and thermally robust bearing system that is specifically matched to your machine tool and application.

This brochure gives you an initial overview of our finely graduated range of High-Speed spindle bearings. It is not uncommon for a long-term customer relationship and development partnership to begin in this way.

# Equipped for all eventualities?

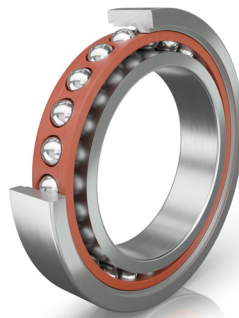
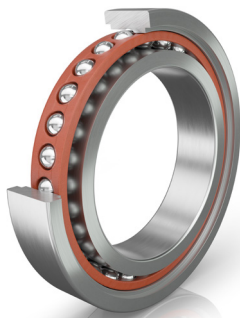
Three fundamental spindle bearing designs have established themselves on the spindle bearing market, and these can be categorized according to the size of the rolling elements:

**Small ball series  
for very high speeds**

**Series with  
medium-size balls**

**Large ball series with  
high load carrying capacity**

**Schaeffler spindle bearings:**



## **H spindle bearings (High-speed design)**

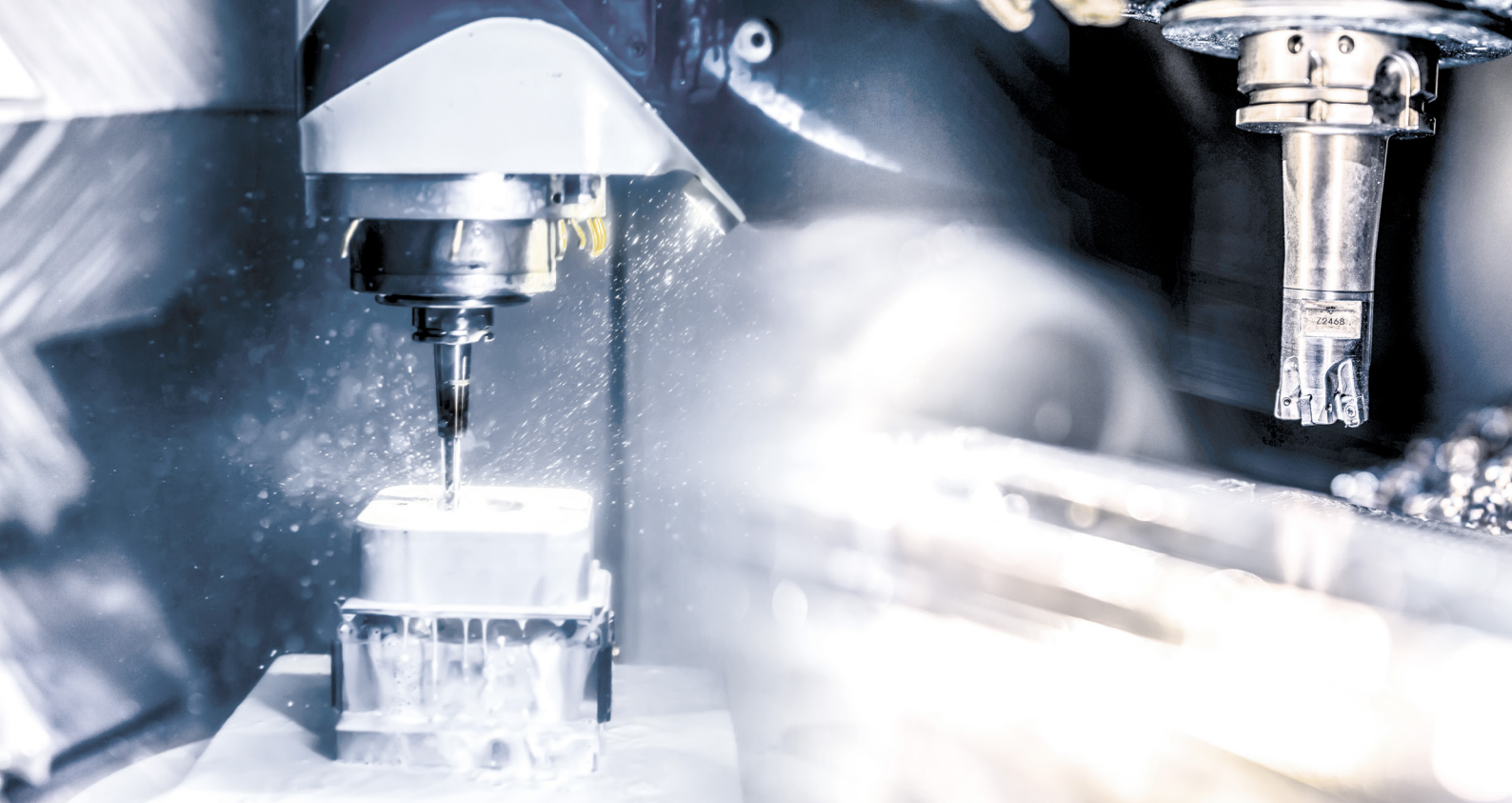
- With small balls
- Contact angle 15° and 25°
- Suitable for very high speeds due to internal construction with optimized friction characteristics and very low centrifugal forces on the rolling elements
- Very high rigidity at high speeds
- Particularly suitable for very high-speed spindles and grinding spindles

## **M spindle bearings**

- Medium-size balls
- Contact angle 17° and 25°
- Suitable for high to very high speeds due to bearing internal construction with optimized friction characteristics
- Kinematic insensitivity to tilting
- Minimal change in bearing preload due to operating parameters (speed and temperature)
- High load carrying capacity especially under combined axial and radial load
- Very high resistance to high temperatures, collisions, and the ingress of contamination in the design with bearing rings made from Vacrodur

## **B spindle bearings**

- Conventional spindle bearing
- With large balls
- Contact angle 15° and 25°
- High load carrying capacity and very high rigidity
- For moderate speed level



Preferred bearing designs have established themselves based on requirements – but the boundaries are not fixed:

#### **Grinding spindles**

Grinding spindles have the following characteristics:

- Very high machining accuracy
- Maximum suitability for high speeds
- High rigidity
- Low heat generation

Here, the spindle bearing with small balls is a frequently used bearing design with its

- suitability for very high speeds
- lower friction and heat generation
- high rigidity during operation at high speeds due to the low ball mass

#### **Milling spindles**

Milling spindles have a very wide range of applications, not least due to different power ratings, tool holders, and depending on the materials to be machined. All three types of spindle bearings are used here.

Typical operating conditions in milling spindles are

- Combined axial and radial loads
- Alternating speeds, wide speed range (small and large tool diameters)
- Fluctuating operating temperatures (absolute temperature and temperature difference)
- Alternating forces (roughing and finish machining)
- Motor spindles are often designed with spring preload in order to compensate changes in the preload due to the influence of speed or temperature

#### **Turning machine spindles**

Turning machine spindles are characterized by the following boundary conditions:

- Moderate speed level
- Shock loads due to tool collisions

Here, spindle bearings with large balls are ideally suited with their

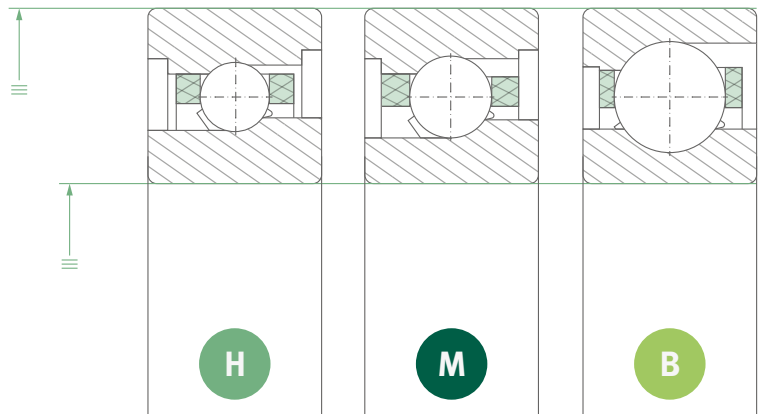
- high dynamic and static load carrying capacity and
- high rigidity

# The all-rounder – bearing with medium-size balls

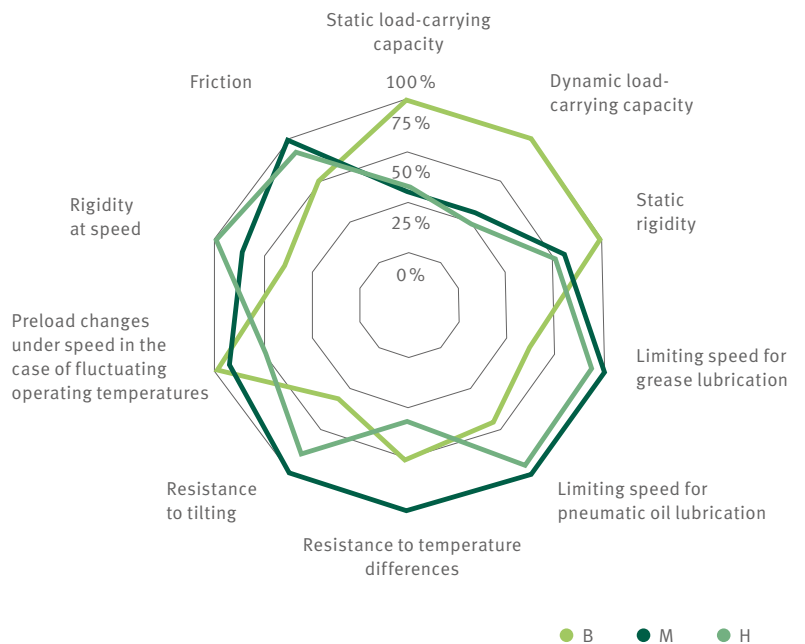
Milling spindle applications are characterized by a very wide range of machining tasks. Form cutters with long protrusions, very high speeds, and minimal cutting depths are just as common as the cutting of high strength materials with milling heads and large feed values at comparatively low speeds. To achieve this range of applications, our development engineers' solution was to combine,

- the kinematic suitability for high speeds of the existing small-ball High-Speed series (H-series)
- with the robustness of large-ball bearings (B-series)

in the spindle bearings with medium-size balls of the M-series.

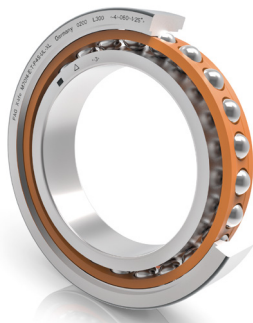


M-series spindle bearings are significantly more resistant to varying operating conditions in the spindle. The minimal increase in bearing preload enables the highest operating and limiting speeds. The optimized internal construction also reduces the influence of tilting on the bearing kinematics and allows a higher load carrying capacity of the spindle under radial loads even with long tool protrusions.



# One series, two contact angles, and three performance classes

Schaeffler offers the new M-series spindle bearings in three performance classes: M, HCM, and VCM. These classes are based on the dimension series 70 and 719. The three classes differ from each other as follows:



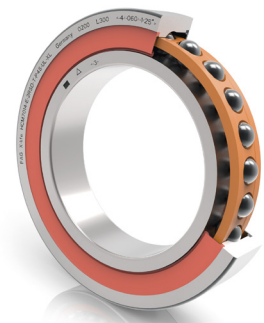
## **M – Cost-effective and robust**

The balls and rings of High-Speed M spindle bearings are manufactured from the proven 100Cr6 rolling bearing steel. This version provides a high-performance, cost-effective bearing solution for motor spindles.



## **HCM – Outstanding productivity thanks to high performance and suitability for high speeds**

High-Speed HCM spindle bearings are equipped with ceramic balls and rings made from 100Cr6 rolling bearing steel. Thanks to its high-performance capability and suitability for very high speeds, the HCM version allows the performance of motor spindles to be increased even further.



## **VCM – A highlight with new design options for motor spindles**

High-Speed VCM spindle bearings also feature balls made from ceramic material, but with bearing rings made from Vacrodur high-performance material. Spindles equipped with VCM spindle bearings achieve very long operating hours even under very difficult operating conditions.

These bearings allow spindle manufacturers to offer particularly robust spindles with a much longer warranty period.

## **Design variants**

M-series spindle bearings can be designed in open versions as well as in sealed and greased versions. The bearings are also available as a “direct lube” version with lubrication holes and seal rings in the outer ring. The bearings are matched for universal use, which means they can be assembled in any configuration without additional outlay.

# What advantages would you like to offer your customer?

With the three spindle bearing series B, M, and H as well as the options of using a rolling bearing steel with a higher load carrying capacity, you can equip practically all conventional spindles with spindle bearings precisely matched to the machine tool and range of machining tasks. This demonstrably increases the mechanical and thermal load carrying capacity and thus the perfor-

mance ranges of your spindles. The M-series, in particular, has proven to be a true all-rounder. In some cases, it is possible to dispense with a complex spring-loaded arrangement in the spindle in favor of a cost-effective, rigidly adjusted bearing support. Put us to the test!

## **Added value for machine tool manufacturers**

Schaeffler's High-Speed spindle bearings offer significant safety reserves and are thus very effective in preventing premature failure of the spindle. Longer machine running times, reduced maintenance costs, and lower unit costs ensure a competitive advantage.

## The advantages for you at a glance



- Reduced overall costs and improved function in the case of rigidly adjusted bearing supports
- Lower maintenance costs
- Highest possible machine availability
- High cutting performance and long operating life
- Extremely thermally stable and robust
- Significant improvement in running time and operating hours
- Improved performance in critical applications

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