

SHIELDS AND SEALS

Your essential guide



An essential guide to shields and seals

So, you've chosen your preferred bearing type? You're not quite done just yet, there are still several important design considerations to bear in mind.

The selection of shields and seals is largely dependent on your desired application and environment, but where do you start in specifying your requirements?

This guide provides a technical introduction to bearing shields and seals, covering the three main options: the metal shield, contact seals and non-contact seals. It explains the key characteristics for each of these options, the lubrication options and application advice.

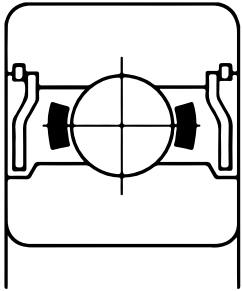
Finally, it wouldn't be an SMB guide without including some FAQs, so we also deal with some of our most common customer queries. If you have any remaining questions after reading this guide, call a member of the SMB Bearings technical team on +44 (0)1993 842555.



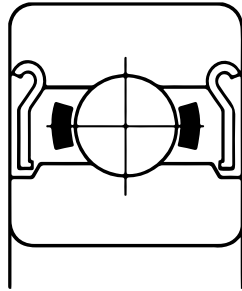
Chris Johnson
Managing director
SMB Bearings

KNOWING THE TERMINOLOGY

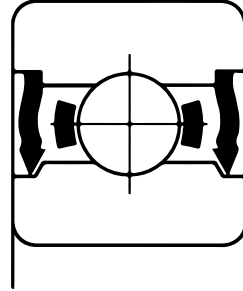
Bearings are available with different types of shields and seals, commonly referred to as closures. These closures are not always essential; however shielded and sealed bearings provide much better protection from contamination and help retain the bearing lubricant.



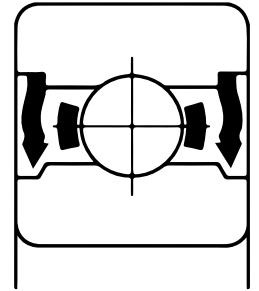
**CIRCLIP
REMOVEABLE
SHIELD (ZZ TYPE)**



**PRESSED NON-
REMOVEABLE
SHIELD (ZZ TYPE)**



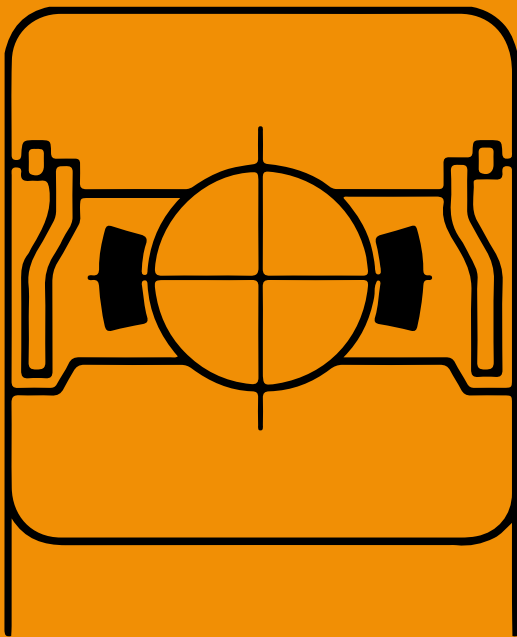
**CONTACT SEAL
(2RS TYPE)**



**NON-CONTACT
SEAL (2RU TYPE)**







SHIELDS (ZZ TYPE)

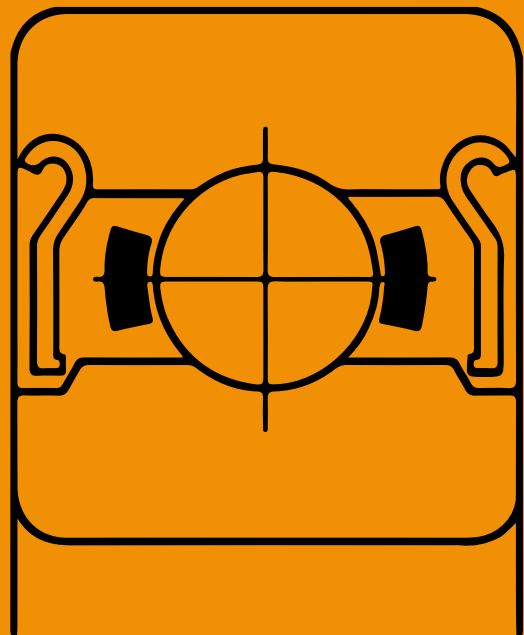


Shields are designed for two main purposes — to prevent larger particles from entering the bearing and to keep grease inside the bearing. A shield may be removable or non-removable but there is no difference in performance. Non-removable shields (or “pressed shields”) are pressed into the bearing’s outer ring, whereas removable shields are retained by a circlip and usually only available on miniature and instrument bearings. Removable shields allow for easier cleaning and relubrication although we at SMB Bearings can relubricate all types.

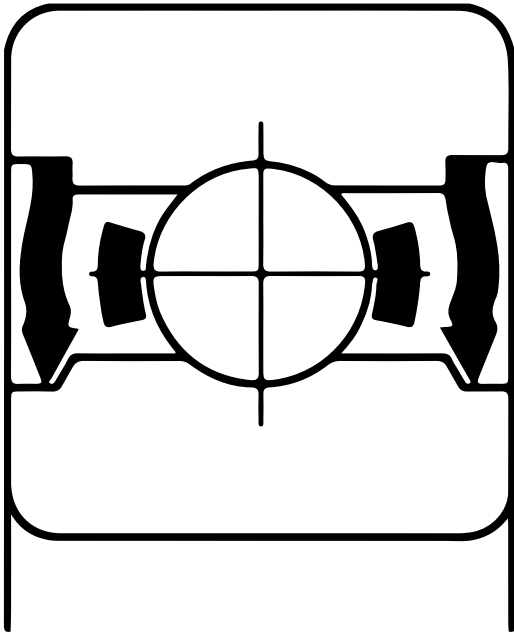
The good news is that most of our bearings are available with metal shields. Shields on stainless steel bearings are generally made from AISI 304 stainless steel. Importantly, the shields make no contact with the inner ring, so they do not increase starting or running torque.

Shields offer the following advantageous properties:

-  Prevent contamination by larger particles
-  Reduce lubricant leakage
-  Do not increase torque
-  Wide temperature range, especially stainless steel



CONTACT SEALS (2RS TYPE)



A contact seal is designed to contact the bearing inner ring with the lip of the seal. The inner lip of the seal rubs against the bearing inner ring to provide an effective seal against smaller particles such as dust and moisture, while preventing lubricant leakage.

The standard bearing seal consists of nitrile/BUNA-N rubber bonded to a metal washer. The washer is made of SPCC cold rolled steel for chrome steel bearings or 304 stainless steel for stainless steel bearings. High temperature PTFE seals (up to 250°C) or Viton seals (up to 230°C) are available on some bearing sizes.

Contact seals produce much higher frictional torque levels than shields and reduce the maximum speed of a bearing. Below -40°C nitrile rubber and Viton will stiffen and provide a less effective seal so PTFE seals or metal shields should be considered for very low temperature applications.

Contact seals offer these properties:

- ⚙️ Good protection against contamination
- ⚙️ Greatly reduce lubricant leakage
- ⚙️ Reduce maximum speed by approximately 40 percent
- ⚙️ Greatly increase bearing torque

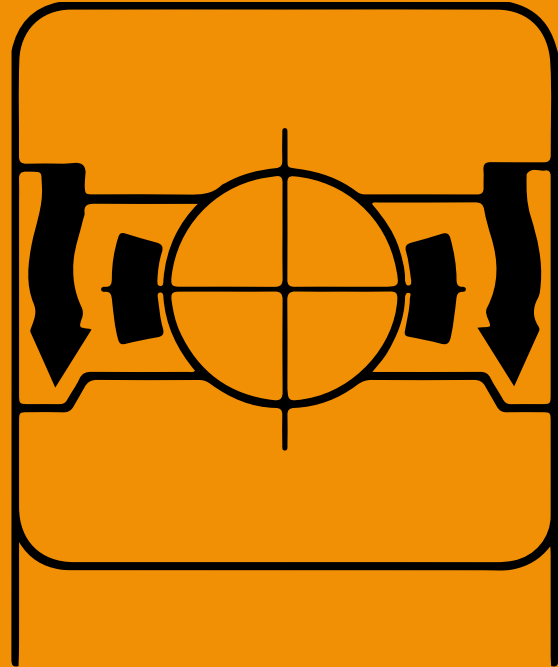


NON-CONTACT SEALS (2RU TYPE)

Often made of nitrile rubber bonded to a metal washer, non-contact seals share some physical similarities with contact seals. However, they do not rub against the bearing inner ring and therefore do not have the same effect on bearing torque and maximum speed.

The seal is fixed into a groove in the outer ring and has a very thin lip adjacent to the inner ring but crucially does not make contact.

Non-contact seals can therefore be used for low torque, high speed applications. They offer superior contamination protection over metal shields but are not as effective sealants as contact seals.



Here are their key advantages:

- ⚙️ Good protection against contamination
- ⚙️ Reduced lubricant leakage
- ⚙️ No torque increase
- ⚙️ Do not affect maximum speed
- ⚙️ No frictional heat increase

COMPARISON

Still confused? We've created this handy comparison table to guide you through some of the important characteristics of shields, contact seals and non-contact seals.

Characteristic	Shield	Contact seal	Non-contact seal
Wear	Minimal maintenance, no component wear	Rubbing wear	Minimal maintenance, no component wear
Speed	Does not increase torque	Greatly increases bearing torque, reduces maximum speed by approximately 40 percent	Does not affect maximum speed
Contamination	Keeps out large particles of dirt, poor water resistance	Keeps out large particles and smaller dust particles	Keeps out large particles and provides superior protection to shields
Materials	Metal, generally AISI 304 stainless steel	Nitrile rubber, PE, Viton, PEEK, PTFE	Nitrile rubber, PE, PEEK, PTFE
Increase in temperature	No frictional heat increase	Increase in heat due to friction	No frictional heat increase
Temperature range	Wide temperature range, especially stainless steel +300°C	-40°C/+110°C for nitrile rubber -190°C/+250°C for PTFE	-40°C/+110°C for nitrile rubber -190°C/+250°C for PTFE

FINDING THE BEST LUBRICANT MATCH

We offer a wide stock of oils and greases. Lubrication provides a thin film between the contact areas in a bearing to reduce friction, dissipate heat and inhibit corrosion on balls and raceways. The lubricant choice will affect maximum running speed and temperature, torque level, noise level and, ultimately, bearing life. There are a range of options depending on your application.

Certain lubricants and chemicals react with rubber, so particular consideration should be placed on lubricant choice, when paired with seal closures. Perfluorinated lubricants or PFPE lubricants are non-flammable, oxygen compatible

and highly resistant to many chemicals. They do not react with plastics or elastomers. Many have low vapour pressure and are suitable for vacuum or clean-room applications. Some can also withstand temperatures of up to 300°C.

Greasing non-removeable shielded bearings can be a challenge, so we've designed bespoke equipment which enables us to apply highly accurate grease fills without removing the shields.

If you're interested in exploring our complete range of oil and grease options, check out our lubrication services guide.



ASKING THE RIGHT QUESTIONS

There are three important application focused questions to consider when choosing between shields and seals:

- 1. Do you require high contamination protection?**
- 2. Will the bearing be operating in extreme temperatures?**
- 3. What speed will the bearing be operating at?**

DO YOU REQUIRE HIGH CONTAMINATION PROTECTION?

For applications in the food and beverage or pharmaceutical industry, equipment must adhere to strict hygiene and safety standards. In these environments, contamination protection is of utmost importance, so opting for a contact seal is favourable to ensure dust does not enter the bearing. For equipment that deals with regular wash-downs, a contact seal will also offer effective water resistance. This will stop grease washing out of the bearing, which leads to excess heat generation and rapid wear. Bearings for these industries often need to be supplied with non-toxic lubricants approved to NSF (formerly USDA) H1 or H2 standards.



WILL THE BEARING BE OPERATING IN EXTREME TEMPERATURE CONDITIONS?

Shielded metal bearings can generally withstand higher temperatures than sealed bearings. For high temperature applications, 440 grade stainless steel bearings can be used at temperatures of up to 300°C. Rubber or plastic will melt if subjected to high temperatures and can cause the bearing to seize or fail if debris enters the bearing. In these scenarios, a shielded bearing is advisable.



WHAT SPEED WILL THE BEARING BE OPERATING AT?

Contact seals reduce the maximum speed of a bearing so for high speed applications, shields or non-contact seals are preferred. This is also the case for low-friction applications such as cycling and skateboarding. Non-contact seals are relatively easy to remove and offer greater contamination protection than shields while not affecting maximum speed or bearing torque.

FREQUENTLY ASKED QUESTIONS



Here are some of the questions the team at SMB Bearings are most commonly asked. We've heard it all, so if you're in need of further advice, get in touch!

WHY DO BEARINGS HAVE SEALS AND SHIELDS?

Shields and seals protect the bearing from contamination such as dust and dirt. Shields keep out larger particles. Seals keep out finer particles such as dust.

The best type of seal for protection against dust is the contact seal (as opposed to a low friction non-contact seal) but they make the bearing more difficult to rotate as the inner lip of the seals drag on the inner ring of the bearing.

Metal shields contact seals and non-contact seals all help to keep lubricating grease inside the bearing. If a bearing is used at higher speeds and oil lubricated by oil jet or oil bath, it should be open to allow the oil to reach the balls and raceways.

Contact rubber seals, although not watertight, also help to prevent liquids from entering the bearing. This is useful in food and beverage applications where equipment is regularly washed down or steam cleaned.



HOW DO YOU REMOVE BEARING SHIELDS?



Only circlip retained bearing shields may be removed for cleaning or relubrication purposes. Use a needle on one end of the circlip to gently remove it from the outer raceway. The shield can then be removed by easing the needle into the gap between inner ring and shield and levering the shield out. Take great care not to push the needle too far inside the bearing as this may damage the bearing retainer. Also, be careful to not dent the shield.

CAN YOU RELUBRICATE BEARINGS WITH SHIELDS AND SEALS?

Yes. Relubricating bearings with shields or seals can increase operational efficiency, energy efficiency and can extend the overall life of the bearing. SMB's expert relubrication system allows us to grease lubricate ball bearings without removing shields, meaning we can happily rework open, shielded and sealed bearings. Whether you need to relubricate a high precision instrument bearing or change the grease type in a deep groove ball bearing with non-removable shields, we have the equipment and the expertise to do it.



HOW DO YOU CLEAN A SEALED BEARING?

Very gently remove the rubber seals by prising out the seal from the inner lip. You can use a penknife or small screwdriver but do not push it too far into the bearing or you may damage the retainer (cage).

Use a degreaser and some paper cloth to make sure you fully clean away all old grease before relubricating. Alternatively, you may use a can of spray degreaser with a fine straw applicator to direct a jet of degreaser into the bearing assembly. It may take a few applications, but make sure to get all the old grease out.

Once satisfied that the bearing is completely grease-free, use a lint-free cloth to dry the bearing. At this point, take the time to inspect the bearing and decide if it needs replacing. Make sure the bearing surfaces are completely clean and oil free before adding new grease.



ANY OTHER QUESTIONS?

Got any more questions about shields and seals? E-mail us at sales@smbbearings.com or call us on +44 (0) 1993 842 555.



www.smbbearings.com



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