## Profile overview

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<td>Nitrile rubber O-ring energizer, PTFE slide ring; also available with polyurethane slide ring to improve wear resistance and ease installation</td>
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<td>Buffer seal with PTFE slide ring, nitrile rubber energizer; patented and improved design to reduce pressure peaks acting on the rod seal and vent pressure back to system side; improved gap extrusion resistance at abrupt pressure peaks; suitable for heavy duty applications</td>
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Rod and buffer seals

Basics

Rod sealing systems

Rod and buffer seals maintain sealing contact in sliding motion between the cylinder head and the piston rod. Depending on the application, a rod sealing system can consist of a rod seal and a buffer seal (→ fig. 1) or a rod seal only (→ fig. 2). Rod sealing systems for heavy duty applications typically consist of a combination of both seal types, whereas the buffer seal is arranged between the rod seal and the piston in the cylinder head.

In addition to the sealing function, rod seals also provide a thin lubrication film on the piston rod that lubricates themselves and the wiper seals. The lubricant also inhibits corrosion of the piston rod surface. However, the lubrication film must be thin enough so that it returns to the cylinder during the return stroke.

Selecting profiles and materials for a rod sealing system is a complex task, considering all cylinder designs and application criteria. SKF supplies rod and buffer seals in many different profiles and in a wide range of materials, series and sizes, which make them appropriate for a wide variety of operating conditions and applications.

Materials

Depending on the profile and the required characteristics of its components, rod and buffer seals can consist of one or several materials. Common materials used for the sealing and energizing elements of rod and buffer seals are thermoplastic polyurethane (TPU), polytetrafluoroethylene (PTFE) or nitrile rubber (NBR). Common materials used for rod seal anti-extrusion rings are polyamide (PA), polyacetal (POM) or PTFE.
Anti-extrusion rings

External forces acting on the rod can cause pressure peaks. They can be far in excess of the system operating pressure and may press a rod seal into the gap between the piston rod and the cylinder head. This risk of gap extrusion can be avoided for rod and buffer seals by using anti-extrusion rings. These hard and temperature-resistant rings can be integrated in the seal or a separate full-face anti-extrusion ring can be used. This ring can be added to a rod seal by simply extending the groove length (→ fig. 3). Integrated anti-extrusion rings fit into a notch in the rod or buffer seal and do not need a longer groove.

DZR (→ fig. 10) profile rod seals and RBB profile buffer seals incorporate an anti-extrusion ring. Other U-cup and energized U-cup rod seals with an integrated anti-extrusion ring are available on request. Full-face anti-extrusion rings for rod and buffer seals, for example BUS profile, are not covered in this catalogue, but are available also on request. For additional information about anti-extrusion rings, contact SKF.

Rod guidance

Guide rings avoid sliding contact between the piston rod and cylinder head surfaces and react the radial loads of forces acting on the cylinder assembly. Although rod sealing systems are designed to accommodate slight radial motion between the piston rod and head, effective guide ring function to accurately centre the rod within the head is important for rod seal performance.
Rod Seals

Rod seals

Rod seals are typically single-acting seals, which means that fluid pressure acts from inside the cylinder on one seal side only. Pressures acting on the rod side of the piston can be in excess of 400 bar (5,800 psi), pressure peaks can be even higher. The pressure acting on the rod seal increases contact forces between the rod seal and cylinder surfaces. Therefore, rod seal materials should be wear resistant and the rod surface need to be manufactured to the recommended specifications.

Polyurethane U-cup rod seals

U-cup seals, as their name implies, have an U-shaped profile, including an outside static sealing lip and an inside dynamic sealing lip. The unique combination of resilience and its resistance to gap extrusion and wear makes thermoplastic polyurethane (TPU) the most common material used for U-cup seals in hydraulic application. When installed, the radial compression of the sealing lips provides adequate sealing force between the sealing lips and the cylinder components.

These U-cup seals are suitable for heavy duty applications. They are available with a single or double lip design, whereas the single lip design is preferred. However, depending on the application, system design, size and individual customer preferences, it may be preferable to use a U-cup with a secondary dynamic sealing lip.

S1S profiles

S1S profiles (fig. 4) are made of ECOPUR (TPU) and have a single lip design. The geometry has been optimized using advanced FEM (Finite Element Modeling) and simulation techniques to provide the longest possible maintenance-free service. They are suitable for pressures up to 400 bar (5,800 psi) in heavy duty applications and are available in metric sizes.

ZBR profiles

ZBR profiles (fig. 5) are made of LUBRITHANE (TPU) and have a double lip design. They are suitable for pressures up to 400 bar (5,800 psi) in heavy duty applications and are available in metric and inch sizes.

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Fig. 4

S1S

Fig. 5

ZBR
SIL profiles

SIL profiles (→ fig. 6) are made of ether-based TPU and have a double lip design. They provide good resistance to hydrolysis (attack from moisture) and good low temperature resilience. These profiles are suitable for pressures up to 350 bar (5 075 psi) for light to medium duty applications and are available in metric sizes.

Energized U-cup rod seals

Energized U-cup rod seals incorporate a nitrile rubber (NBR) X-ring in their thermoplastic polyurethane (TPU) U-cup. The X-ring serves as energizer, provides additional sealing force and improves the long-term resilience of the sealing lips. This can be beneficial in applications with low operating pressure or low temperatures.

PTB profiles

PTB profiles (→ fig. 7) are made of LUBRITHANE (TPU). Its type-B back-bevel sealing lip design with a chamfer on the leading edge regulates the fluid film on the piston rod surface. These profiles are suitable for pressures up to 400 bar (5 800 psi) and are available in metric and inch sizes. Some metric sizes fit seal housings in accordance with ISO 5597.
**Rod Seals**

**STD profiles**
STD profiles (→ fig. 8) are made of LUBRITHANE (TPU). They are suitable for pressures up to 400 bar (5,800 psi) and can also be used as a heavy-duty static seal or a snap-in wiper seal. These profiles are available in inch sizes where narrower seal housings are used. Metric sizes are available on request.

**Hybrid rod seals**
Hybrid rod seals incorporate dynamic sealing lips of different materials. These material combinations provide a hybrid with the functional benefit of each material and, therefore, a robust rod seal. An example is the sealing ability and resilience of nitrile rubber (NBR) combined with the extrusion and wear resistance of polyurethane (TPU).

**DZ profile**
DZ profiles (→ fig. 9) combine a NBR primary sealing lip with a LUBRITHANE (TPU) secondary sealing lip into one seal. This combination provides a good low temperature resilience and is suitable for pressures up to 400 bar (5,800 psi). DZ profiles are available in metric and inch sizes. They are also available with an elastomer (FLUOROTREL/TPC) secondary sealing lip on request.

These hybrid rod seal profiles from SKF are the original of its kind and the first to be introduced into the market. DZ profiles are well established in the market.
DZR profile
DZR profiles (→ fig. 10) combine a NBR primary sealing lip, a LUBRITHANE (TPU) secondary sealing lip and a triangular polyamide (PA) anti-extrusion ring into one seal. These combinations provide good low temp.

resilience, and improved resistance to deformation, wear, and gap extrusion. They are suitable for pressures up to 690 bar (10 000 psi) and for extreme heavy duty applications. DZR profiles are available in metric and inch sizes.
**Rod and buffer seals**

**Buffer seals**

Buffer seals protect the rod seals by reducing pressure peaks. Abrupt pressure peaks can occur by external forces acting on the piston rod, initiated by the fluid inside the cylinder. These pressure peaks can be far in excess of the system operating pressure. Buffer seals in combination with rod seals provide an effective rod sealing system for cylinders in heavy duty applications at high temperature and pressure.

**Polyurethane U-cup buffer seals**

**RBB profile**

RBB profiles (→ fig. 11) have a LUBRITHANE (polyurethane/TPU) sealing ring that incorporates a polyamide (PA) or polyacetal (POM) anti-extrusion ring. The flexible outside static sealing lip and channels in the front face ensure that pressure can return to the system side of the buffer and prevent build up of pressure between the rod and buffer seals. These profiles are suitable for pressure peaks and demanding workloads in heavy duty applications up to 690 bar (10,000 psi). They are available in metric and inch sizes.

**Buffer seals incorporating slide rings**

**S9B profile**

S9B profiles (→ fig. 12) have a nitrile rubber (NBR) O-ring energizer and a PTFE slide ring as standard. Depending on the application, SKF can manufacture the slide rings from a variety of PTFE materials. On request, SKF can supply these profiles also with X-ECOPUR polyurethane (TPU) slide rings for improved wear resistance and ease of installation compared to PTFE. S9B profiles with a PTFE slide ring are suitable for pressures up to 400 bar (5,800 psi), those with an X-ECOPUR slide ring up to 600 bar (8,700 psi). Both material combinations are available in metric and inch sizes.

Fig. 11

Fig. 12
More rod and buffer seals

The rod and buffer seals listed in this catalogue represent the preferred profiles in common sizes. SKF supplies many additional sizes and profiles and provides customized solutions for the toughest application conditions. The following profiles are also manufactured in series production.

Rod locking T-seals

LTR profiles (→ fig. 15) are T-seals for rod applications with a rubber sealing ring supported by patented locking anti-extrusion rings on both sides. Therefore, they can be used as double-acting rod seals for special applications. For example, in tandem cylinders that require a rod seal to take pressure from both sides.

TEFLATHANE seals

These rod seals of various designs and material combinations incorporate an anti-extrusion ring that is bonded into the body. They are suitable for high temperature and/or short-stroke applications. For example, U-cup seals made of special high temperature polyurethane bonded to a PTFE anti-extrusion ring in rock hammer applications (→ fig. 16).

Chevron sets

These moulded or machined chevron sets (→ fig. 17) are available in a wide variety of materials and designs. They are also called “vee packings” and typically consist of a header ring, one or several chevron rings, and a base ring. These rings can be made of different materials to achieve their own specific functional benefits.
SPECTRASEAL

SPECTRASEAL is a PTFE seal that can be used as a single-acting rod seal (→ fig. 18). The metal spring energizer adds radial load to the seal lip contact areas. SPECTRASEAL is intended for extreme condition applications including high temperature or aggressive media.