

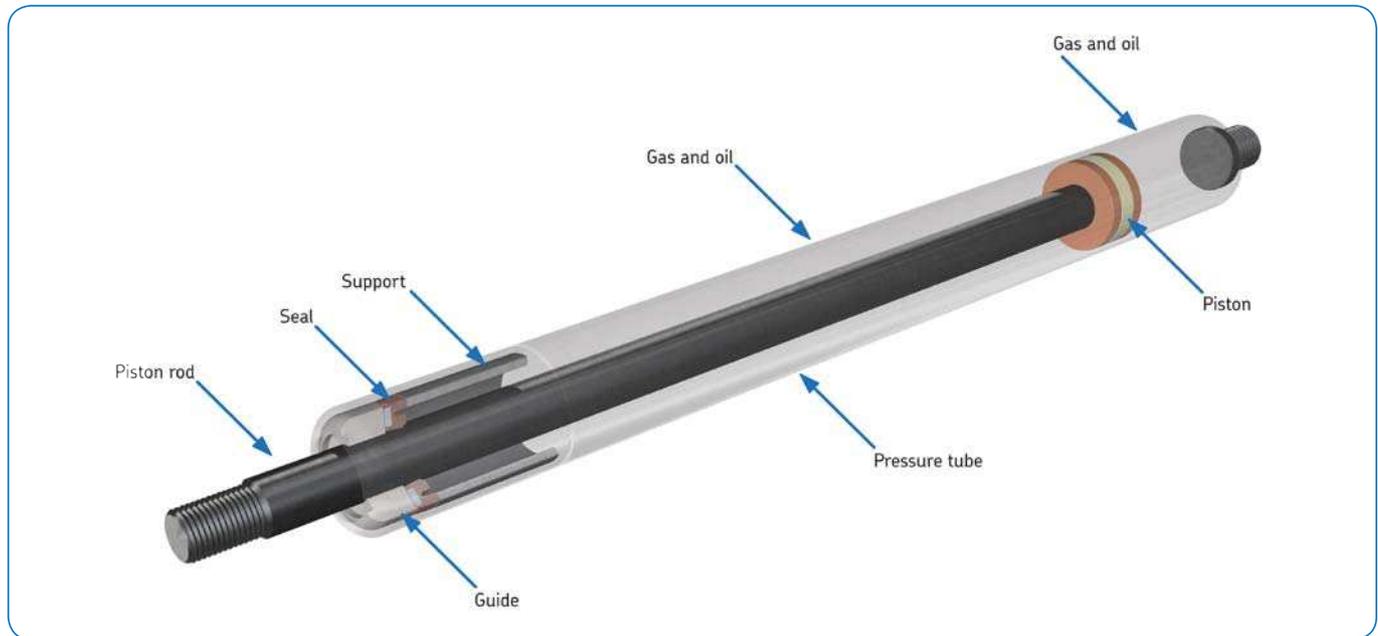
Gas spring seals



SKF, the market leader for gas spring seals

Gas springs are hydropneumatic devices that lift, lower and position equipment of all types. A very important component of these devices is the gas spring seal which provides the dynamic seal to the piston rod and the static seal to the tube. SKF gas spring seals are engineered to give reliable operation with filling pressures of up to 200 bar and are key to the overall functioning and service life of the gas spring.

Schematic view of a gas spring



Types of SKF gas spring seals

SKF gas spring seal designs are based on a rubber seal bonded permanently onto a steel reinforcement ring. This configuration provides several advantages over other concepts and has led to this design being chosen in the majority of gas springs.

- The stability of the steel ring makes it easy to handle during installation
- The inner and outer sealing lips are separated and are therefore able to operate independently of each other
- The dynamic sealing lip is supported under high pressure, thus reducing friction
- A reliable barrier is provided to the rubber material minimizing creeping under pressure
- Because steel is impervious to the filling gas and the rubber cross section is small, permeation of the gas through the seal is kept to a minimum, thus providing the maximum pressure retention and hence service life

The designs and specially formulated materials allow for optimum sealing over a wide range of operating conditions and provide tangible

- Lowest possible loss of force (high pressure retention) for a long service life
- Low breakaway force for smooth operation
- Low static and dynamic friction for maximum efficiency

Gas spring seal designs

SKF offers three gas spring seal designs, catering for piston rod diameters in the range of 6 to 20 mm. Other sizes can be developed

Gas spring seal – standard design

This seal design is the most commonly used in automotive applications. The height of the static sealing lip on the outer diameter is greater than that of the inner lip, which is dynamically loaded. The outer sealing lip is designed for use without axial preloading.



Standard design

Gas spring seal – flat design

For lockable gas springs, e.g. for office chairs and applications with low pressure, the seal height of the static sealing lip on the OD is reduced. This flat sealing pad allows for axial preloading without having a negative influence on the sealing function of the dynamic sealing lip.



Flat design

Gas spring seal with garter spring

This design is used in damping applications. The addition of a spring on the dynamic sealing lip supports the sealing function when the



Gas spring seal with garter spring

Application parameters

Design considerations for the piston rod

Surface treatment:
Nitrided or chrome plated

Recommended surface roughness, based on a nitrided rod surface:

R_a	$< 0,15 \mu\text{m}$
R_z	$< 1,2 \mu\text{m}$
R_{max}	$< 1,8 \mu\text{m}$

To make a specific enquiry, details of the application can be added on the separate product questionnaire included in this brochure. SKF representatives can assist in determining the parameters necessary to respond to individual requirements.

Friction, pressure and material relationship

The friction of the gas spring is related to the applied pressure. For high pressures (150 bar and above), a rubber compound with high hardness is needed in order to meet the durability requirements. However, such a material used at lower pressures increases the friction, so a lower material hardness is selected for this use. SKF has rubber compounds with different hardnesses to provide the optimum performance for the specific application.

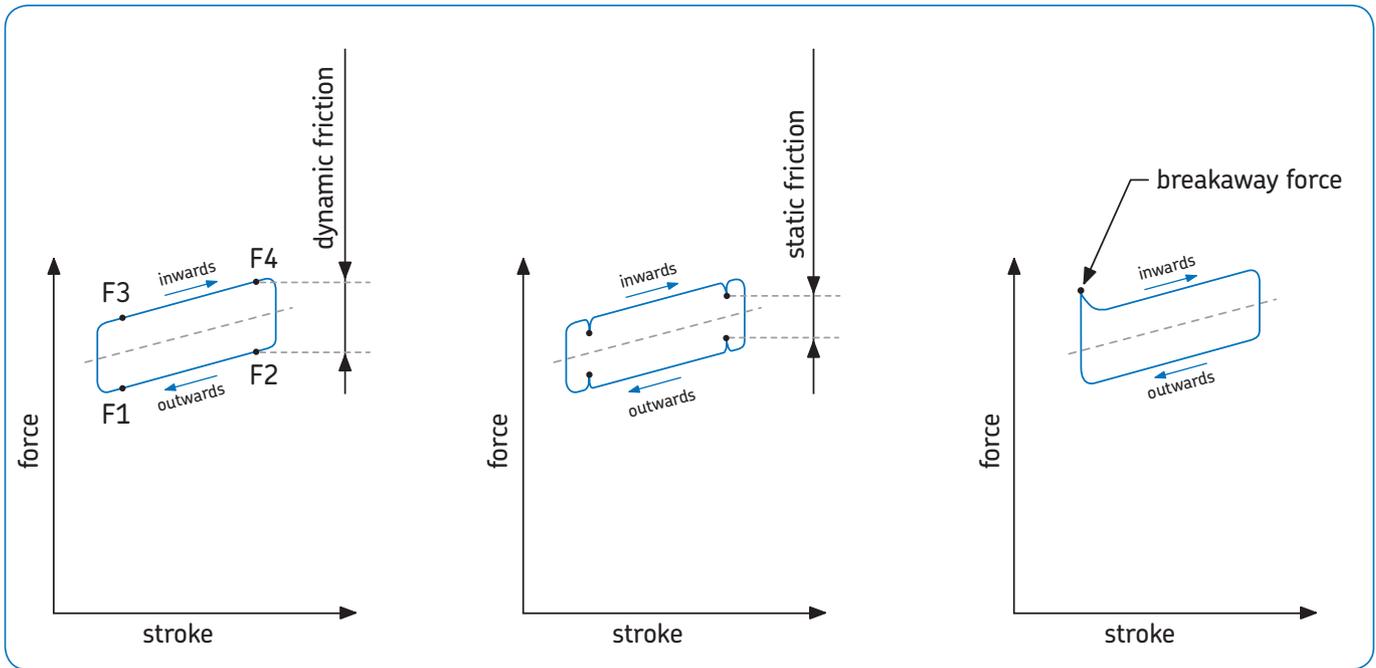
The application temperature is also a factor for material selection:

- NBR materials typically allow a temperature ranging from -40 to $+80$ °C / short term 120 °C
- FKM materials typically allow a temperature ranging from -10 to $+180$ °C / short term over 200 °C

The friction is defined in a hysteresis curve, which is determined from a given stroke with the piston rod moving slowly. It is the difference between the forces F3 and F1, or additionally F4 and F2 (see diagram below – dynamic friction).

There is a differentiation between dynamic and static friction. The dynamic friction is measured during the rod motion. For the static friction, the piston rod must be stationary at defined positions for a small period (see diagram below – static friction). The static friction is lower than the dynamic friction.

The peak when pushing the rod into the gas spring for the first time after a long stationary period is called the breakaway force (see diagram below – breakaway force).



Testing

SKF has fully equipped test facilities that are able to perform tests to validate the performance of the seal in the gas spring. Typical tests include:

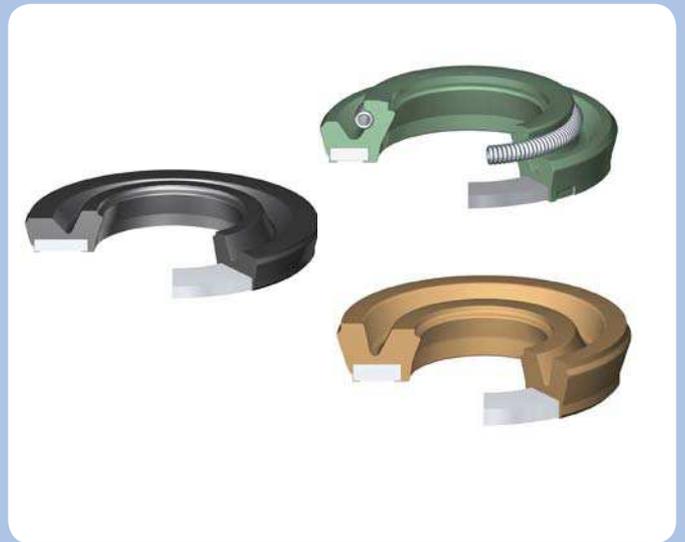
- Cold and hot durability test (−40 to +80 °C)
- Linear or swivel durability test for 50 000 cycles
- Vibration test (high frequency) with ±1 mm amplitude at 10 Hz

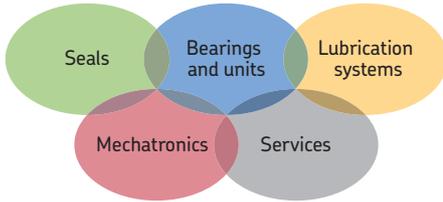
Sealing solutions from SKF

Through extensive experience, SKF has become the market leader in the engineering and supply of gas spring seals and offers the following value:

- Complete technical service to analyze the application and provide not only a product, but a complete sealing solution
- Unique manufacturing technology with automatic optical inspection of 100% of parts to maximize the quality
- Unrivalled quality – if the seal has a defect, then the whole gas spring may not work
- Flexibility to design to specific requirements, or the ability to use a product from the range of cost effective standard seals

Over the years, SKF has evolved into a complete sealing solutions provider, offering system solutions for rotating, reciprocating and static applications to both OEM and aftermarket customers across all applications and industry segments. Additionally, SKF can provide extensive seal validation and testing capabilities. Tests are conducted to final application requirements which represent end user working conditions.





The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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