# Sealing systems in gas springs

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Parker Prädifa

ENGINEERING YOUR SUCCESS.

# Sealing systems in gas springs

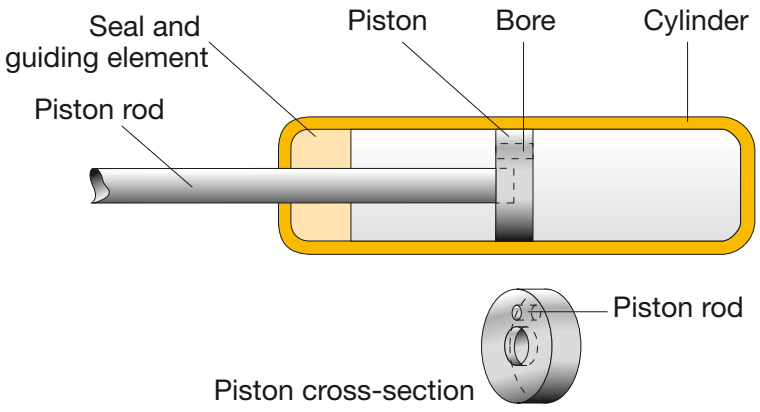
## Serving to enhance consumer comfort and industrial productivity

Modern life has become unthinkable without gas springs and product developers come up with new applications for them year after year. These silent helpers assist us in adjusting the optimum seating position of our office chairs, help us to load or unload our cars by making the boot lid seem virtually weightless before gently slowing its downward motion, adjust the desired positive connection between a skier's boots and bindings and facilitate the movement of heavy loads in industrial applications. Whether the gas spring serves to enhance consumer comfort or industrial productivity, its function is to provide effective cushioning and damping.

**Functional principle**
A gas spring is a pneumatic spring that is energized by a pressurized gas. The principle of the system is relatively simple. Its core elements are a cylinder, piston, piston rod and the locking package with the seal. Initially introduced nitrogen generates service pressure, and a few cubic centimetres of – typically synthetic – lubricants support the desired function. The gas pressure acts on the cross-sectional areas of the piston, which vary in size, and generates a force in the extension direction when the piston rod penetrates the interior. The rod seal has the job of preventing leakage of the gas from the cylinder and to thus prevent loss of performance.

**The right seal for any task**
Factually, permeation and losses caused by leakage at the interfacing areas slowly but surely reduce the gas volume that was initially introduced down to the level of spring failure unless the seal prevents this. Therefore, the specific evaluation of the respective tribological system including the selection of the seal best suiting this system is extremely critical.

Increasing demands made on product service life and actuation frequency are directly related to the demand for sealing compounds with long service life and high wear resistance.




Parker-Prädifa has developed a range of high-performance compounds specifically tailored to meet these needs.
These high-performance compounds offer a myriad of outstanding properties for gas spring applications which include the following highlights:

- Excellent wear resistance
- Very low permeation rates
- Very broad media resistance
- Broad temperature range
- Easily achievable baked enamel finishing and powder coating of the gas spring
- Very good price-performance ratio

As rod and piston seals and runner-less O-rings, Parker's sealing compounds are successfully used in static and dynamic gas spring applications.

Parker-Prädifa offers the right sealing geometry and suitable compound for any field of application and the related requirements: from low-cost NBR, HNBR and FKM high-temperature seals through to very wear-resistant polyurethane sealing solutions that can be optimized for low temperatures down to -55 °C if needed.

# Industrial gas springs

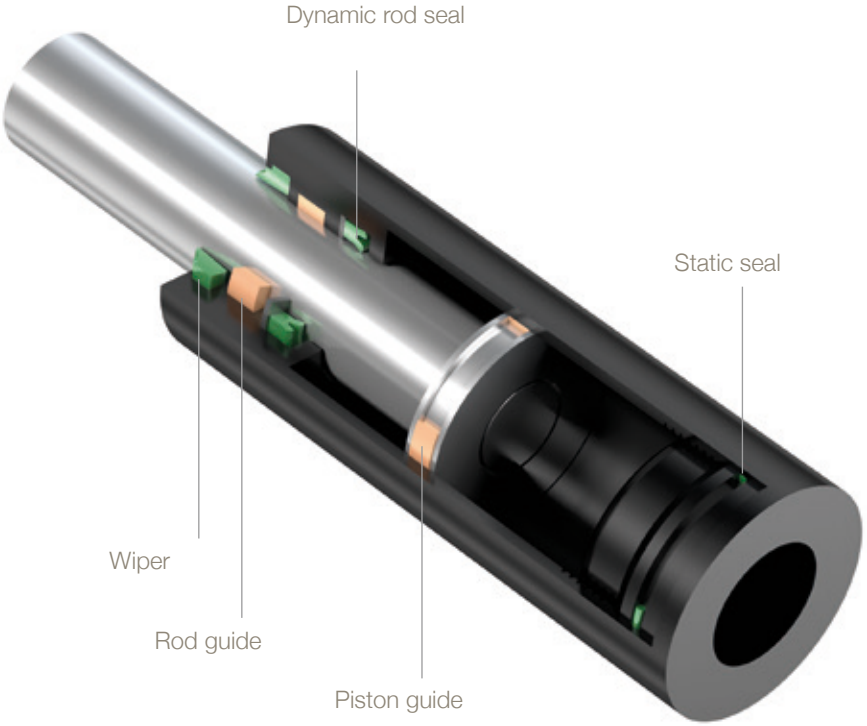
Industrial gas springs are primarily found in tool, die and mould making. Traditionally used mainly in cutting and stamping tools, gas springs have recently started to make their way into injection moulds as well. For the additional motion of a cavity plate when the mould opens they provide higher process reliability and thus improved productivity of the system compared with conventional jigs and fixtures such as latch locks.

**Millions of strokes**
The use of gas pressure springs in tool, die and mould making puts special demands on the sealing system of the spring. Long service life with a guaranteed number of strokes between 1 and 2 million are required in this case. At the same time, the seals have to ensure maximum gas tightness and uniform friction across the entire lifecycle.

**High pressures**
Gas pressures of 500 to 600 bar, which are inevitable due to the compact design of the spring, place special requirements on the sealing system. Both the statically and dynamically acting seal in the spring has to withstand these high pressures and remain fully functional.
The tailored specialty seals by Parker-Prädifa, which are made from particularly well-suited, high-performance polyurethane compounds that are polymerised in-house, have proved to behighly viable for these applications.

**“Strong guidance” required**
Special demands are made on the guiding elements in industrial gas pressure springs as well. They have to reliably prevent metallic contact between the moving piston rod and the pressure housing in order to avoid damage to the seal’s contact area. Particularly when used in stamping and forming tools guide tapes have to be able to absorb extremely high lateral forces without losing their geometry or dimensional stability.

High cycle rates must not lead to guide wear and thus an increase of the radial guide clearance, as this could result in higher loss of gas and premature failure of the gas spring.
Fabric tapes impregnated with phenolic resin, which are cut at high accuracy, have proved their viability in harsh industrial conditions. The tapes are very easy to handle and, as cut products, can be supplied in any desired special size.




Sealing system of an industrial gas spring

**No drag-in of foreign matter**
In addition to the seal and the guide element, the wiper as a component of the sealing system plays a very important part with respect to the service life of a gas pressure spring. It prevents foreign matter from being dragged into the gas tube. Incompressible foreign matter that enters the gas tube reduces the compression volume. The resulting overpressure can cause the gas spring to burst. Drag-in of foreign matter into the gas tube is the major risk of failure of a gas spring.

## Sealing elements for industrial gas springs

| Profile | Product properties | Recommended compounds |
|---|---|---|
| **Wipers** | | |
| A1 | - Easy snap-in installation into closed grooves | P5008 (TPU) |
| AF | - Wiper with metal jacket<br>- Installation into open grooves (press fit)<br>- Robust seal profile for harshest operating conditions | P5008 (TPU) |
| AG | - Wiper with metal jacket<br>- Installation into open grooves (press fit)<br>- Robust seal profile for harshest operating conditions | P5008 (TPU) |
| **Rod guide** | | |
| FR | - Open guide ring for snap-in installation into closed grooves<br>- Extreme wear resistance | Q5038 (phenolic resin acrylic fabric + PTFE) |
| **Dynamic rod seals** | | |
| B3 | - Standard rod seal<br>- Easy snap-in installation into closed grooves<br>- Operating pressure: ≤ 400 bar | P5008 (TPU) |
| B4 | - Rod seal with integrated back-up ring made of modified PA<br>- Operating pressure: ≤ 600 bar | P5008 (TPU) |
| GS | - Special development for gas springs<br>- Extremely low friction<br>- Maximum gas tightness<br>- Particularly small dimensions for slim designs<br>- Operating pressure: ≤ 300 bar | P5008 (TPU) |
| **Piston guide** | | |
| FK | - Open guide ring for snap-in installation into closed grooves<br>- Extreme wear resistance | Q5038 (phenolic resin acrylic fabric + PTFE) |
| **Static seal** | | |
| V1 | - High extrusion resistance<br>- Operating pressure: ≤ 600 bar | P6030 (TPU) |

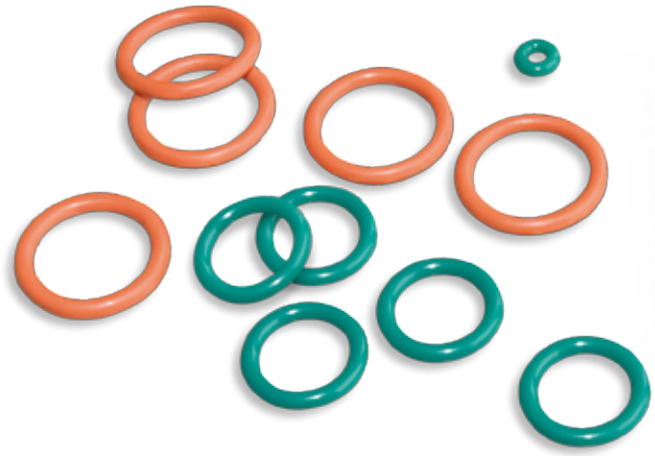
# Comfort gas springs

Unlike industrial gas springs, comfort gas springs are primarily used for retention functions and facilitating motion in everyday items. Modern life would be hard to imagine without them. Comfort gas springs – typically unnoticed – make everyday life easier, for example, when opening kitchen cabinets or windows, vehicle tailgates or bonnets and keeping them open. They support our health when we work out on steppers or treadmills at the gym. And they enhance our comfort even in more complex applications such as aircraft engineering and medical technology, installed in seats, doors or tables.

**Simpler design – higher demands**

Compared with industrial gas springs, the extension lengths of comfort gas springs are normally longer and the forces lower. Besides reducing the space required for installation this allows the required components to be reduced in size as well. As most comfort gas springs are used in conditions that tend to be clean additional components such as complex guide systems or wipers against ambient media are often unnecessary.

But the essentially simpler design of such systems does not mean that the demands made on the seals and guides used in them are lower as well. Instead, due to the smaller housing and the challenge of assuring sufficiently long service life of the components and thus the gas spring, the requirements may actually be higher than those for industrial gas springs.




Sealing system of a comfort gas spring

## Sealing elements for comfort gas springs

| Profile | Product properties | Recommended compounds |
|---|---|---|
| **Rod seal** | | |
| C1 | - Standard rod seal | NBR, HNBR, FKM |
| GS | - Special development for gas springs<br>- Extremely low friction<br>- Maximum gas tightness<br>- Particularly small dimensions for slim designs<br>- Operating pressure: ≤ 300 bar | P5008 (TPU) |
| B3 | - Standard rod seal<br>- Easy snap-in installation into closed grooves<br>- Operating pressure: ≤ 400 bar | P5008 (TPU) |
| **Guide** | | |
| F3 | - Guide tape<br>- Installation into closed grooves<br>- Wear-resistant<br>- Low friction | Polon® 052<br>(PTFE + 40 % bronze) |
| **Secondary seal** | | |
| V1 | - High extrusion resistance<br>- Operating pressure: ≤ 600 bar | P6030 (TPU) |

# Rod seal GS

## The specialist for gas spring applications

The GS rod seal has been specifically developed for the challenging demands of gas spring applications. Apart from small housings, they include long service life and maximum gas tightness with low friction. These properties make the seal, in addition to its use in gas springs, suitable for applications in hydraulic and pneumatic equipment that involve the same demands.
The short contact space of the sealing area guarantees low friction values. Back-up rings or retainers are not required due to the special shape. The seal can be used in both hydraulic and pneumatic systems with oiled air.

The GS rod seal is compatible with the time-tested C1 seal profile and fits into the same housings.

**Product benefits**
- Good wear resistance
- Easy assembly
- High temperature resistance
- Excellent media resistance
- Suitable compounds available for special requirements of the chemical process industry and the food industry
- Installation in closed and undercut grooves

| Range of application | |
|---|---|
| Operating pressure[1)]<br>- in compound P5008<br>- in compound P6000 | <br>≤ 200 bar<br>≤ 300 bar |
| Operating temperature[1)]<br>- in compound P5008<br>- in compound P6000 | <br>-35 / +90 °C<br>-55 / +120 °C |
| Sliding speed | ≤ 1 m/s |

[1)] Depending on profile width and compound.

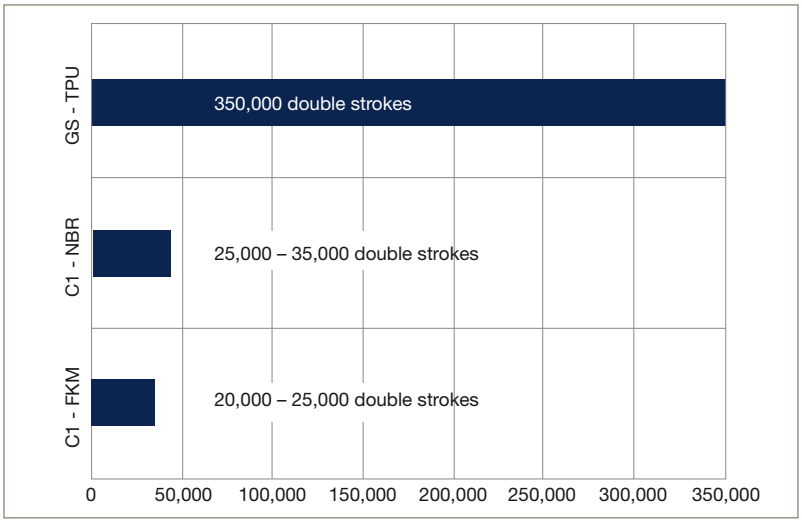
**Compounds**

| | |
|---|---|
| Standard: | P5008, TPU (≈ 94 Shore A) |
| For high pressures (> 200 bar): | P6000, TPU (≈ 94 Shore A) |
| For low temperatures (> -55 °C): | P5009, TPU (≈ 93 Shore A) |
| For high temperatures (< 120 °C): | P4300, TPU (≈92 Shore A) |

**Installation guidelines**
Profile GS rod seals are manufactured with an oversized outer diameter, which results in the required secure press fit on the adhesion part. The sealing lip only achieves the require size during installation. GS rod seals can be easily snapped into the housing by deforming them in the shape of a kidney.
When selecting the seal for a certain diameter the seal with the largest possible cross-section should be given preference.

In the case of nominal diameters ≤ 25 mm, depending on the seal's cross-section and position of the installation groove, an open housing is recommended.
For applications in gas springs – as opposed to the general installation guidelines contained in our catalogues – we recommend housings with improved surface requirements.

| | |
|---|---|
| Dynamic sealing: | $R_z$ < 0,5 µm |
| Static sealing: | $R_z$ < 1,0 µm |
| Percentage of contact area: | $t_p$ > 80 % |




Service life comparison of rod seals

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