Gas Springs and Dampers

for applications in automotive engineering
Piston
wide.
S T A B I L U S supplies and supports and incorporated in the automotive and furniture industries for several decades, STABILUS gas springs have now also become an indispensable design element in countless industrial applications in the most diverse sectors.

Gas springs and dampers for applications in vehicle engineering
Compact design, high level of operating convenience and safety in use continue to expand the field of applications for STABILUS products. e.g. Motor vehicles and superstructures...
Gas springs and dampers facilitate the opening and adjustment of hoods, hatches and covers. e.g. Agricultural vehicles...
They dampen unpleasant shocks in the driver’s seat caused by uneven land resulting in comfortable, relaxed and ergonomic seating.
e.g. Buses... They allow seats to be adjusted to the passengers’ bodies, so that even long journeys become a positive experience.
e.g. Railway vehicles... Here, too, blocking gas springs in stepless adjustable seats ensure ergonomic seating.

Customer satisfaction
Customer service and customer satisfaction are key objectives for the company. STABILUS is known in particular for its technical innovation, quality and competitive pricing in all its business units.

Highest Quality
As the leading gas spring supplier worldwide, our quality management system fulfills without question the high quality requirements of international standards, such as DIN EN ISO 9001:2000, as well as the new world standard ISO/TIS 16949:2002 with the regulatory requirements of QS 9000, VDA 6.1, EAQF, and AVSQ.

Care for the environment
STABILUS places utmost importance in achieving environmentally friendly production methods. Its success in this area is documented by the certification of its environmental management system in conformity with DIN EN ISO 14001.

Service and technical application support
STABILUS provides extensive technical, design and installation support in specific applications as a matter of course. The extensive knowledge of our application consultants and technicians coupled with our highly efficient installation proposal programmes and practical arrangements, also on site, ensure optimal solutions.

Operating principle
The gas spring is a hydropneumatic adjusting element, consisting of a pressure tube, a piston rod with piston and appropriate connection fittings. It is filled with compressed nitrogen, which acts with equal pressure on differently dimensioned cross-sectional areas of the piston. This produces a force in the extension direction. This extension force can be exactly defined within physical limits through the appropriate selection of the filling pressure.

Spring characteristic curve and F1 force
The spring characteristic curve describes the gas spring progression force over the stroke, i.e. from the extended to the compressed state and vice versa. Unlike mechanical springs, gas springs have an extremely flat, almost linear characteristic curve and therefore allow a uniform comfortable adjustment or pivoting movement. The spring rate, X, representing the force ratio F2/F1, lies between 1.2 and 1.4 with standard gas springs. Other values can be defined on request and according to the application. Together with the dimensions, the F1 force is the major descriptive feature for the choice of a gas spring and it is therefore specified in all STABILUS brochures. It defines the value of the spring force and is measured 5mm before the end of the extension movement. The difference between the force lines for the compression and extension direction, FR, is the result of friction effects.

Extending speed and damping
A significant advantage of gas springs over mechanical springs is the definable speed curve, which allows for a damped and comfortable adjusting movement. Two types of damping can be distinguished:
Hydraulic damping
The extending speed is determined both by the arrangement and the diameter of the bores in the piston and by the viscosity of the oil used. When the gas spring is installed with the piston rod facing down the extending piston first travels through the gas-filled and then

... technology gives comfort
Choice and application of gas springs

Dimensions according to choice

STABILUS offers an extremely wide range of gas spring types, which vary in respect of their external dimensions, speed curves and extension variants, and invariably meet the most stringent requirements. A large selection is included in the STABILUS standard product range and can be delivered at short notice.

Service life and maintenance

Gas springs are maintenance-free! They are designed to specific requirements and operate for years and years without failure when properly installed. Also for particularly high numbers of load alterations special sealing systems are available which allow e.g. specific gas springs in swivel chairs to withstand up to one million load cycles without damage.

Connections

Different connections are available depending on the application. STABILUS therefore offers a wide range of plastic or metal hinge eyes, including the easy-to-mount angle joint that only has to be fitted on the ball socket and allows for twist-free installation.

Installation instructions

Twist-free connection

For maximum service life, gas springs should not be exposed to twists or lateral forces. Suitable connection fittings, e.g. angle joints, can be used for the twist-free connection of the gas springs.

Installation position

Gas springs – except those designed for position-independent installation – are preferably installed with the piston rod facing down so as to maximise the hydraulic damping effect and to ensure optimal lubrication of the guide and seal system.

Temperature behaviour

The temperature of the gaseous nitrogen inside the gas spring influences its extension behaviour within certain limits. The standard temperature range lies between -30°C and +80°C. In addition, gas springs with special sealing systems for extreme loads are available.

Operational safety

The operational safety of the gas spring is primarily achieved by seals designed to keep the gas pressure inside. For your protection, no bending loads should be exerted on the gas springs. Damage caused by subsequent mechanical operations, including welding, performed on the gas springs, as well as contamination or painting of the piston rod may lead to the failure of the devices.

Characteristics and benefits

- Available in a variety of standard sizes and force variants
- Linear spring curve for uniform force progression over the entire spring travel
- Available with progressive or degressive spring curve for force support at stroke start or end position
- Available with dynamic or hydraulic damping according to application and fitting position
- Various connection systems for practical and swift installation

Non-blocking gas springs – LIFT-O-MAT®

Lifting, lowering, moving and adjusting

With their accurately adjusted extension force and application-specific damping LIFT-O-MAT® gas springs offer optimum weight compensation, force support, they open and close flaps and bonnets and ensure user-friendly movement sequences thanks to their damping characteristic.

Product variants

- Hydro-Lift*: In addition to the LIFT-O-MAT® function, these gas springs can be positioned at any desired point
- LIFT-O-MAT® high friction: The increased friction of these gas springs allows for stepless positioning
- Electro-Lift: In addition to the gas spring function, an electric current is transmitted or even switched, e.g. for illuminating the engine compartment or boot space
- Inter-Stop®: The stroke is divided into a number of functional areas to allow manual positioning of the application, e.g. a flap

<table>
<thead>
<tr>
<th>Standard Series Program</th>
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<tbody>
<tr>
<td>Piston rod diameter D1</td>
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<tr>
<td>mm</td>
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<tr>
<td>Pressure tube outside diameter D2 (mm)</td>
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<td>6</td>
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**Variable positioning, rigid or spring blocking**

BLOC-O-LIFT® gas springs raise loads with an accurately tuned extension force and application-specific dampening while ensuring user-friendly movement sequences. In addition, BLOC-O-LIFT® gas springs can be blocked in any position, with springing or rigid blocking in the extension or compression direction depending on the design. Variable blocking is made possible by integrating the valve into the piston, which separates both pressure chambers gastight. When the valve is closed, thereby interrupting the gas exchange between both pressure chambers, the BLOC-O-LIFT® gas spring is blocked. The valve closes automatically when the valve tap is released externally. The springing blocking variant is ideal for the smooth dampening of e.g. shocks, impacts or pulse-type peak loads (e.g. in seats and office swivel chairs).

**Characteristics and benefits**

- Rigid or spring blocking in the extension or compression direction. Optionally, a position-independent variant is available.
- Also available with short release travel of only 1 mm (normally 2.5 mm) for extremely light operation.
- Continuous release is also available on request (e.g. for rocking the backrest of swivel chairs).

**Calculating the installation of a gas spring**

The STABILUS installation design proposal software selects and designs the optimal gas spring for a specific application. For this, the following application details, e.g. a flap, are needed:

- dimensions and weight
- opening angle to be achieved
- attachment points for the gas springs

From this data the following is derived:

- the stroke A [mm]
- the extended length B [mm]
- the extension force F 1 [N]
- the type of connection

In a subsequent step, the desired extension and damping characteristic can be determined.

**Hydraulic dampening of vibrations**

Dampers are needed to positively influence the nature of movements and vibrations. They are designed to match the particular application. Oil-hydraulic dampers consist of a pressure tube, a piston rod with piston system and a piston rod connection fitting. The movement of the piston presses the filling medium (oil) through suitably dimensioned bores into the piston, thus producing the desired damping force.

**Characteristics and benefits**

- Compact dimensions with maximum reliability and durability.
- Suited for operating temperatures between -40°C and +130°C.
- Continuous release is also available on request (e.g. for rocking backrests of swivel chairs).

**Hydraulic calculation**

To make your own rough estimate and to select the appropriate gas spring from our standard product range, you can use the following approximation formula and application sketch.

\[
F_1 = \frac{G \times D \times 13}{B \times n} \quad [N]
\]

- \(G\) = weight of flap in kg
- \(L\) = distance from centre of gravity to pivot point in mm.
- \(b\) = effective lever arm of gas spring in mm, flap open.
- 13 = conversion factor
- \(P\) = flap attachment (suggest approx. 2/3 L)
- \(n\) = number of gas springs (standard: \(n = 2\))
- \(D\) = effective lever arm of gravity in mm, flap open.

**Determining the extension force**

\[F_1 = \frac{G \times D \times 13}{B \times n}\]

- \(G\) = weight of flap in kg
- \(L\) = distance from centre of gravity to pivot point in mm.
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- \(P\) = flap attachment (suggest approx. 2/3 L)
- \(n\) = number of gas springs (standard: \(n = 2\))
- \(D\) = effective lever arm of gravity in mm, flap open.

**Product variants**

- Defined linear, progressive or degressive damping force characteristic for optimal results.
- Variable damping rate e.g. for steering dampers and driver seat dampers.
- Electrically adjustable dampers.
- Several connection variants for easy installation.

**Instructions for the design of gas springs**