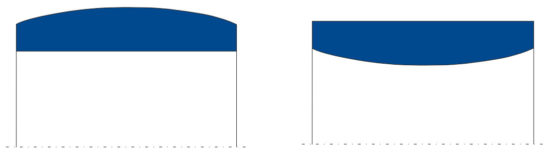
GUIVEX SBK / KBK FOR AEROSPACE

Guivex SBK respectively the version KBK are profiled piston (SBK) and rod (KBK) guide bands made of resin bonded fabric. Patented product design (patent No.: PCT/EP95/03874)



Applications

- Long-stroke cylinder (piston-rod deflection)
- Short guiding distance (piston-rod tilting)
- Short stroke (inadequate lubrication)
- Frictionally optimized sealing systems
- Replacement for metallic guides

Operating conditions

Guivex guide bands can be used in all hydraulic fluids normally found in hydraulic systems such as oils and greases based on mineral oils, water, fire-resistant hydraulic fluids (HFA, HFB, HFC, HFD) and biodegradable hydraulic fluids (HETG, HEES, HEPG). The maximum permissible operating temperature is 120°C (248 °F).

Material

Material	Designation	Color
Fabric-base laminate	HGW HG517	Dark gray
Fabric-base laminate	HGW HG650	Red

VALUE TO THE CUSTOMER

Intended, among others, for standardized housings as per ISO 10766

- Can replace the types SB and SF respectively KB and KF in current housings
- High radial load capacity
- Very good guide-length utilization based on uniform stress distribution
- Enhanced penetration of lubricating media based on optimized stress distribution within the contact zone between the guide ring and the counter surface (favorable frictional behavior)
- Reduced propensity for stick-slip
- Excellent sliding behavior over a short guiding distance (no jamming)

GLAND DESIGN

Surface Finish

Peak-to-valley heights	R_a	R_{max}
Sliding surface	2 to 12 µinch (0.05 to 0.3 µm)	≤99 µinch (≤2.5 µm)
Groove	≤63 µinch (≤1.6 µm)	≤248 µinch (≤6.3 µm)
Groove sides	≤119 µinch (≤3.0 µm)	≤591 µinch (≤15.0 µm)

Material content M_r > 50 % to max. 90 %, with cut depth c = R_z/2 and reference line Cr_{ef} = 0 %

The long term behavior of a sealing element and its reliability to avoid early failure are crucially influenced by the quality of the counter surface. Therefore a precise description and assessment of the surface is critical.
Based on recent findings, we recommend supplementing the above definition of surface finish for the sliding surface by the characteristics detailed in the table below. With these new characteristics derived from the material content, previous more general descriptions of the material content are significantly improved, especially in regard to surface roughness (see section with additional information on surfaces in our Technical Manual).

Surface finish of the sliding surfaces

Characteristic value	Limit	
R_a	>0.05 µm (>2 µinch)	<0.30 µm (<12 µinch)
R_{max}	<2.5 µm (<99 µinch)	
R_{pkx}	<0.5 µm (<20 µinch)	
R_{pk}	<0.5 µm (<20 µinch)	
R_k	>0.25 µm (>10 µinch)	<0.7 µm< (28 µinch)
R_{vk}	>0.2 µm (>8 µinch)	<0.65 µm (<26 µinch)
R_{vkx}	>0.2 µm (>8 µinch)	<2.0 µm (<79 µinch)

The limit values listed in the table do not currently apply for ceramic or semi-ceramic dynamic surfaces.

Tolerances

Diameter D_1 / d_1	Profile thickness [mm]
H9 / h9	–0.01 to –0.06 (–0.4 to –2.4 µinch)

The tolerance regarding diameters d and D_F (SBK) resp. d_F and D (KBK) is determined in connection with the calculation of the gap dimension. Tolerance zones f7 and f8 resp. H7 and H8 (SBK) as well as H7 and H8 resp. h7 and h8 (KBK) are usually selected for typical hydraulic applications with a nominal size of up to 1.000 mm.

Surface load

The value for the specific surface pressure depends on the operating temperature and the scope of elastic deformation (spring deflection) of the guiding element involved. The maximum possible spring deflection in a sealing system is limited by the minimum gap dimension downstream of the primary seal. Further information in our Technical Manual.

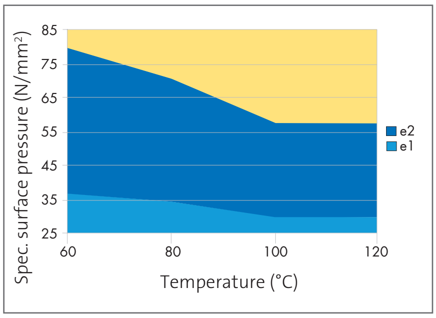
Spring deflection

e1 = 0.1 at s = 2.5 e2 = 0.15 at s = 2.5
e1 = 0.15 at s = 4 e2 = 0.2 at s = 4

data in [mm]

e1 = 0,004 at s = 0,1 e2 = 0,006 at s = 0.1
e1 = 0,006 at s = 1,6 e2 = 0,008 at s = 1,6

data in [Inch]



Spec. surface pressure under parallel loads

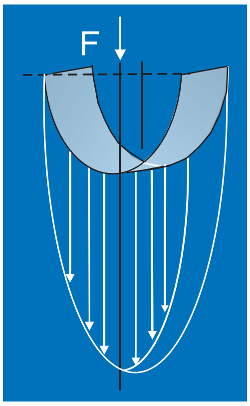
Design notes

Diameter D_1 (SBK) resp. d_1 (KBK) indicated in the table of dimensions should be viewed solely in connection with the guide band. The corresponding diameter of the connected seal housing must be in tune with the sealing element involved.

GLAND DESIGN

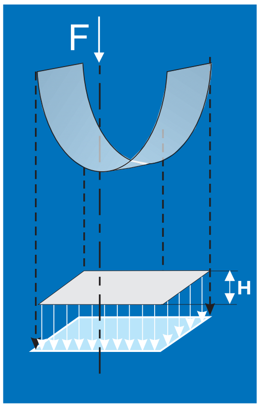
Side load

Side loads within the contact area between the guide and the counter surface are not linear. The guiding width required can be calculated by applying the formulas indicated below on the basis of the projected area. The non-linear progression of side load pressures is taken into account in the contact pressure value. It may be advisable to reduce the loads by selecting a broader guide in individual cases to obtain an extended service life.



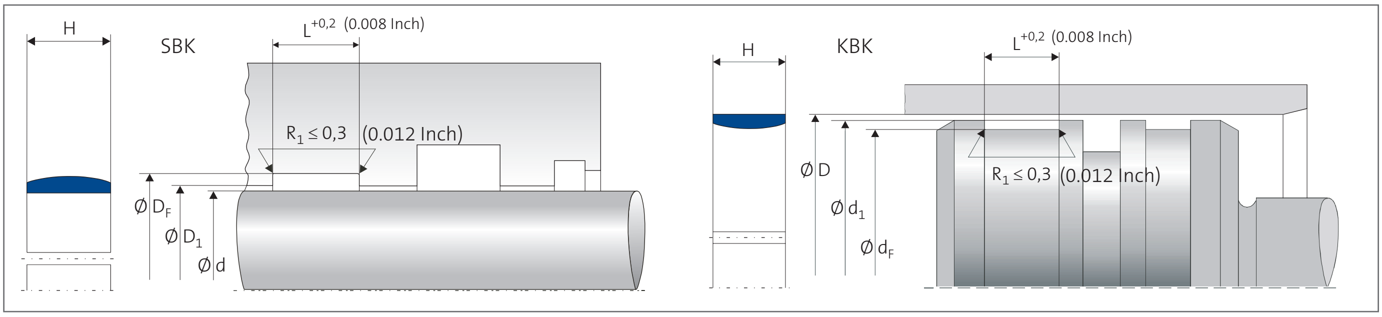
F_{max} = P x A
A = d x H
H = F/(d x P)

H = Width of guide band
F = Radial loads
A = Projected area

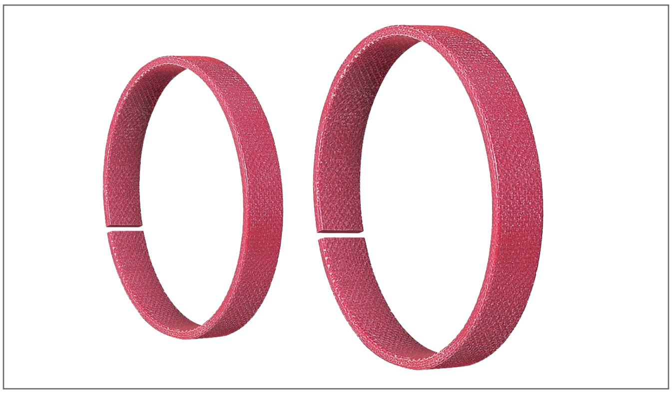


P = Permissible surface pressure
d = Rod diameter (rod guide) resp. piston diameter (piston guide)

Installation diagram



ADDITIONAL PRODUCT DESCRIPTION



Side load

The use of guide elements makes it possible to achieve low-friction and low-wear between the moving components of a hydraulic cylinder. Any side loads occurring during operation are absorbed effectively and any metal to metal contact between the piston rod and/or the piston barrel and the surrounding housing components is precluded.

The scope of the maximum side load is essentially determined by the geometrical marginal conditions and the properties of the guide element involved.

Excessive stresses

The guide play and elastic deformation of the elements under load results in an angular deviation between the piston rod and/or the piston barrel and the counter surface during operation. Consequently, guides inside hydraulic cylinders will not remain parallel, but primarily stressed at the edges.

In this case, the permissible side load of the guide is defined by the lower maximum load up to edge break and not by the maximum compressive strength of the material. Excessive stresses within the edge area (Figure 01) make the penetration of lubricating media more difficult, too. The hydraulic medium is wiped along the edge stressed on the guide element and the lubricating film is reduced to a minimum, thus leading to stick-slip effects and greater wear.

Profiling

Guivex guide bands are provided with a convex profile oriented towards the groove base. The side load applied is distributed evenly over the width of the guide element here. The maximum contact pressure value remains within the medium range and stress peaks at the edges are reduced (Figure 02).

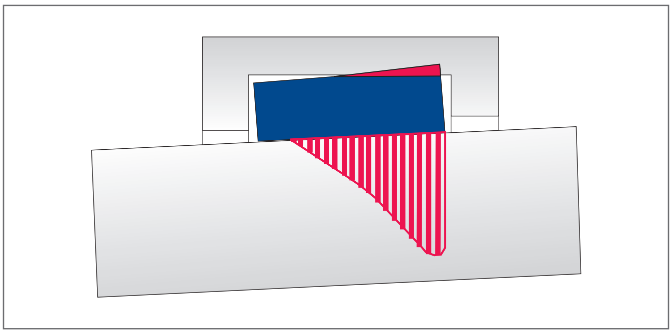


Figure 01: Rectangular guide band
Excessive stress within the edge area

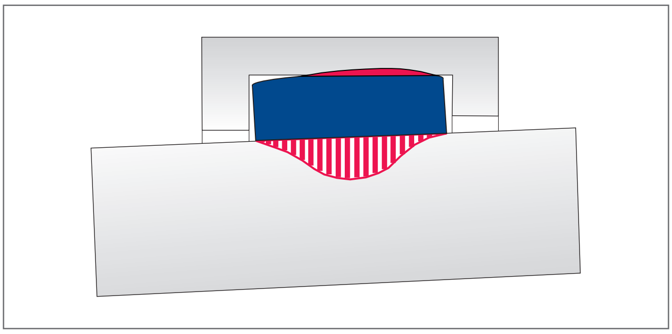


Figure 02: Guivex guide band – uniform stress distribution

Sliding properties

Guivex guide bands made of HGW HG517 and HGW HG 650 materials are compounded with graphite and/or PTFE in order to achieve a better dry-running behavior. As a result, guide bands made of resin bonded fabric exhibit excellent sliding properties, due to the material properties alone, even in the event of inadequate lubrication.

The absorption of lubricating media within the area comprised between the guide and the counter surface is greatly enhanced by the patented profiling of Guivex guide bands. Consequently, the sliding behavior is also improved by the Guivex geometry with correspondingly positive effects in terms of service life and stick-slip behavior.

ADDITIONAL PRODUCT DESCRIPTION

Radial load capacity
The resin bonded fabric materials HGW HG517 resp. the version HGW HG650, a special Freudenberg development are characterized by a high degree of load capacity.
The impact of the operating temperature on the load capacity of resin bonded fabric guide rings is reduced, of course, when using duroplastic resin bonded fabric quality HGW HG517. The resin matrix of our material HGW HG650 includes both duroplastic and thermoplastic constituents. If permissible side loads are simultaneously less dependent on temperatures, the flexibility will be noticeably improved for assembly with small diameters.

Purely thermoplastic basic materials like polyester, for example, exhibit a temperature-dependent material behavior. Permissible cross loads are greatly reduced under the effect of rising operating temperatures. (See Figure 03).

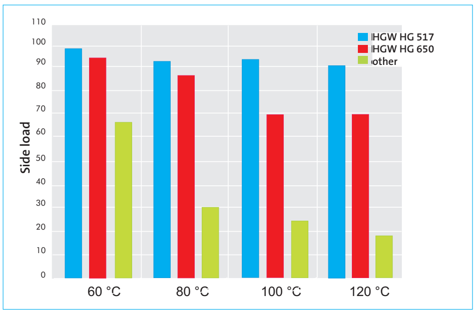


Figure 03: Resin bonded fabric materials in comparison of load capacity among plane-parallel guides depending on the operating temperature involved.

Forces are always introduced within the medium range of the guide ring in conjunction with the patented Guivex geometry. The maximum permissible cross load is not reduced here by excess stress at the edges. Uniform movements along the stroke, coupled with a high radial load capacity, can be achieved even in conjunction with short guide lengths and long-stroke cylinders with high angular offset to be expected.

The absorption of lubricating media within the area comprised between the guide and the counter surface is greatly enhanced by the patented profiling of Guivex guide bands. Consequently, Guivex guide bands exhibit a favorable frictional behavior with correspondingly positive effects in terms of service life and stick-slip behavior.

Forces are always introduced within the mid-section of the guide band. Uniform movements along the stroke, coupled with a high radial load capacity, can be achieved even in conjunction with short guide lengths and long-stroke cylinders with the large angular offset to be expected. The system of guides inside the hydraulic cylinder will not be inclined to jam over a short guide distance either.

The use of Guivex guide bands makes a vital contribution to the functional reliability and dependability of hydraulic cylinders