



# PERMAGLIDE® P10 Plain Bearings

Maintenance-free, suitable for dry running



# PERMAGLIDE® – Wear-resistant sliding materials



## KSPG Automotive

### KSPG (Kolbenschmidt Pierburg)

As long-standing partners to the automotive industry, the companies in the KSPG Group develop innovative components and system solutions with acknowledged competence in the fields of air supply and emission control, for oil, water and vacuum pumps and for pistons, engine blocks and plain bearings. The products satisfy the exacting requirements and high quality standards of the automotive industry. Low emissions, reduced fuel consumption, reliability, quality and safety – these are the forces that drive innovation at Kolbenschmidt Pierburg.

## GLEITLAGER

### KS Gleitlager

Within the KSPG Group, KS Gleitlager GmbH is the specialist for high-precision sliding elements. The introduction of new technologies in production and surface finishing, innovative developments and a clear customer focus have made KS Gleitlager one of the world's leading suppliers of engine bearings and dry plain bearings (KS PERMAGLIDE®).

## MOTOR SERVICE

### Motor Service Group

The Motor Service Group is the sales organisation for the global aftermarket activities of Kolbenschmidt Pierburg. It is a leading supplier of engine components for the independent aftermarket, including the premium brands KOLBENSCHMIDT, PIERBURG and TRW Engine Components. Our comprehensive product range enables our customers to procure engine components from a single source. What's more, as a problem solver for repair shops and the aftermarket, we offer an extensive service and the technical expertise that you would expect from the subsidiary of one of the largest automotive suppliers.



## 1

### Description of material

KS PERMAGLIDE® P10 is a universal plain bearing material for both dry and lubricated applications. The composite, multi-layered system excels through its high rigidity, durability, high chemical resistance and good emergency running characteristics. These properties are achieved to a great extent through the use of leaded bronze sintered onto a steel substrate, and friction-lowering additives of fluoropolymer PTFE and lead.

KS PERMAGLIDE® P10 offers the following advantages over conventional, lead-free plain bearing products:

- Higher thermal conductivity
- Good chemical resistance
- Good transfer of lubricant onto the interacting sliding partner
- Good passivation of the interacting sliding partner
- Insensitive to high edge loading

In damp environments, in particular, this sliding layer system provides outstanding protection against corrosion. Moreover, lead and PTFE are virtually non-absorbent. Absorption of the surrounding fluids with consequent swelling of the materials is prevented, as is chemical damage to interacting sliding partners. The result is dimensional stability and optimum corrosion protection during use.

## 2

### Material composition and material versions

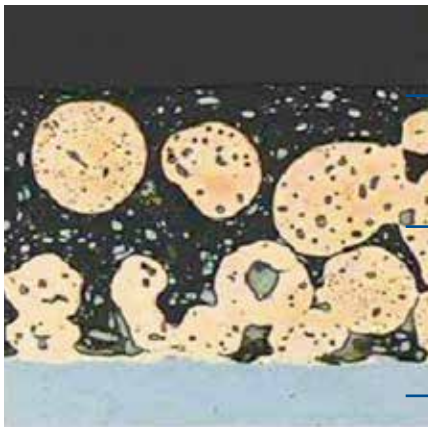


Fig. 1: Microsection of P10

#### Material composition of P10/P11(P10Bz)

1	Running-in layer	
	PTFE matrix with bulking agent <sup>1)</sup>	
	Layer thickness [mm]:	max. 0.03
2	Sliding layer	
	Tin-lead-bronze (P10) Tin-bronze (P11/P10Bz)	
	Layer thickness [mm]:	0.20 – 0.35
	Pore volume [%]:	approx. 30
3	Bearing back	
	Steel (P10)	
	Steel thickness [mm]:	Variable
	Steel hardness [HB]:	100 – 180
	Alternative P11(P10Bz) Bronze	
	Bronze thickness [mm]:	Variable
	Bronze hardness [HB]:	80 – 160

Tab. 1: Material composition

### 3

#### Technical data

The performance limits of plain bearings are described in so-called pv value diagrams. The product of surface pressure and circumferential speed is equivalent to the input power per bearing surface. If an operating point lies inside the curve, we can basically assume that KS PERMAGLIDE® P10 plain bearings can be used.

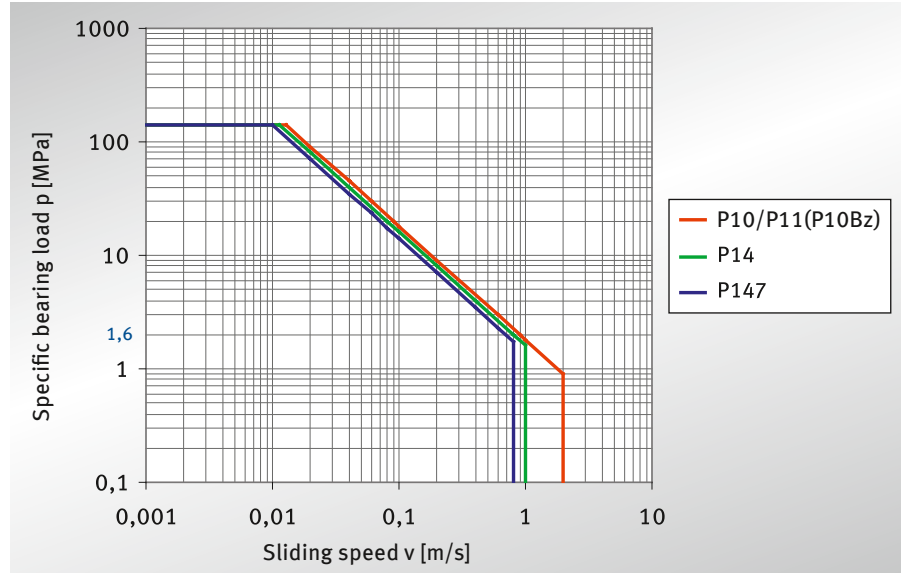


Fig. 2: pv value [MPa·m/s], limit curve (values apply at room temperature)

Characteristic values, load limit	Designation	Unit	Value
Permitted pv value	$p v_{per.}$	MPa · m/s	1.8
Permitted specific bearing load			
Static	$p_{per.}$	MPa	250
Concentrated load, circumferential load at a sliding speed of $\leq 0.013$ m/s	$p_{per.}$	MPa	140
Concentrated load, circumferential load at a sliding speed of $\leq 0.032$ m/s	$p_{per.}$	MPa	56
Concentrated load, circumferential load, increasing at a sliding speed of $\leq 0.064$ m/s	$p_{per.}$	MPa	28
Permitted sliding speed			
Dry running	$v_{per*}$	m/s	2
Hydrodynamic operation	$v_{per.}$	m/s	3
Permitted temperature	$T_{per.}$	°C	-200 to +280
Coefficient of thermal expansion			
Steel back	$\alpha_{St}$	K <sup>-1</sup>	$11 \cdot 10^{-6}$
Bronze back	$\alpha_{Bz}$	K <sup>-1</sup>	$17 \cdot 10^{-6}$
Coefficient. of thermal conductivity			
Steel back	$\lambda_{St}$	W(mK) <sup>-1</sup>	> 40
Bronze back	$\lambda_{Bz}$	W(mK) <sup>-1</sup>	> 70

Tab. 2: Characteristics, load limit – P10/P11(P10Bz)





## 4

### Applications

KS PERMAGLIDE® P10 covers a broad range of applications, e.g. as main bearings in gear pumps in the chemical industry (Fig. 3). The bearings come into direct contact with aggressive pumping media, where abrasion resistance and chemical compatibility with a minimal swelling tendency are what matter.

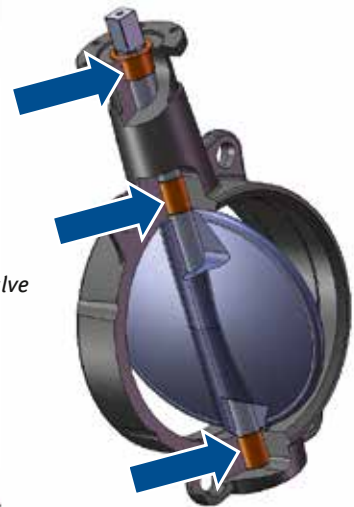
KS PERMAGLIDE® P10 bearings are also used in maintenance-free shut-off valves (Fig. 4), as employed in the chemical industry. The bearings are permanently exposed to the influence of chemicals and high or extremely low temperatures. Despite these extreme operating conditions, a long-lasting bearing function is guaranteed.

KS PERMAGLIDE® P10 is used as a dry-running thrust bearing in pneumatic cylinders (Fig. 5). A high guiding accuracy under changing operating conditions is demanded from this bearing. P10 has proven itself excellent for this application. Despite lateral forces, high speeds and strong vibrations, P10 satisfies the requirement of a precise guide bearing over a long service life.

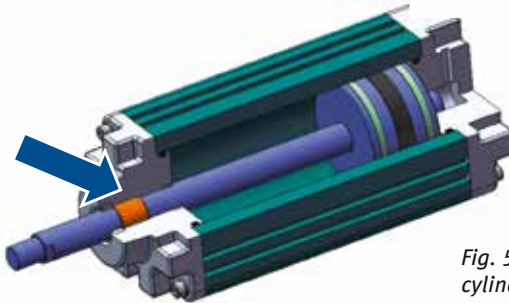
KS PERMAGLIDE® in hinges of high-voltage switches (Fig. 6). In open-air distributor systems, these switches are exposed to the weather without protection. Even after a year without being used, the bearing assembly must never stick or suffer seizure due to micro-movements caused by high-frequency vibrations, because in the event of power failure the switches still have to work within milliseconds.



*Fig. 3: Gear pump application*



*Fig. 4: Shut-off valve application*



*Fig. 5: Pneumatic cylinder application*



*Fig. 6: High-voltage switch application*

## 6

### Application parameters

For dry running, care must be taken to ensure that the sliding pair does not produce a galvanic effect, e.g. the zinc coating of a galvanised shaft can be worn off relatively quickly, causing the shaft to rust in the vicinity of the plain bearing. Hard, loose particles have an abrasive effect on the bearing and can provoke galvanic corrosion, which is known as tribochemical wear.

P10 must generally be protected against abrasion. Sand, chips or hard particles may well become embedded in the sliding layer to a certain extent, but these also pose a threat of premature damage to the shaft.

When P10 is initially lubricated on assembly, there is a risk of a paste forming due to

abrasion. A lubricating film containing particles may promote wear. Therefore, P10 should only either be used in dry running systems, or adequate relubrication intervals must be ensured.

Most types of oil and grease are suitable for P10. Only bio-oils should not be used. The products of reactions to the methyl esters they contain can cause lead damage.

The operational reliability and service life of P10 plain bearings are largely dependent on the interacting sliding partner.

Good conditions are produced by the use of stainless steel, hard chrome-plated steel or hard-anodised aluminium. The interacting sliding partner should have a surface roughness in the region of Rz 0.8 to 1.5 µm.

Standard plain bearing bushes are dimensioned as low-cost catalogue goods to DIN ISO 3547. Adapted designs and individual plain bearing solutions can also be produced.

**Motor Service offers you assistance with designing your plain bearings.**

## 7

### Versions of the KS PERMAGLIDE® P1



*PAP bushes*  
P10, P10Bz\*, P14, P147\*

*PAF collar bushes*  
P10, P10Bz\*, P14, P147\*

*PAW thrust washers*  
P10, P10Bz\*, P14, P147\*

*PAS strips*  
P10, P10Bz\*, P14, P147\*

\* On request



### KS PERMAGLIDE® – The advantages at a glance



- Central management and production – Made in Germany
- Advice, calculation and plain bearing design
- Standard parts to DIN ISO 3547
- Special designs as per customers' wishes
- Top quality standards of the German automotive industry
- Stable, reliable processes:
  - Strength tests parallel to production
  - Continuous dimensional checks
- Material development
- Test benches to suit real-life conditions, based on customers' requirements
- Stocking of parts, availability and logistical performance



ORIGINAL  
PERMAGLIDE

[www.permaglide.de](http://www.permaglide.de)



You can find further information  
in the latest **KS PERMAGLIDE®** catalogue  
Part No. 50 003 863-02  
or at:  
[www.ms-motor-service.com](http://www.ms-motor-service.com)  
[www.permaglide.de](http://www.permaglide.de)

KS PERMAGLIDE® partner:

International Sales:  
**MS Motor Service International GmbH**  
Wilhelm-Maybach-Strasse 14-18  
74196 Neuenstadt, Germany  
[www.ms-motor-service.com](http://www.ms-motor-service.com)

Production:  
**KS Gleitlager GmbH**  
68789 St. Leon-Rot, Germany  
[www.kspg-ag.de](http://www.kspg-ag.de)

KSPG AUTOMOTIVE GROUP

