

PERMAGLIDE® P2 Plain Bearings

Low-maintenance, for applications with grease
or liquid lubrication



Making sure everything runs smoothly



Motorservice

The Motorservice Group is the sales organisation for the global aftermarket activities of KSPG (Kolbenschmidt Pierburg). It is one of the leading suppliers of engine components for the independent aftermarket, including the premium brands KOLBENSCHMIDT, PIERBURG and TRW Engine Components, as well as the BF brand.



KS Gleitlager

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



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 for air supply and emission control, for oil and water pumps, for pistons, engine blocks and engine bearings. The products comply with the high demands and quality standards of the automotive industry. Low emission, reduced fuel consumption, reliability, quality and safety – these are the forces that drive innovation at KSPG.

PERMAGLIDE® is a registered trademark of KS Gleitlager GmbH

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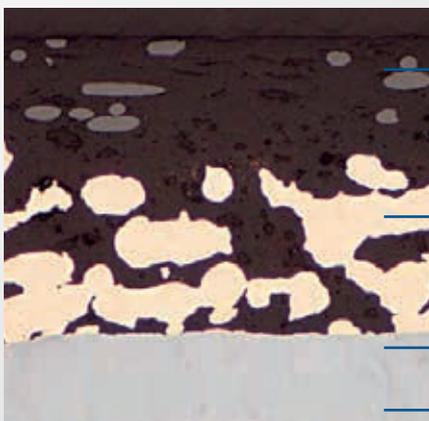
1 Description of material

KS PERMAGLIDE® P2 is a low-maintenance sliding material for lubricated applications. This composite, multi-layered system excels through its high rigidity, durability and resistance to oscillation and vibration. These properties are largely achieved by a sliding layer system made of polyvinylidene fluoride (PVDF) and polytetrafluoroethylene (PTFE), plus mineral fillers.

KS PERMAGLIDE® P2 materials offer the following advantages over comparable products:

- High wear resistance
- Good damping characteristics
- Good chemical resistance
- Minimal swelling tendency
- Insensitivity to shocks and impacts
- Insensitivity to high edge loading

2 Material composition and material versions



- PVDF compound sliding layer
 - Layer thickness approx. 0.2 mm
 - Versions containing lead P20, P22 and P23
 - Lead-free versions P200, P202 and P203
- Layer thickness approx. 0.3 mm
 - Spattered tin bronze
 - Porosity approx. 50 %
- Steel back DC04
- Corrosion protection – Tin approx. 2 µm

Fig. 1: Microsection of P203

P20/P200

- Ready to install, with lubricating pockets
- Lubricating pockets act as a grease reservoir in mixed friction systems

P22/P202

- With machining allowance, without lubricating pockets
- With machining allowance for higher precision with additional machining when installed

P23/P203

- Ready to install, without lubricating pockets
- Smooth surfaces for fluid friction

3 Characteristic profiles

The general performance characteristics of composite materials depend on the properties of the polymers used. The balanced characteristic profile of the KS PERMAGLIDE® P2 is achieved thanks to the ideal composition of the sliding layer. The primary component and therefore most important influencing factor is a polymer matrix of polyvinylidenfluoride (PVDF). In contrast, the majority of comparable products from other manufacturers are produced from low-cost polyoxymethylene (POM). The radial diagrams (Fig. 2) show a relative comparison of characteristic features.

Points that lie far outside in the direction of the arrow indicate a very marked characteristic.

PVDF attains a high level for most characteristics, and is therefore a universal material for plain bearing applications. By adding fillers, in the KS PERMAGLIDE® P2 resistance to wear and abrasion and emergency running characteristics have been further improved. The POM polymer, on the other hand, is generally deficient in terms of damping, toughness and resistance to chemicals.

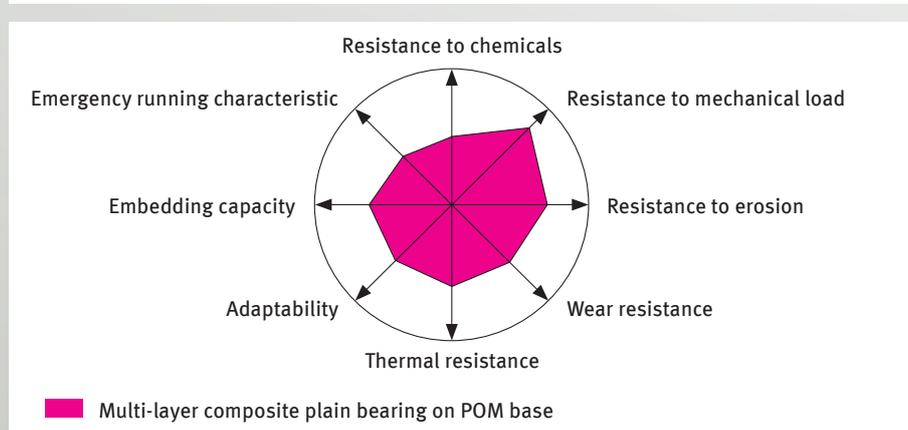
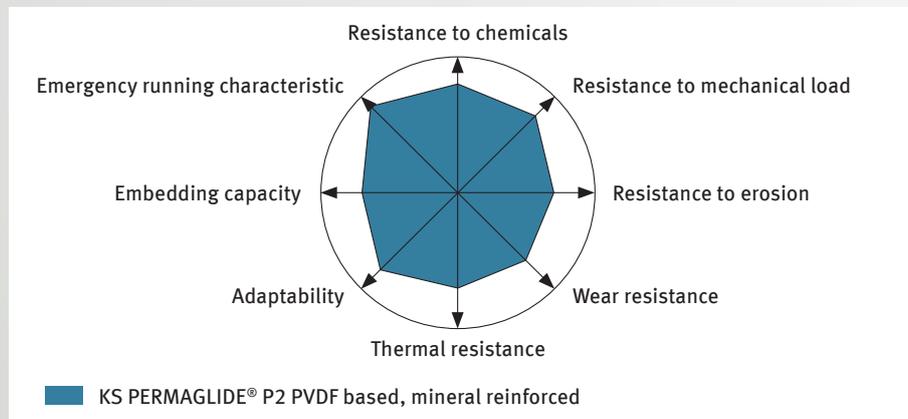
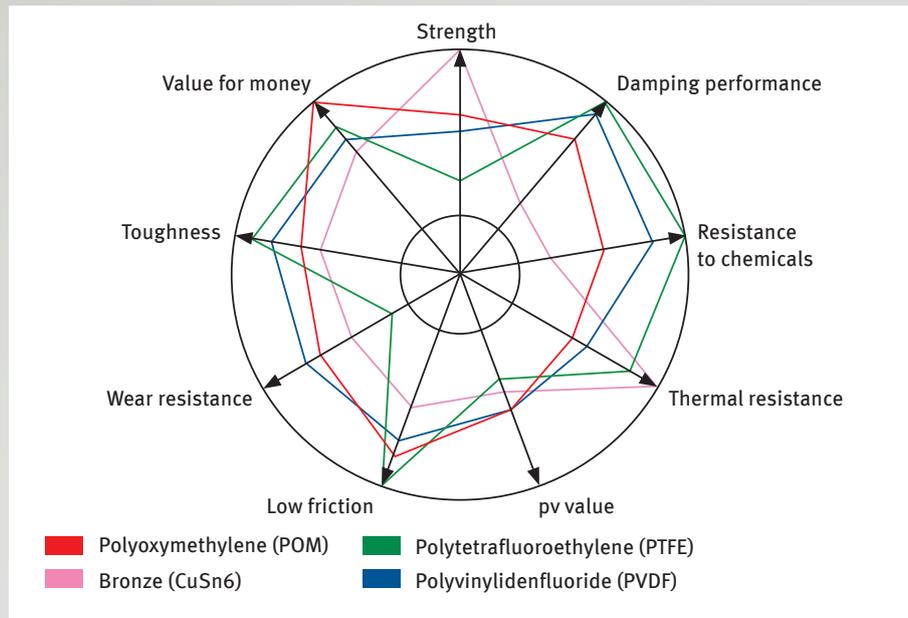


Fig. 2: Radial diagrams

4 Technical data

The performance limits of plain bearings are described in so-called pv value diagrams (Fig. 3).

The product of surface pressure (p) and circumferential speed (v) is equivalent to the input power per bearing surface. If an operating point lies inside the curve, it can be assumed that KS PERMAGLIDE® P2 plain bearings can be used.

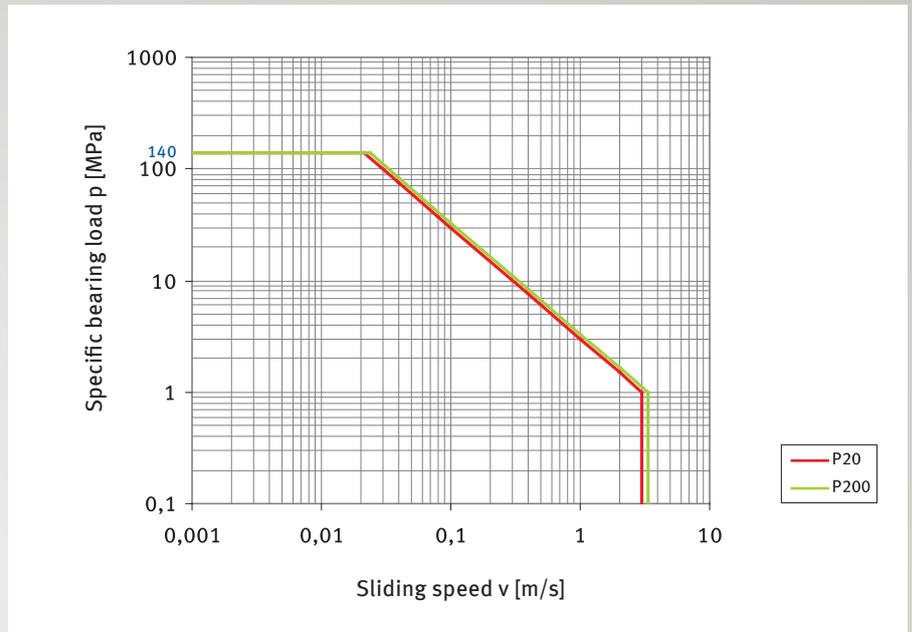


Fig. 3: pv value [MPa·m/s], limit curve (values apply at room temperature)

Characteristic values, load limit	Designation	Unit	Value
Types of pressure			
Static	p_{stat}	MPa	250
Dynamic	p_{dyn}	MPa	140
Speed			
Rotating	v_{rot}	[m/s]	3.3
Linear	v_{lin}	[m/s]	6
Continuous operating temperature			
Min.	T_{min}	°C	-40
Max.	T_{max}	°C	110
Short-time	T_{short}	°C	140
Coeff. of therm. expansion	a_{steel}	$10^{-5} 1/K$	1.1
Thermal conductivity	λ_{steel}	W/m/K	<40

PERMAGLIDE® P2 – Robust and reliable

5 Applications

KS PERMAGLIDE® covers a broad range of applications, e.g. as main bearings in gear pumps in the chemical industry (Fig. 4). The bearings come into direct contact with aggressive pumping media, where abrasion resistance and chemical compatibility are what matter. Fluoropolymers are extremely non-absorbent, which means that virtually none of the surrounding fluid is absorbed and the sliding surface is not prone to swelling.

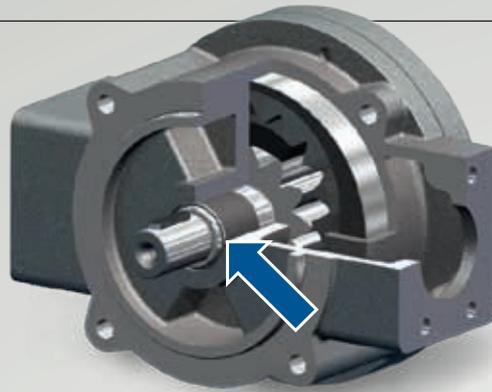


Fig. 4: Gear pump application

KS PERMAGLIDE® P20 is also used in the bearing assembly of maintenance-free ball heads, in the steering linkage of tractors, for example (Fig. 5). In extremely tough operating conditions, the bearings are permanently exposed to the influence of dirt, temperature fluctuations and vibrations with severe shocks. Despite this exposure, precise guidance is guaranteed over a long service life.



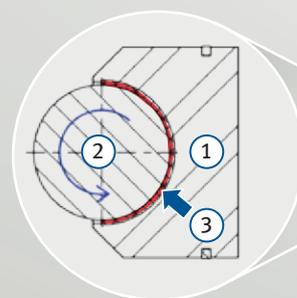
Fig. 5: Application in steering linkage ball heads

KS PERMAGLIDE® P2 is used for thrust bearings in shock absorber systems (Fig. 6). A high guiding accuracy under changing operating conditions is demanded from this bearing. P2 has proven itself especially suitable for this particular application. On poor surfaces, P2 has a considerably longer service life, which the competition cannot match.



Fig. 6: Application in shock absorber systems

KS PERMAGLIDE® is used in radial piston engines (Fig. 7). These engines generate very high torques at low revolutions. It's a straightforward principle: Hydraulic mechanisms move pistons radially. Rollers transfer the radial force to a cam track, thereby transforming it into a rotary movement. The rollers are mounted on half-shells of P23. They are subject to extremely high pressure while only mixed friction is present.



1 Piston
2 Roller
3 KS PERMAGLIDE® half-shell

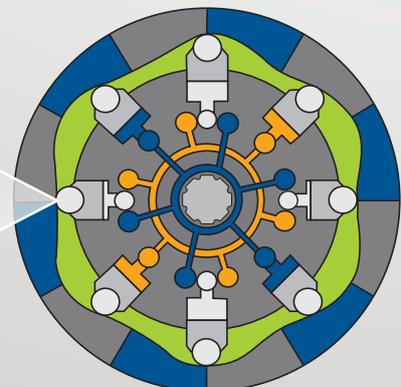


Fig. 7: Application in radial piston system

6 Application parameters

Low-maintenance P2 plain bearings can be used in systems with lifetime lubrication.

Suitable lubricants are all commonly available types of grease based on

- Lithium (resistance to ageing)
- Barium (good adhesion)
- Aluminium (good wettability) and oil
- HLP hydraulic oil
- Bed track oil
- Mineral oil



Important:

The suitability of bio-oils must first be verified in tests, due to the ketone and ester they contain.

The operational reliability and service life of KS PERMAGLIDE® P2 plain bearings are largely dependent on the interacting sliding partner.

Good conditions are produced by the use of both stainless or hard chrome-plated steel and hard-anodised aluminium. The interac-

ting 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.

Motorservice offers you assistance with designing your plain bearings.

7 Versions of the KS PERMAGLIDE® P2



PAP bushes
P20, P22*, P23*, P200, P202*, P203*



PAW thrust washers
P20, P22*, P23*, P200, P202*, P203*



PAS strips
P20, P22*, P23*, P200, P202*, P203*

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



* On request



Original
KS PERMAGLIDE®
Plain Bearings

You can find further information
in the latest **KS PERMAGLIDE®** catalogue
Part No. 50 003 863-02 or at:
www.ms-motorservice.com
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