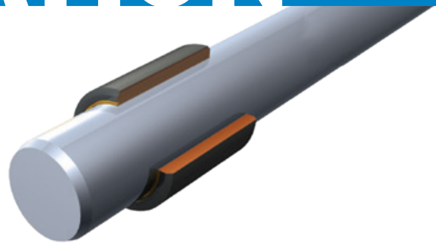
SERVICE**INFORMATION**



INTERACTING SLIDING PARTNER FOR PERMAGLIDE® PLAIN BEARINGS

INFLUENCING FACTORS

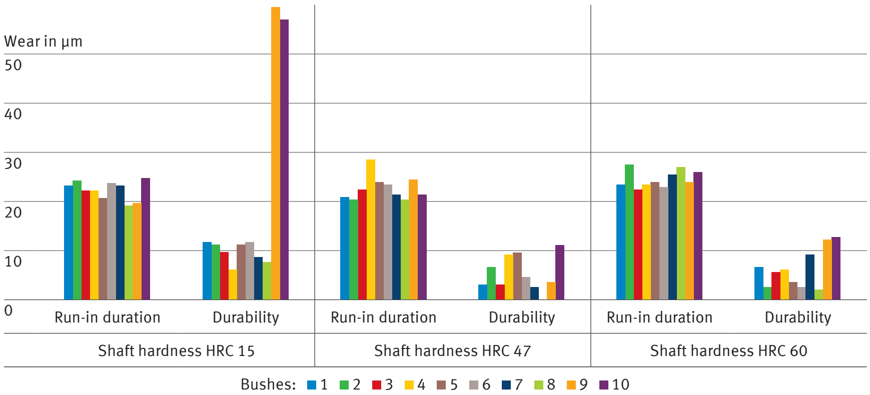
The operational safety and durability of a maintenance-free or low-maintenance bearing position depend not only on the load collective and lubricant for low-maintenance bearing positions, but also on the material and surface of the interacting sliding part. The materials of the interacting sliding parts may exert a considerable influence on the wear properties and durability of the plain bearing (see table "Correction factor").

HARDNESS OF THE INTERACTING SLIDING PARTNER

For good tribological conditions, the interacting sliding partner should be as hard (HRC › 45) and smooth (roughness depth R_z 0.8 to 1.0) as possible here. Tests with different shaft hardness levels show increased lifetime wear when shafts with lower hardness levels or a higher surface roughness are used.

For plain bearings made from P1 materials, it is always advantageous in terms of durability to use interacting sliding parts with a hardened sliding surface, or one featuring a special coating. This is particularly the case under higher stresses or at higher sliding speeds. If the shaft material can not be hardened further, the surface of the journal should be finely ground. Sanding marks across the direction of movement or machining grooves and swirls should be avoided. For lead-free materials like PERMAGLIDE® P14, tin-bronze is used, for example, which is harder than the lead-bronze used in the material P10.

With lead-free PERMAGLIDE® P1 plain bearings, a hard interacting sliding partner with HRC › 47 is therefore recommended. This results in less wear on the material and the interacting sliding partner is less affected.



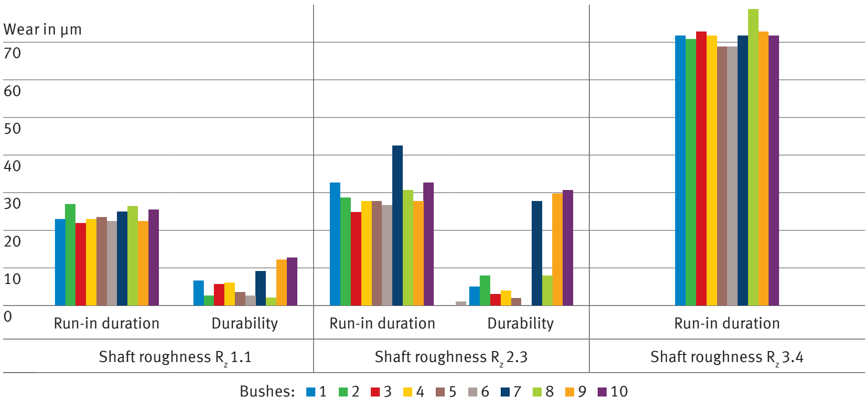
Analysis rotating test bench: Wear in µm with **different shaft hardness HRC**

ROUGHNESS OF THE INTERACTING SLIDING PARTNER

The surface roughness of the interacting sliding part is also extremely important in respect of the operational safety and durability of the tribological pairing. The most favourable friction conditions are achieved with a surface roughness of R_z 0.8 to R_z 1.5.

For plain bearings made from P1 materials, the solid lubricant cannot stick sufficiently to the interacting sliding part if the surface is too smooth. Adhesion repeatedly occurs during the sliding movement, resulting in stick-slip effects, squeaking noises and problems during operation. If the surface of the interacting sliding part is too rough, on the other hand, the available solid lubricant in the plain bearing is no longer adequate for producing a sealed lubricating film on the interacting sliding part. The consequence is abrasion, together with increased friction, a rise in temperature and increased wear.
With plain bearings made from P2 materials, abrasion occurs with increased wear despite the use of grease as a lubricant with larger roughness depths.

v = 0.42 m/s p = 2 MPa Run-in 4 h Durability 56 h P14



Analysis rotating test bench: Wear in µm with **different shaft roughness R_z, shaft hardness HRC 60**

CORRECTION FACTOR INTERACTING SLIDING PART MATERIAL

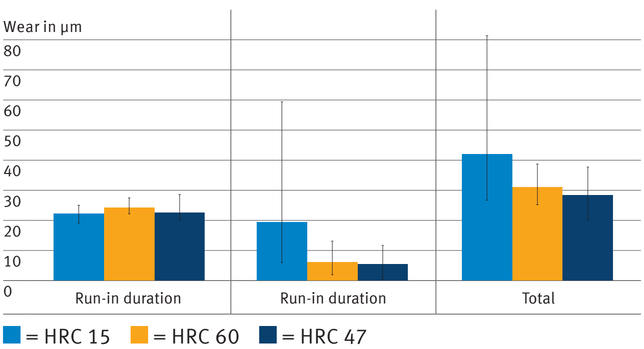
Material of interacting sliding surface	f_w
Steel	1
Nitrided steel	1
Corrosion-resistant steel	2
Hard chrome-plated steel (min. layer thickness 0.013 mm)	2
Galvanised steel (min. layer thickness 0.013 mm)	0.2
Phosphated steel (min. layer thickness 0.013 mm)	0.2
Grey cast iron R_z 2	1
Anodised aluminium	0.4
Hard anodised aluminium (Hardness 450 +50 HV; 0.025 mm thick)	2
Copper-based alloys	0.1 to 0.4
Nickel	0.2

Material correction factor f_w
(with roughness depth R_z 0.8 to R_z 1.5)

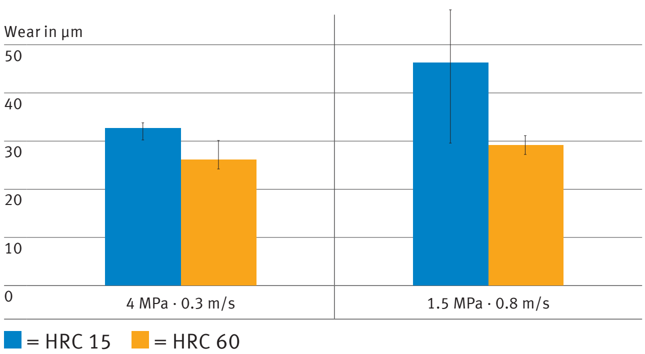
WEAR VALUES

1. TEST PARAMETER 1

Load 2 MPa, sliding speed 0.42 m/s



2. TEST PARAMETER 2



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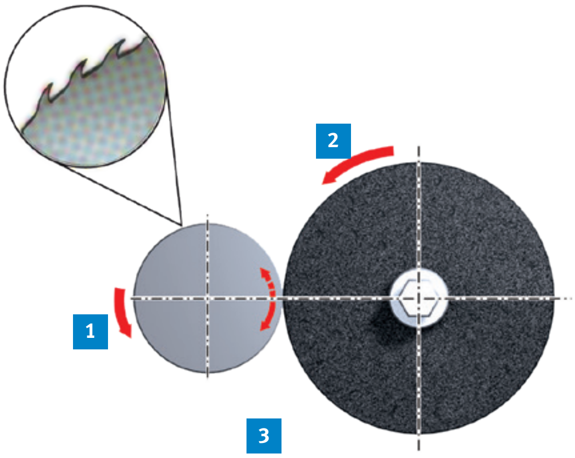
DESIGN OF THE INTERACTING SLIDING PART

THE FOLLOWING GENERALLY APPLIES:
In a tribological system, the shaft (in the case of radial bearings) or the pressure shoulder (in the case of thrust bearings) should project over the sliding surface to maximise the contact ratio and prevent running-in with deposits in the sliding layer.



Grinding a cast shaft

01 Direction of rotation of shaft during use
02 Direction of rotation of grinding disc
03 Direction of rotation of shaft during grinding optional

SHAFT

Shafts must be chamfered and all sharp edges rounded, which:

- Simplifies mounting
- Prevents damage to the bush sliding layer

Shafts must never have grooves or pricks in the area of the sliding zone.

INTERACTING SLIDING SURFACE

Optimum service life thanks to correct roughness depth

- Optimum service life is achieved when the interacting sliding surface has a roughness depth of R_z 0.8 to R_z 1.5:
  - with dry-running PERMAGLIDE® P1
  - with lubrication on PERMAGLIDE® P2.

ATTENTION:

Smaller roughness depths do not prolong the service life and may even cause adhesive wear. Larger roughness depths are significantly reduced.

- With PERMAGLIDE® P1 and P2, corrosion on the interacting sliding surface is prevented by:
  - sealing,
  - use of corrosion-resistant steel,
  - suitable surface treatment.

With PERMAGLIDE® P2, the lubricant is also effective against corrosion.

SURFACE QUALITY

- Ground or drawn surfaces are preferable.
- Precision-turned or precision-turned and roller burnished surfaces, even with R_z 0.8 to R_z 1.5, can cause greater wear (precision turning produces spiral scores).
- Spheroidal graphite iron (GGG) has an open surface structure, and should therefore be ground to R_z 2 or better. The illustration shows the direction of rotation of cast shafts in use. This should be the same as the direction of rotation of the grinding disc, as more wear will occur in the opposite direction.

HYDRODYNAMIC OPERATION

For hydrodynamic operation, the roughness depth R_z of the interacting sliding surface should be less than the smallest lubricating film thickness. Motorservice offers hydrodynamic calculation as a service.