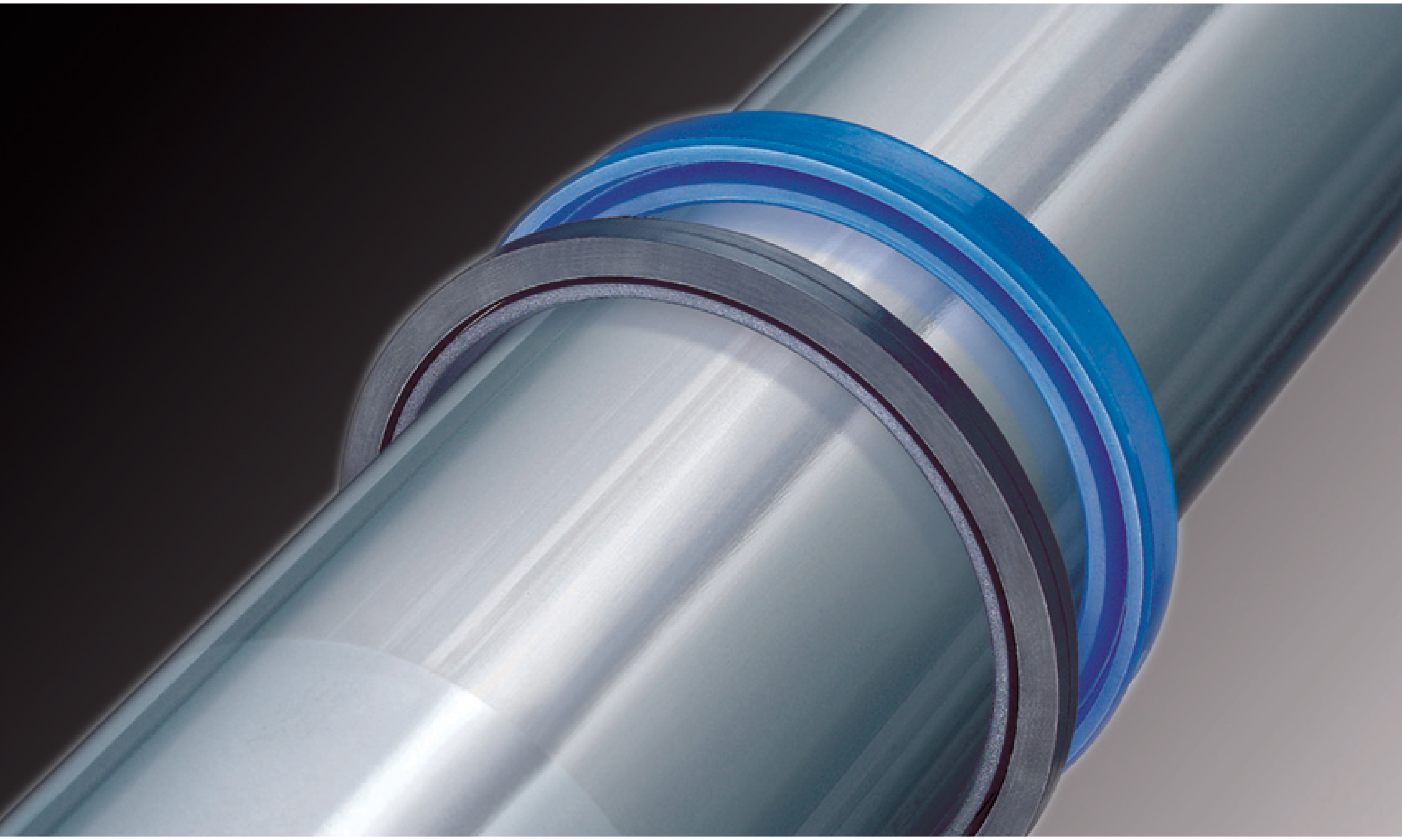

MCPs—Merkel Counter Surface Parameters

A breakthrough concept for inspecting the sliding surfaces of tribological systems in fluid technology

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Merkel Counter Surface Parameters (MCPs)

A breakthrough concept for sustained assessment of sliding surfaces from Merkel developed on MCPs and the specific requirements involved in hard-soft contacts

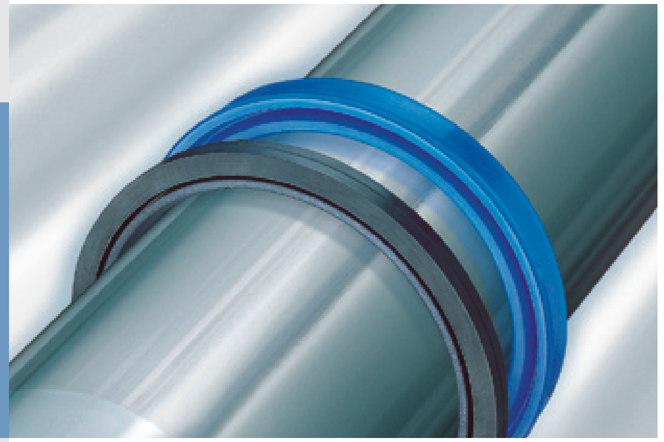
Seal counterfaces have so far usually been assessed on the basis of parameters for metal-to-metal contacts. However, as a piston and rod seal in hydraulic systems always involves a hard-soft contact, the result obtained for counter-surface assessment in terms of abrasivity, long-term behavior, and oil deposits provides restricted information only. This is leading to greater friction and more rapid wear of the sealing elements in tribological systems.

Merkel Counter Surface Parameters (MCPs) are a new innovative concept for assessment of seal counterfaces.

Greater reliability and longer service lifetime.

With MCPs, surface profiles are registered according to the tried-and-tested contact stylus process. This is the first time, however, that the parameters being relevant for hard-soft contacts are derived from the Abbott Firestone curve (Fig. 4, page 2). The parameters defined therein—core peak-to-valley height R_k, peak height R_{pk}, R_{pkx} and groove depth R_{vk}, R_{vkx} (Fig. 5)—make it possible to obtain a fascinatingly accurate description of surfaces as seal counterfaces. As a result, essential properties of the surface topography can now be determined with accuracy in the field of sealing technology, for example:

- The peaks being responsible for abrasive properties and wear potential
- The profile core governing long-term behavior
- The recesses influencing the conveyance of media (as leaks and/or hydrodynamic lubricating film)



Five new parameters for custom production of sliding surfaces

It is on this basis that the five Merkel Counter Surface Parameters (MCPs) R_k, R_{pk}, R_{pkx} and R_{vk}, and R_{vkx}—and their limiting values—have been derived by Merkel, which now provide valuable additional information about the current limiting values for R_a with 0.05 to 0.30 µm and R_{max} to 2.50 µm.

R_{pk} and R_{pkx} for profile peaks

These parameters describe the profile peaks and, therefore, the possible abrasivity involved. The limiting values recommended by Merkel and developed on the basis of well-founded research for steel surfaces are as follows:

- R_{pk} 0.00 to 0.50 µm
- R_{pkx} 0.00 to 0.50 µm

R_k for long-term behavior

The long-term behavior is excellently characterized by the core peak-to-valley height. For R_k, 0.25 and 0.70 µm are applicable as lower and upper limiting values.

R_{vk} and R_{vkx} for oil deposits

Surface recesses characterize the abrasivity involved through grooves and/or describe oil deposits with the parameters R_{vk} and R_{vkx}. The recommendation based on these parameters makes sure that a certain amount of medium shall take over a lubricating and cooling function for the seal, on the one hand, but that excessive medium cannot be dragged out in the form of leakage, on the other hand. The following limiting values shall apply for this purpose:

- R_{vk} 0.20 to 0.65 µm
- R_{vkx} 0.20 to 2.00 µm

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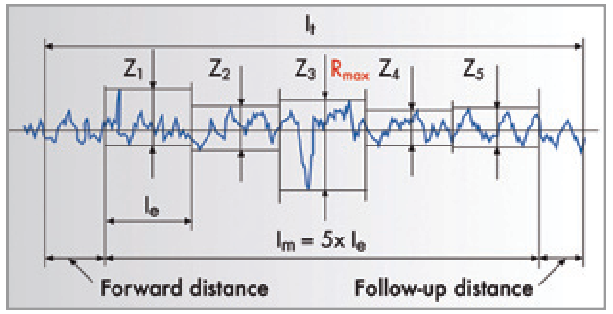
Sealing Solutions

Five parameters for sliding surfaces production

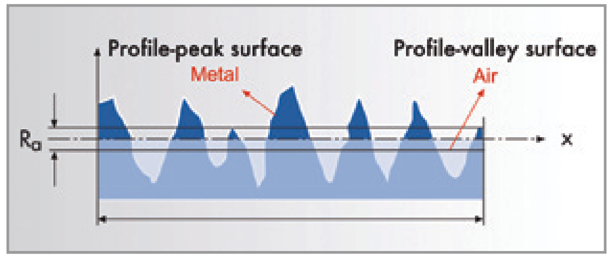
Figure 1



$R_z = (1/5)(Z_1 + Z_2 + Z_3 + Z_4 + Z_5)$

R_z and R_{max} appear to be poor parameters for assessing seal counterfaces. For example, R_{max} is dominated here by a groove in section 3 which is uncritical in terms of sealing technology. The strong abrasivity involved in the first section is not registered by this parameter. R_z, as a mean peak-to-valley height, also fails to display this strong abrasivity at Z_1.

Figure 2



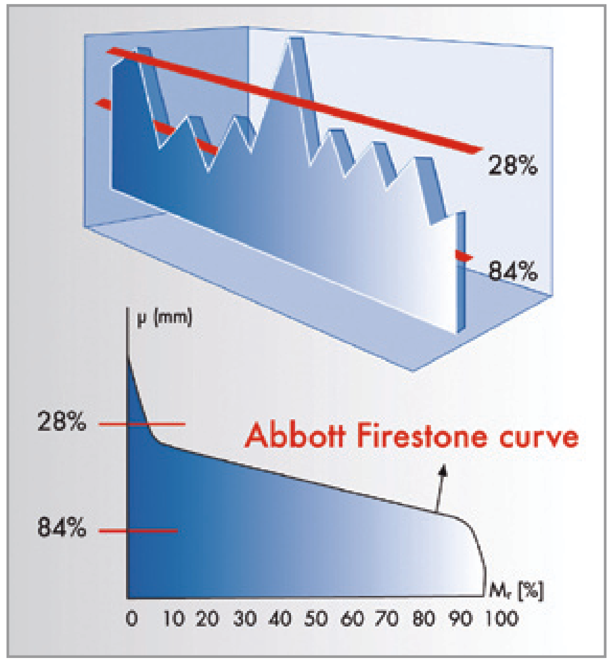
$$R_a = (1/lm) \int_0^{lm} y(x)dx$$

The arithmetical average peak-to-valley height R_a has proven its worth for assessment of surfaces for hard-hard contacts, but it provides no definite data for surfaces involving hard-soft contacts in the field of sealing technology, as it serves to calculate the mean value of peaks (metal) and grooves (air).

Figure 3

Vital factors for an optimum tribological system consisting of a seal, a medium and a counter-surface are the specification of limiting values for the percentage of wear and the oil deposits in the surface profile, as well as the definition of limiting values for an optimum long-term behavior.

Figure 4



The curve for material share (below) is derived from the surface profile (above). In this case, the percentage of high abrasivity values as well as the share of grooves become visible as possible oil deposits.

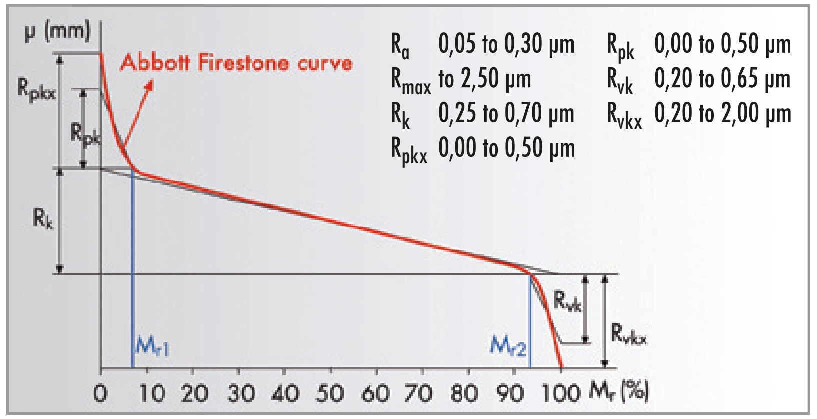


Figure 5: Current development stage for limiting values (left)

The Merkel Counter Surface Parameters (MCPs) from the group including R_{pk}, R_{pkx}, R_k, R_{vk}, and R_{vkx} make it possible to make a clear differentiation between abrasivity, long-term behavior, and oil deposits. The following limiting values shall apply, in this context, for R_a 0.05 to 0.30 µm, R_{max} to 2.50 µm.

Please refer to DIN ISO 4287 and DIN ISO 13565-1 and 2 standards for appropriate values.

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