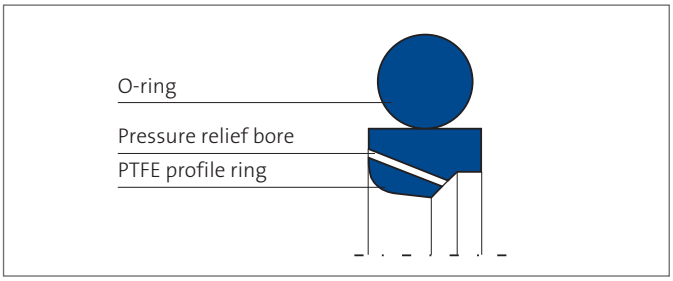
MERKEL OMEGAT OMS-MR PR

Merkel Omegat OMS-MR PR is a two-piece seal set for sealing piston rods, consisting of a PTFE profile ring with an integrated pressure relief function, plus an O-ring as a pre-stressing element.
Patented product design. (Patent No.: DE 10117662 CI)



Applications

- Primary seal in a sealing system
- Long stroke (greater than 400 mm)
- High sliding speed when the piston rod is extended (greater than 0,5 m/s)
- Sizeable velocity differences depending on the direction of movement (v_{ext} greater than 8x v_{retr})
- Fast pressure drop in the main chamber

Material

O-ring

Material	Designation
Nitrile rubber	NBR
Fluoroelastomer	FKM

PTFE Profile ring

Material	Designation	Color
PTFE-bronze compound	PTFE B602	brown
PTFE-glass-fiber-MoS2 compound	PTFE GM201	light gray
PTFE-carbon-fiber-compound	PTFE C104	dark gray

Other material combinations available on request.

VALUE TO THE CUSTOMER

- Interchangeable with housings of the Merkel Omegat OMS-MR series
- Enhanced operating reliability of sealing systems with tough operating parameters (no continuous pressure build-up in the intermediate space)
- Extended service life of sealing systems due to stable long term behavior (reduced loads on the sealing system from friction and wear)

FEATURES AND BENEFITS

Operating conditions

Material	PTFE B602/NBR	PTFE GM201/NBR PTFE C104/NBR	PTFE B602/FKM	PTFE GM201/FKM PTFE C104/FKM
Hydraulic oils, HL, HLP	–30 ... +100 °C	–30 ... +100 °C	–10 ... +200 °C	–10 ... +200 °C
HFA fluids	–	+5 ... +60 °C	–	+5 ... +60 °C
HFB fluids	–	+5 ... +60 °C	–	+5 ... +60 °C
HFC fluids	–	–30 ... +60 °C	–	–10 ... +60 °C
HFD fluids	–	–	–10 ... +200 °C	–10 ... +200 °C
Water	–	+5 ... +100 °C	–	–
HETG (rape-seed oil)	–30 ... +80 °C	–30 ... +80 °C	–10 ... +80 °C	–10 ... +80 °C
HEES (synth. ester)	–30 ... +80 °C	–30 ... +80 °C	–10 ... +100 °C	–10 ... +100 °C
HEPG (glycol)	–30 ... +60 °C	–30 ... +60 °C	–10 ... +80 °C	–10 ... +80 °C
Mineral greases	–30 ... +100 °C	–30 ... +100 °C	–10 ... +200 °C	–10 ... +200 °C
Pressure	40 MPa	40 MPa	40 MPa	40 MPa
Running speed	5 m/s	5 m/s	5 m/s	5 m/s

The figures given are maximum values and must not be applied simultaneously.

Surface finish

Peak-to-valley heights	R_a	R_{max}
Sliding surface	0,05 ... 0,3 µm	≤2,5 µm
Groove base	≤1,6 µm	≤6,3 µm
Groove sides	≤3,0 µm	≤15,0 µm

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

The long term behavior of a sealing element and its dependability against early failures are crucially influenced by the quality of the counterface. 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, the hitherto merely general description of the material content is significantly improved, not least in regard to the abrasiveness of the surface. Please consult our Technical Manual.

Surface finish of the sliding surfaces

Characteristic value	Limit	
R_a	>0,05 µm	<0,30 µm
R_{max}	<2,5 µm	
R_{pkx}	<0,5 µm	
R_{pk}	<0,5 µm	
R_k	>0,25 µm	<0,7 µm
R_{vk}	>0,2 µm	<0,65 µm
R_{vkx}	>0,2 µm	<2,0 µm

The limit values listed in the table do not currently apply for ceramic or semi-ceramic counterfaces. Please consult our Technical Manual.

FEATURES AND BENEFITS

Gap dimension
The dimension D2 is determined by factoring in the maximum permissible extrusion gap, the tolerances, the guide clearance, the deflection of the guide under load, and the pipe expansion. See also Merkel Technical Manual.
The maximum permissible extrusion gap with a one-sided position of the piston rod is significantly determined by the maximum operating pressure and the temperature-dependent dimensional stability of the seal material. Please consult our Technical Manual.

Profile dimension [mm]		Max. permissible gap dimension [mm]			
L	Profile	16 MPa	26 MPa	32 MPa	40 MPa
4,2	5,35	0,5	0,4	0,3	–
6,3	7,55	0,55	0,45	0,35	0,3
8,1	10,25	0,6	0,5	0,4	0,4
8,1	12	0,7	0,6	0,55	0,5
9,5	13,65	0,75	0,65	0,6	0,55

At an operating temperature of above 90 °C, and simultaneous exposure to an operating pressure of more than 26 MPa, we recommend the use of the material compound PTFE B602 and PTFE C104.

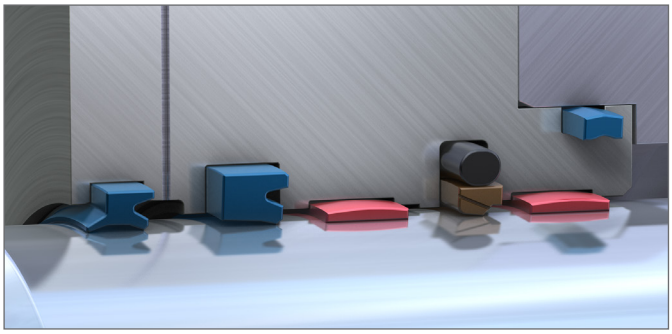
Tolerances

Diameter D [mm]	Tolerance
<500	H8
≥500	H7

The tolerance for the diameter d and D2 is specified in connection with the gap dimension calculation. In typical hydraulic applications up to a nominal dimension of 1.000 mm, the tolerance fields f7 and f8 or H7 and H8 are usually chosen.

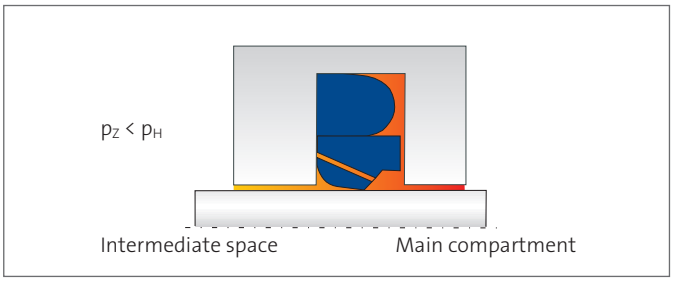
Installation & assembly
Reliable seal function is dependent on correct installation. Please consult our Technical Manual.

Functional principle

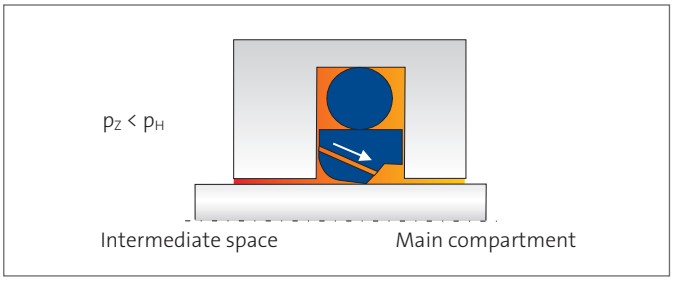


The Merkel Omegat OMS-MR PR features an integrated pressure relief function. As soon as the pressure in the intermediate space pz exceeds the main-compartment pressure pH (caused, for example, by unfavorable velocity conditions during extension and retraction), the seal reliably relieves the pressure. The sealing function of the type OMS-MR PR corresponds to that of the field-proven Merkel Omegat seals.

Pressure relief function not active

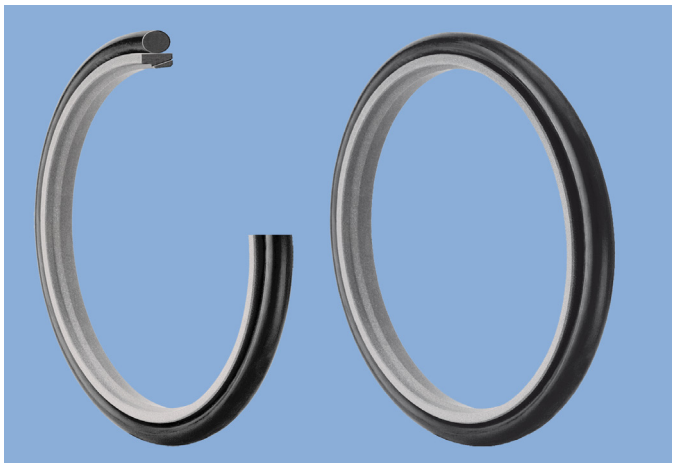


Active pressure relief function



p_Z = pressure in the intermediate space;
p_H = pressure in main compartment

ADDITIONAL PRODUCT DESCRIPTION



Pressue in intermediate space
In operation, the space between the primary and secondary seals is filled with hydraulic medium after a few cycles. The further entry of media leads to an increase of the pressure in the intermediate space. If a U-ring is used as the secondary seal, then it will act as a volume compensator under pressure by reason of the mold-release volume, thus contributing towards reducing the general pressure level. Normally, the pressure in the intermediate space will settle at up to 5 MPa, in dependence on the operating parameters, and is then reduced again with a temporal offset to the main compartment's pressure during the return stroke.

Pressue build-up
In the case of a large stroke length (> 400 mm), and a high running speed (> 0.5 m/s) while the rod is being extended, but also as a consequence of vibrations and in the case of major differences in velocity in dependence on the direction of motion (v_{retr} greater than 8x v_{ext}), a comparatively larger volume of oil is released into the intermediate space under the sealing edge than comes out of it. If these or similar operating parameters apply, a significantly increased pressure level will be formed in the intermediate space. The higher pressure is reduced incompletely during the return stroke, and can be accumulated over a number of cycles. The pressure level can here rise continuously until it exceeds the operating pressure.
The increased pressure in the intermediate space results in an increased amount of friction.
The temperature rises, and thus not only fosters deformation of the PTFE profile ring of the primary seal under load, but also reduces the extrusion resistance of the secondary seal. Because of the increased friction, moreover, intensified wear can be expected, and due to the frictional heat produced, accelerated aging of the hydraulic medium can also be anticipated.
If, as a result of the above-mentioned phenomena, the pressure in the intermediate space is significantly higher than in the main compartment, then the pre-stressing element of the primary seal (O-ring) will be pushed towards the main compartment. The PTFE profile ring of the primary seal is thereby twisted over the neutral position towards the main compartment; this movement causes the sealing edge to become gradually more rounded, and the sealing function of the primary seal is disturbed.
As this goes on, the profile ring may tilt completely to the main compartment, which will ultimately lead to extrusion of the primary and secondary seals, and thus to the system's failure. Leakage will only become visible outside the sealing system, when the secondary seal is no longer performing its function.

Pressure relief
Building successfully on the field-proven functionality of the Merkel Omegat series, the Omegat OMS-MR PR possesses a pressure-relief feature integrated into the profile ring. As soon as the pressure in the intermediate space is greater than in the main compartment, the pressure-relief bore is opened, and can be relied on to relieve the pressure in the intermediate space down to the pressure in the main compartment. A lasting inclusion of overpressure in the intermediate space is not possible here.
In operation, the pressure in the main compartment is higher than in the intermediate space. The pressure-relief bore is closed in contact between the PTFE profile ring and the wall of the compartment (Fig. 01). If the pressure in the intermediate space rises to a level above that in the main compartment, then the contact between the PTFE profile ring and the wall is broken (Fig. 02). Since the pressure is equalized directly via the pressure-relief bore, the prestressing element remains on the side facing the intermediate space. The profile ring will not tilt towards the main compartment.

ADDITIONAL PRODUCT DESCRIPTION

Fig. 01: Pressure relief function not active

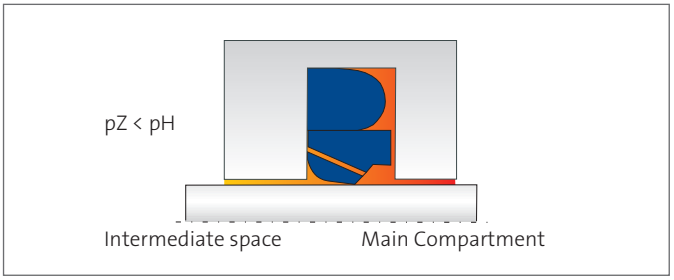
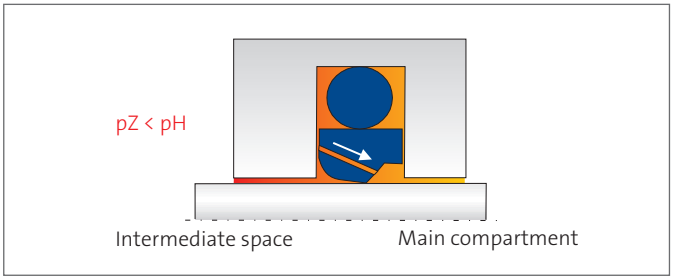


Fig. 02: Active pressure relief function



p_Z = pressure in the intermediate space;
p_H = pressure in main compartment

With the patented pressure relief, the pressure in the intermediate space is maintained at a level which is favorable for continuous operation, regardless of the operating conditions. Due to the low thermal and mechanical loads of the sealing elements, a stable long term behavior is achieved and the service life of the sealing system is significantly increased.

The functionality of the pressure-relief feature makes the sealing system Merkel Omegat OMS-MR PR tolerant to external influences during operation. In addition to a lower the maintenance effort, this mainly benefits operational safety.

Installation diagram