Lubrication Management – Leistungssteigerung von translatorischen Dichtungen durch Schmierfilmoptimierung im Dichtsystem

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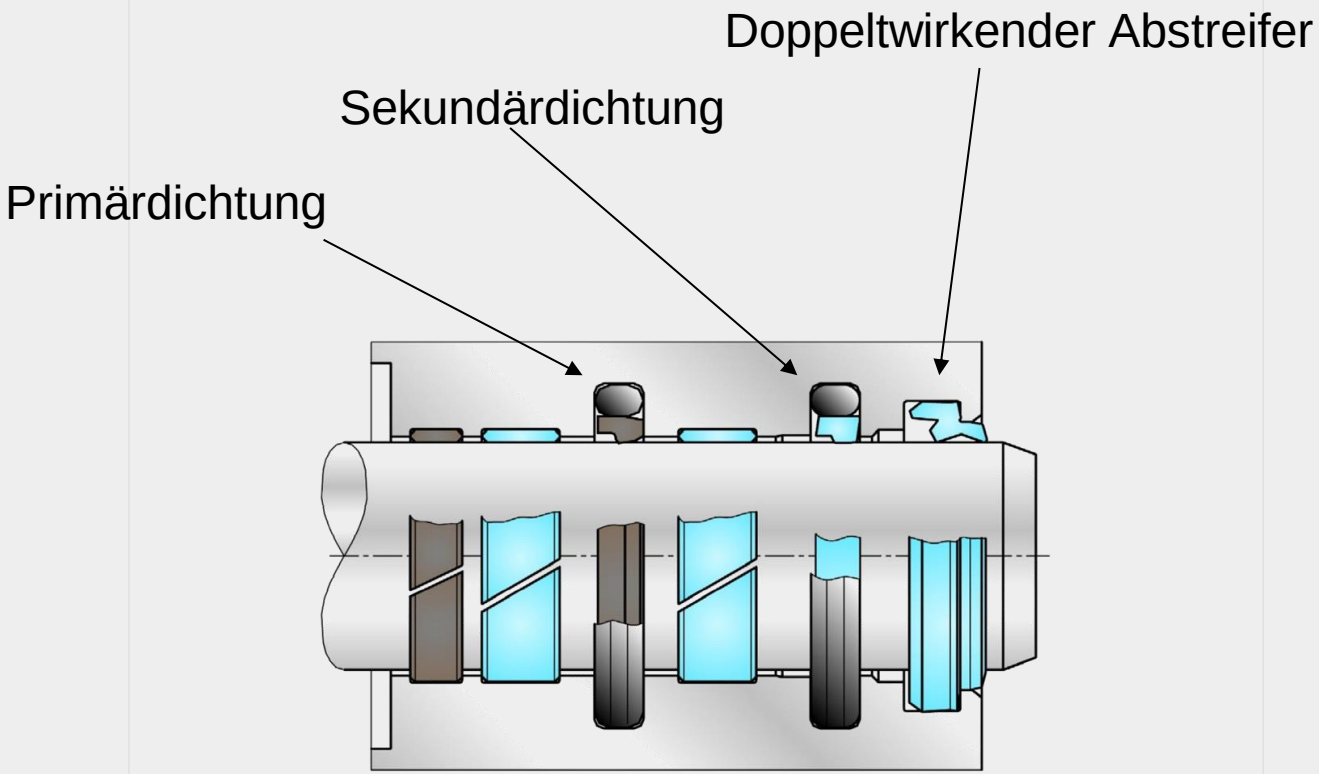
Inhalt

- Grundlagen
- Betrachtung des Dichtsystems
- Untersuchungen an Stangendichtungen PTFE
- Untersuchungen an Stangendichtungen PUR
- Zusammenfassung

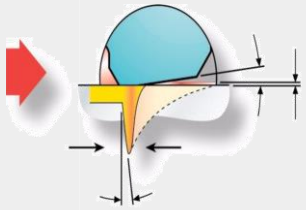
Dichtsystem (Beispiel)



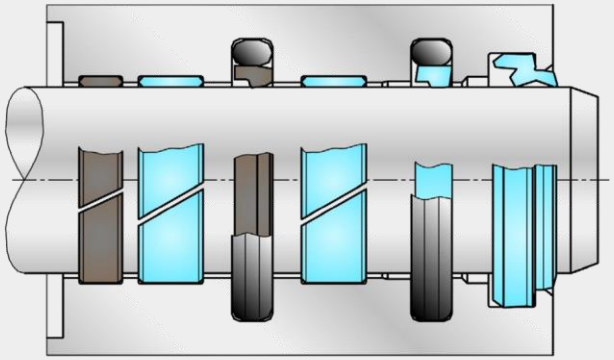
Limitierungen

$$h_a = \sqrt{\frac{2}{9} \cdot \frac{\eta \cdot v_a}{a_a}} \quad ; \quad h_e = \sqrt{\frac{2}{9} \cdot \frac{\eta \cdot v_e}{a_e}}$$

Wenn $h_a > h_e$ entsteht Leckage



Psys Pzw

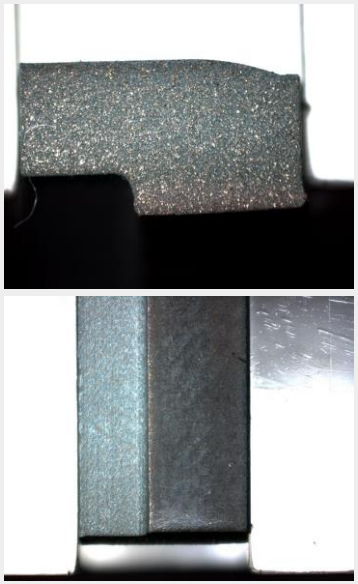


Kontaktpressungsverteilung
Primärdichtung

→ Je größer beide Werte (h_a und h_e) desto besser die Schmierung

Verschleiß Beispiel

Primär



Sekundär

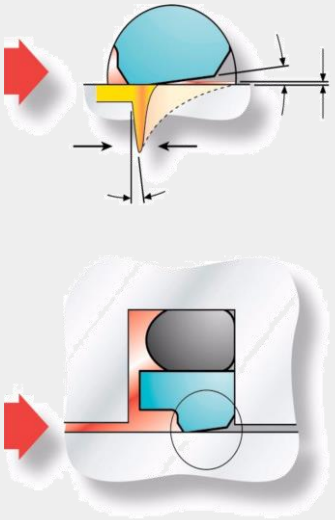
Abstreifer

Schmierfilm-Optimierung

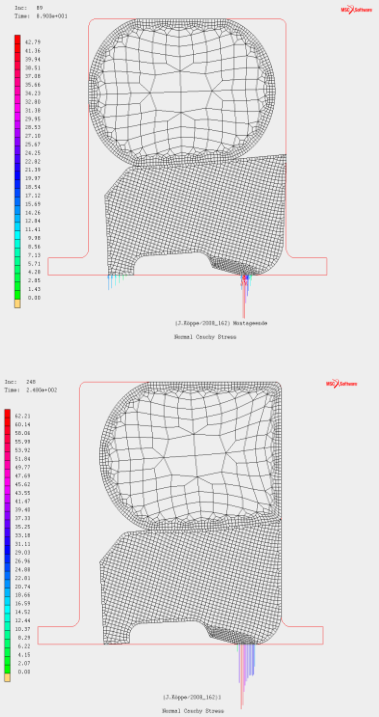
PTFE basiert

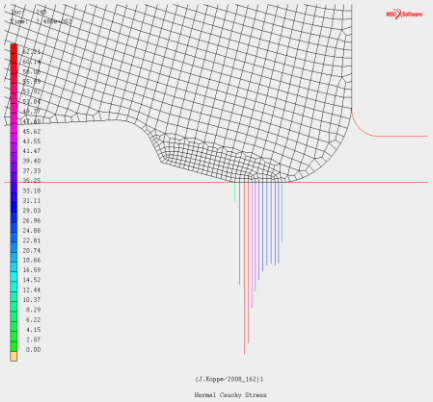
Kontaktpressungsverteilung

Standard

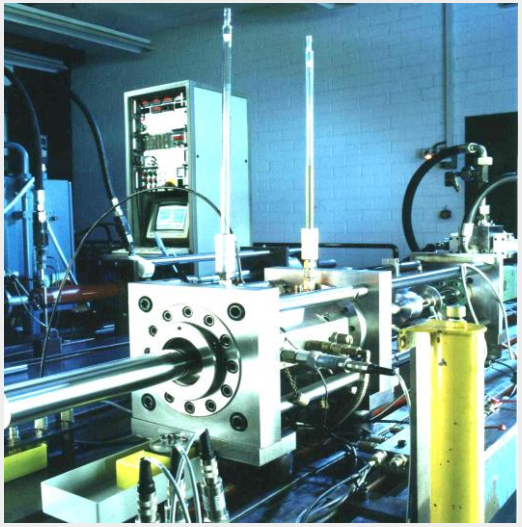


(schmierfilmoptimiert) LM

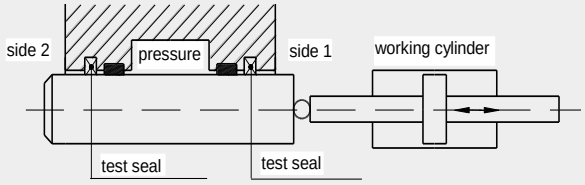




Test Programm Reibung



Druck: (konstant)	0/2,5/5/10/15 und 20 MPa
Geschwindigk.: (konstant)	0,01/0,02/0,05/ 0,1/0,2 und 0,4 m/s
Hub:	50, 100 und 250 mm
Zeit:	~86,000 cycles
Temperatur:	30° und 50°C
Medium:	Shell Tellus 46



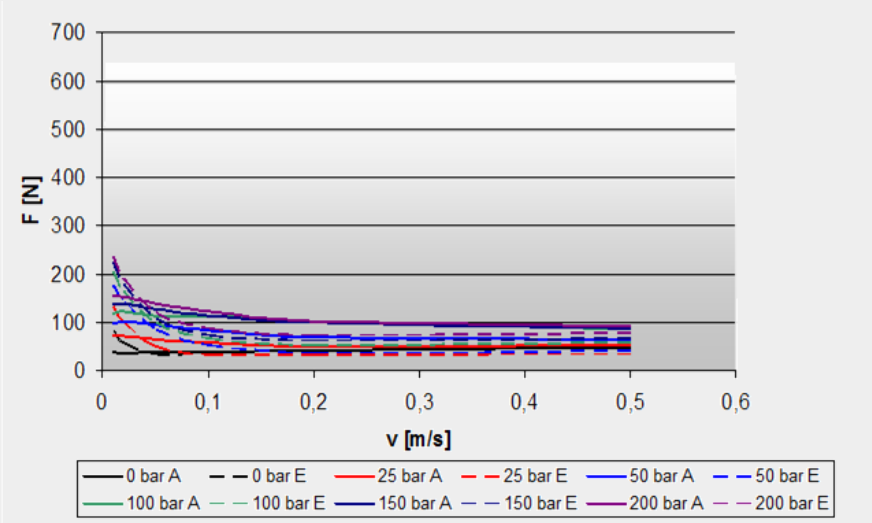
The complete test is divided into 5 parts, including different velocities pressure levels and temperature. The idea behind is to compare the friction before (A/B) and after (D/E) the endurance test (C).

PART	REPEAT	DISTANCE
A	1	702 m
B	1	702 m
C	5	40500 m
D	1	702 m
E	1	702 m

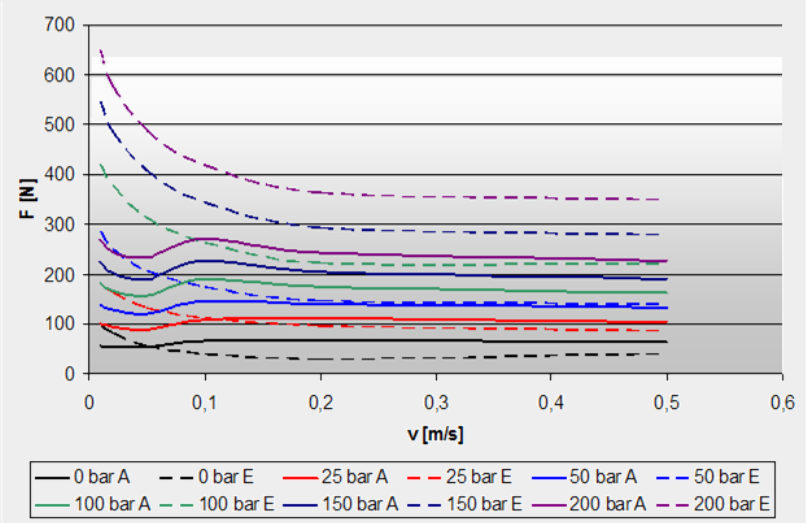
The output of the test will be friction, wear (rod and seal), leakage.

Stangendichtung LM versus Stangendichtung Standard (PTFE Compound)

F(v) Stangendichtung LM

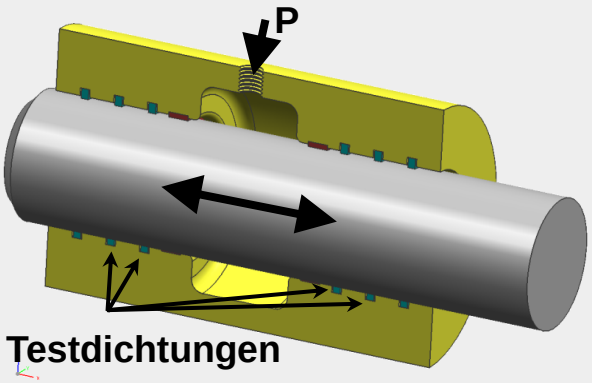


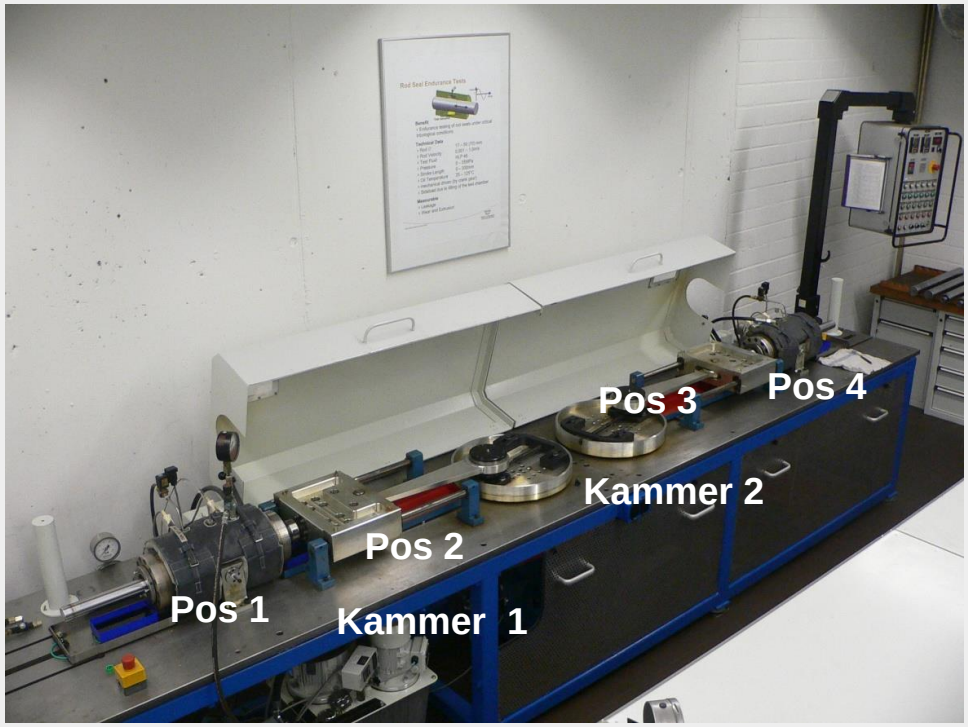
F(v) Stangendichtung Standard

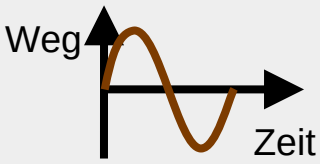


Dauerlaufprüfstand

- **Hub** 300 mm
- **Druck** 1/36 MPa
- **Geschwindigkeit** 0,2 m/s
- **Temperatur** 80°C
- **Zyklen** 1.000.000 DS
- **Durchmesser** 50 mm
- **Medium** Aral Vitam GF 46
- **Stange** TSS Standard



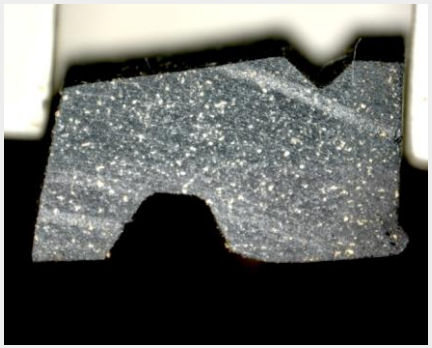


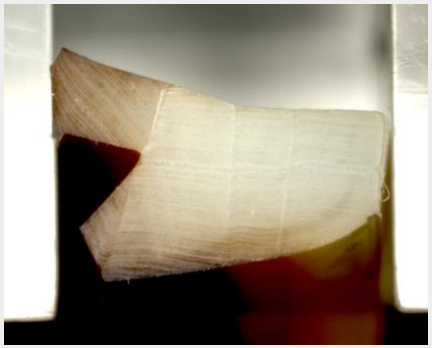


Sinusförmige Bewegung

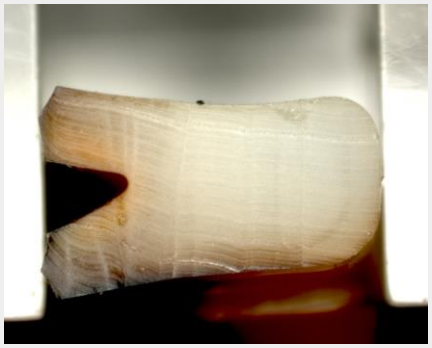
1 Mio Zyklen 36 MPa, 80°C, 0,2m/s,

P1



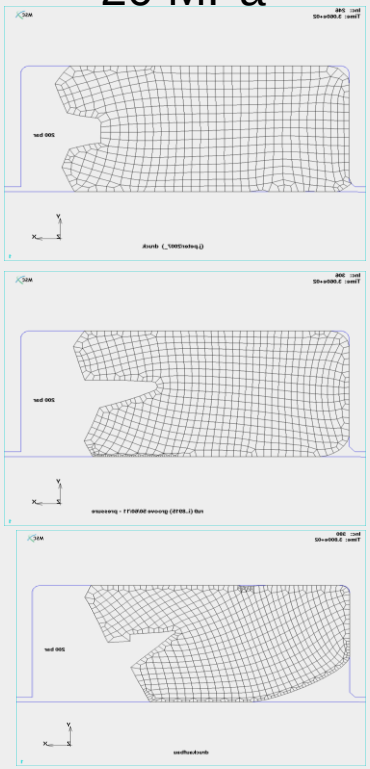


P4

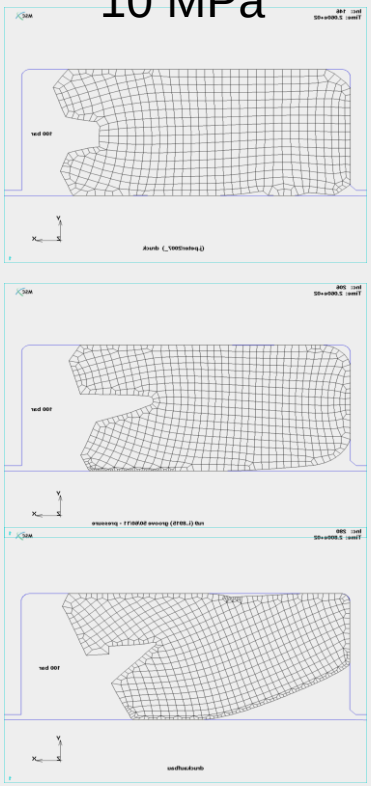


Sekundärdichtung mit Speicherfunktion

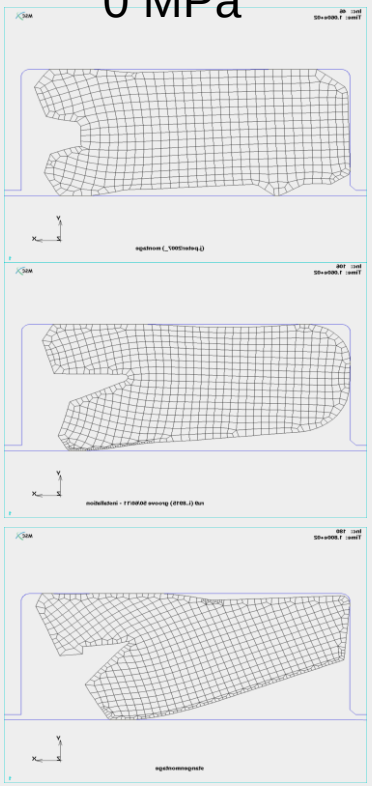
20 MPa



10 MPa



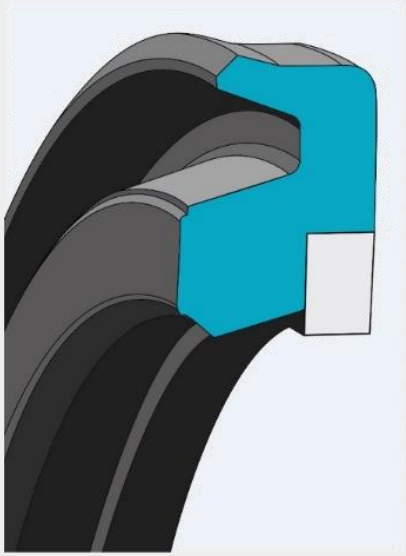
0 MPa



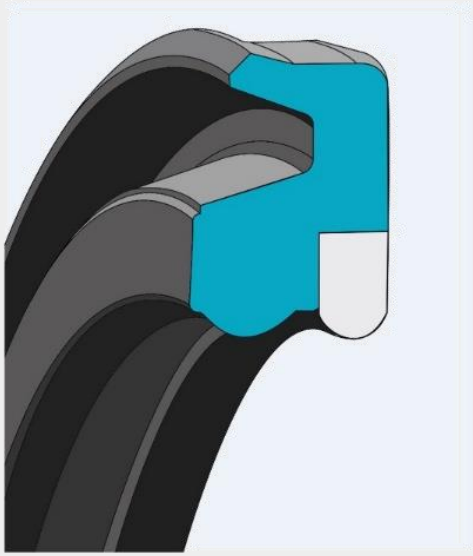
Schmierfilm-Optimierung

PUR basiert

Design



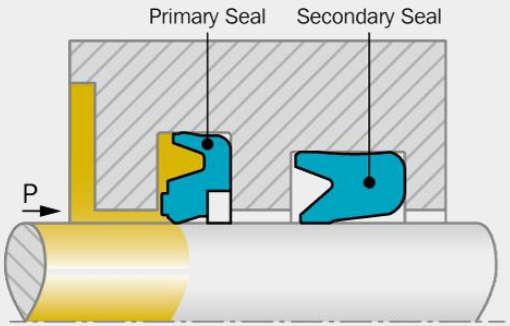
Dichtung mit herkömmlicher Kontaktpressungsverteilung

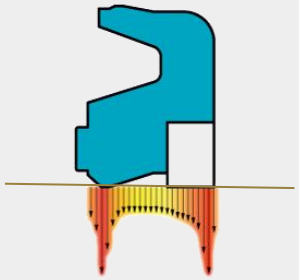


Dichtung mit neutraler / inverser Kontaktpressungsverteilung

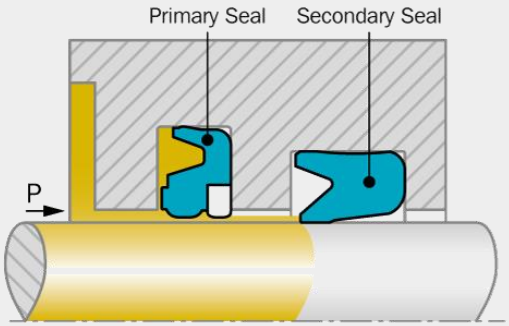
Wirkprinzip

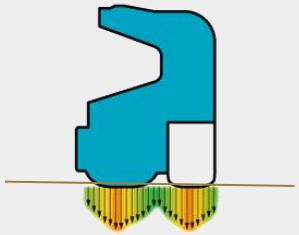
Lubrication Management





Seal edge with standard contact pressure distribution

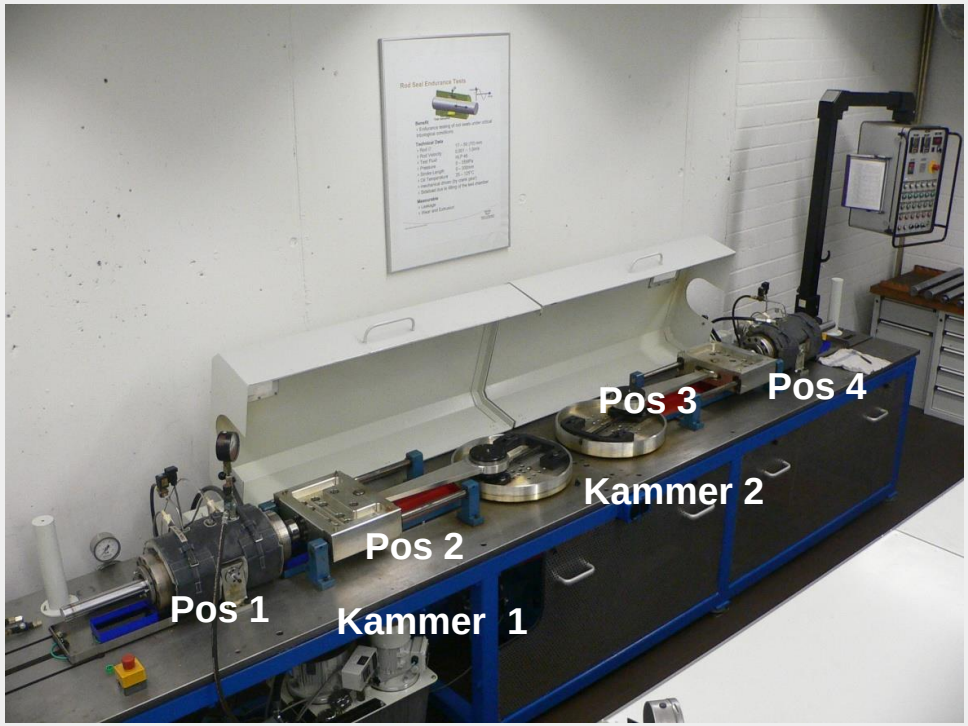


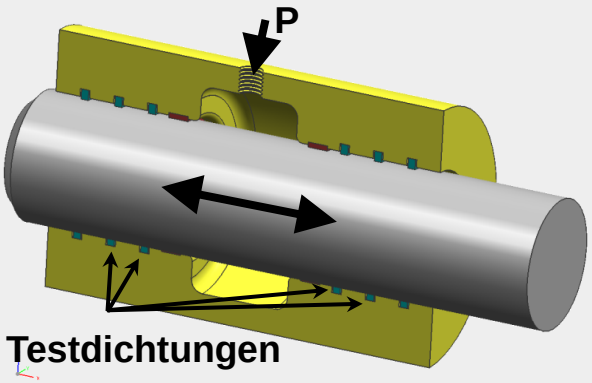


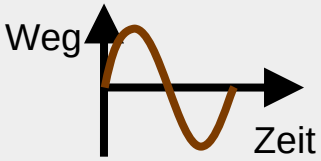
Seal edge with neutral/ inverse contact pressure distribution

Dauerlaufprüfstand

- **Hub** 300 mm
- **Druck** 1/40 // 1/20 MPa
- **Geschwindigkeit** 0,5 m/s
- **Temperatur** 100°C
- **Zyklen** 200.000 // 300.000 DS
- **Durchmesser** 70 mm
- **Medium** Aral Vitam GF 46
- **Stange** TSS Standard

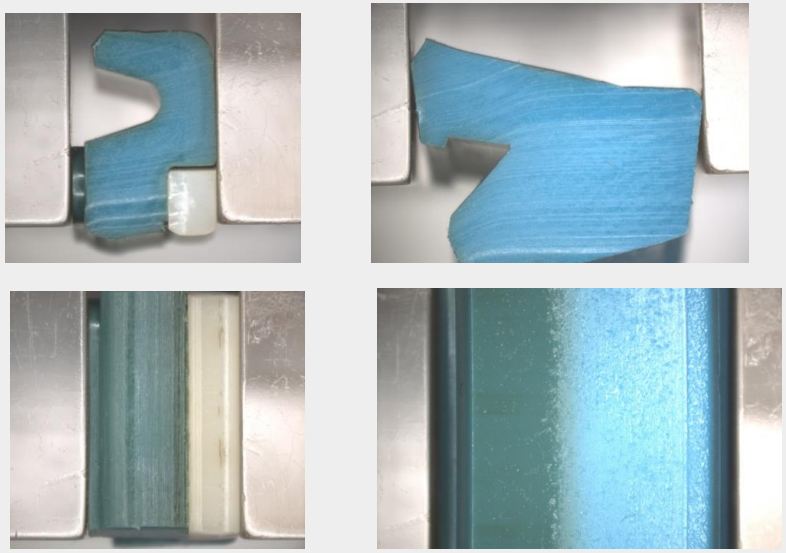






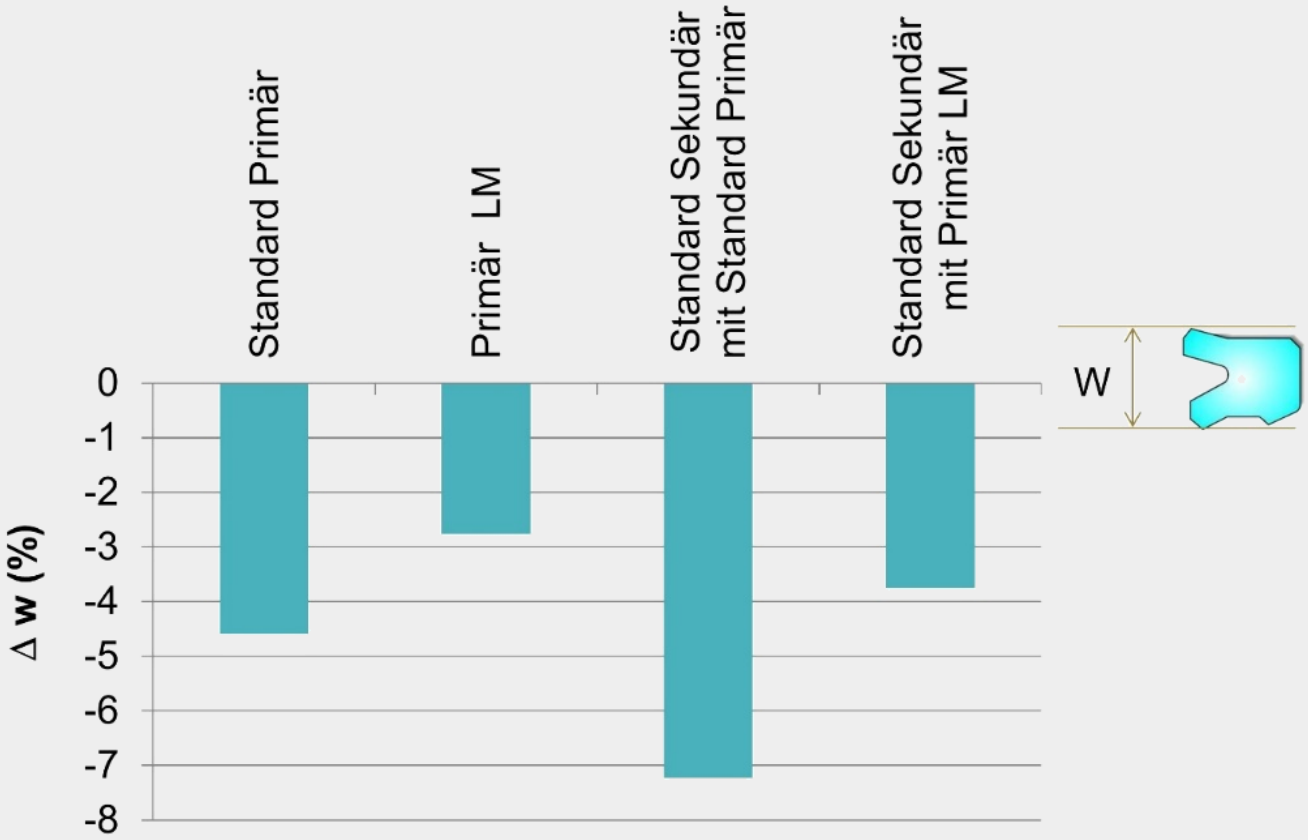
Sinusförmige Bewegung

Dichtsystem Pos 4, 500 000 DH



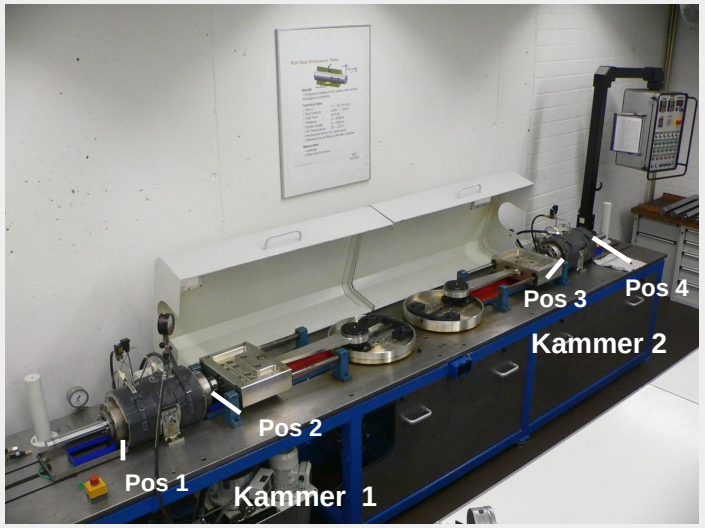
Keine Leckage

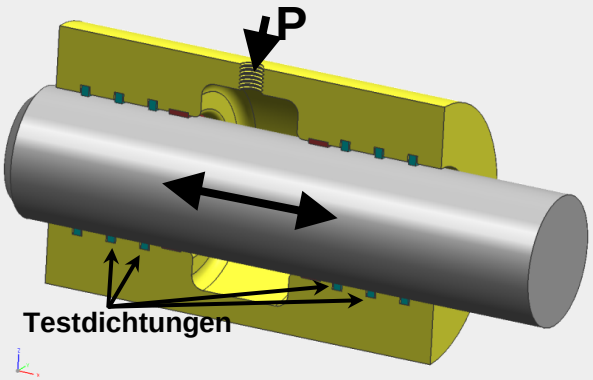
Vorspannungsverlust

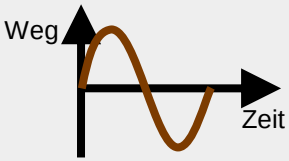


Versuchsbedingungen Kurzhub

- **Hub** 10 mm
- **Druck (konstant)** 25 MPa
- **Geschwindigkeit** 4 mm/s
- **Temperatur** 80°C
- **Zyklen** 1.000.000 DS
- **Durchmesser** 50 mm
- **Fluid** Shell Tellus 46
- **Stange** TSS Standard

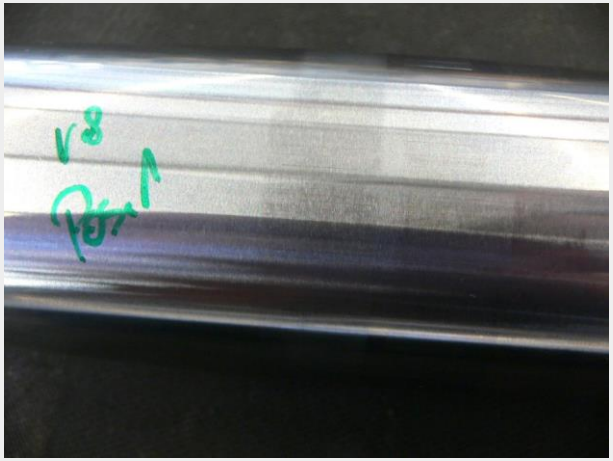






Sinusförmige Bewegung

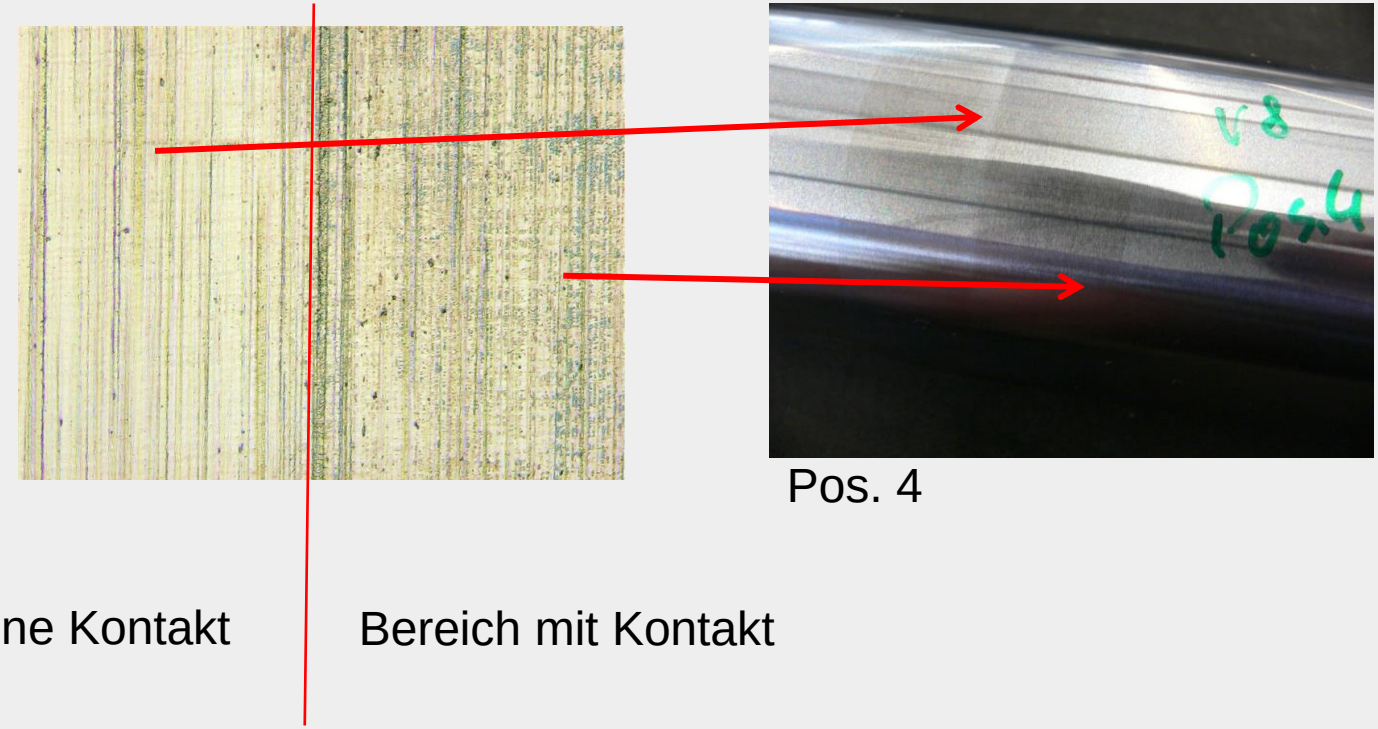
Stangen nach 1.000.000 Doppelhüben



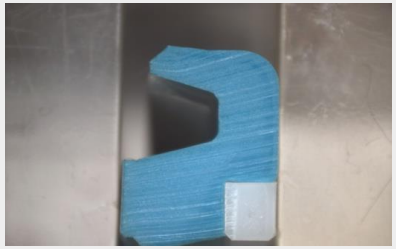
Pos.1

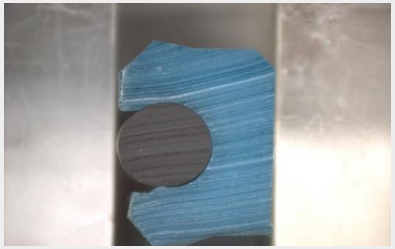
Pos. 4

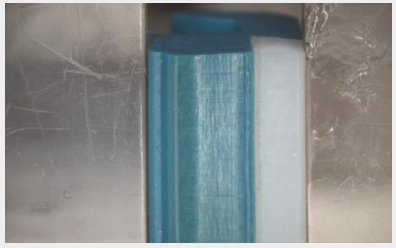
Stangen nach 1.000.000 Doppelhüben



Dichtsystem nach 1 Mio. Doppelhübe

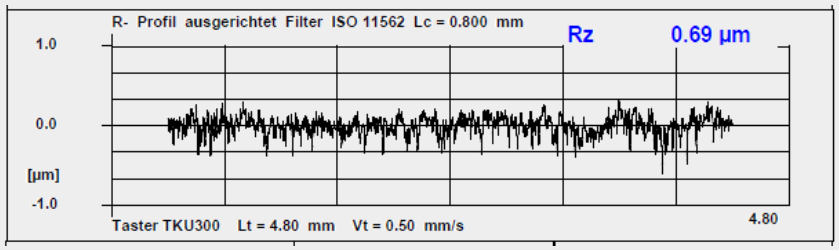


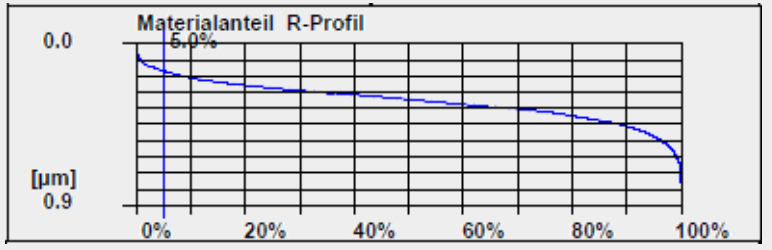




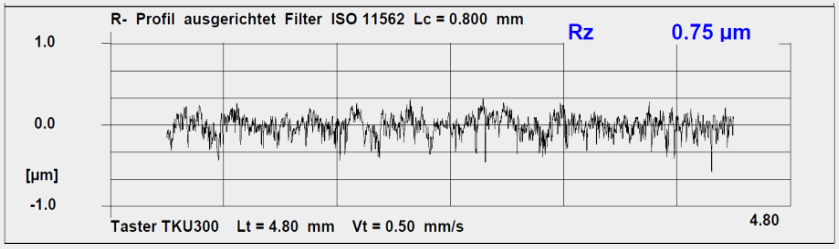
Gegenlauffläche

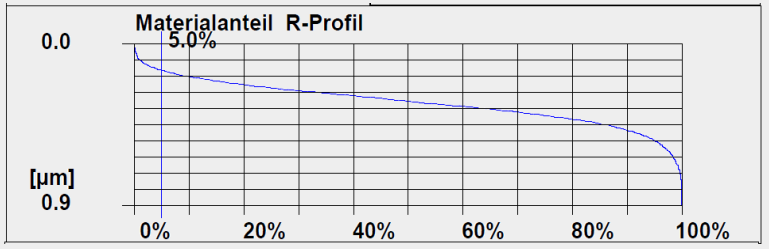
neu



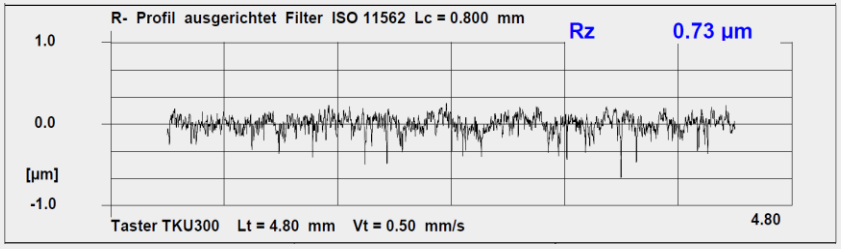


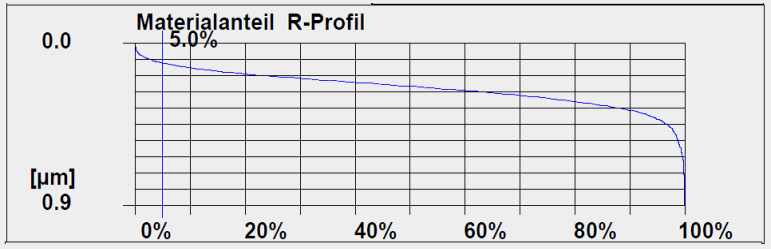
Pos. 1
1 Mio DH
Sekundär



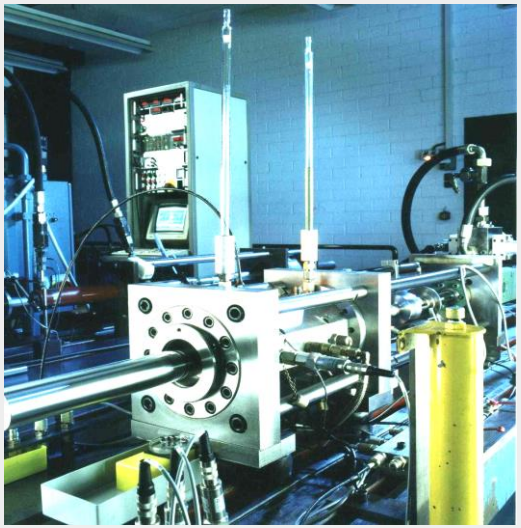


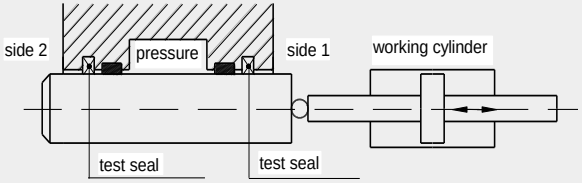
Pos. 1
1 Mio DH
Primär





Test Programm Reibung





Druck: (konstant)	0/2,5/5/10/15 und 20 MPa
Geschwindigk.: (konstant)	0,01/0,02/0,05/ 0,1/0,2 und 0,4 m/s
Hub:	50, 100 und 250 mm
Zeit:	~86,000 cycles
Temperatur:	30° und 50°C
Medium:	Shell Tellus 46

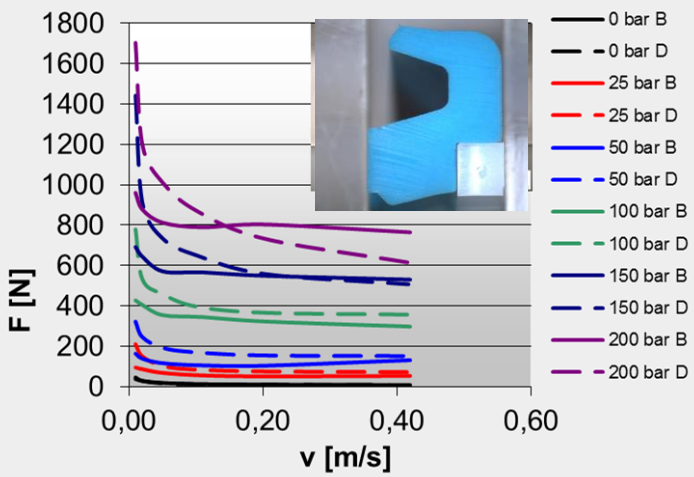
The complete test is divided into 5 parts, including different velocities pressure levels and temperature. The idea behind is to compare the friction before (A/B) and after (D/E) the endurance test (C).

PART	REPEAT	DISTANCE
A	1	702 m
B	1	702 m
C	5	40500 m
D	1	702 m
E	1	702 m

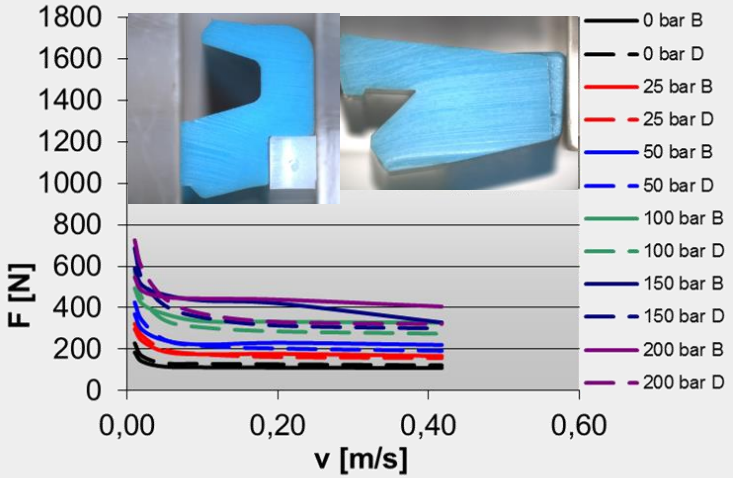
The output of the test will be friction, wear (rod and seal), leakage.

Vergleich Reibung (PUR basierend)

Standard Buffer Seal

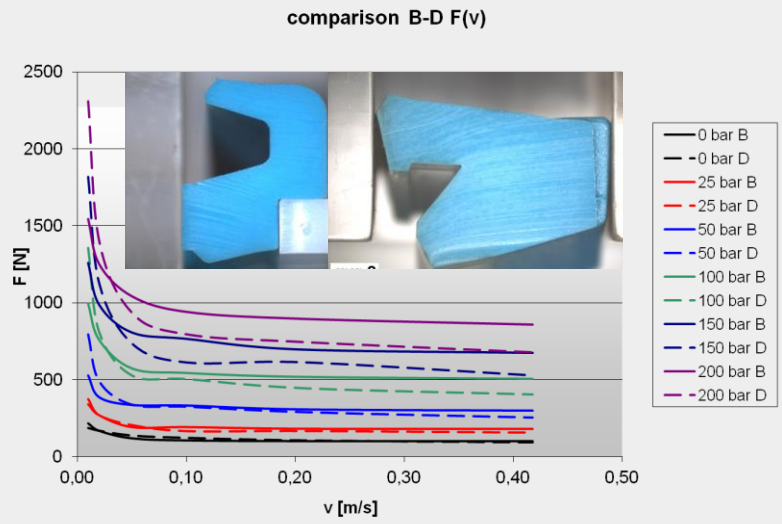


LM System PUR

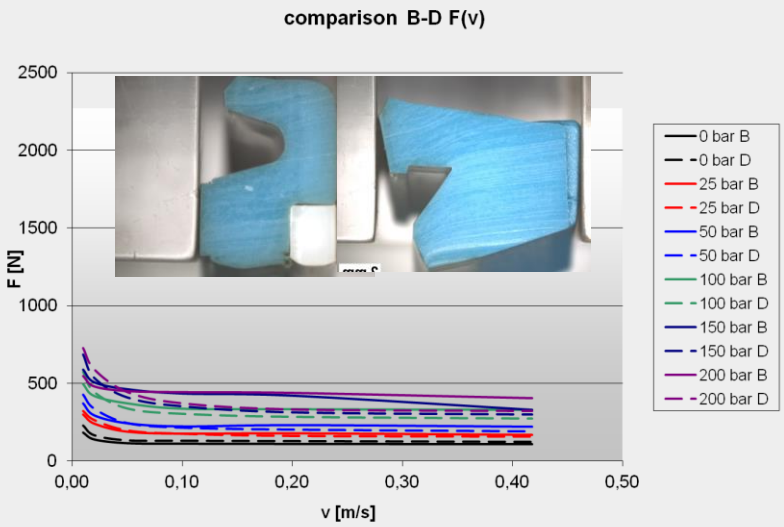


Vergleich Reibung

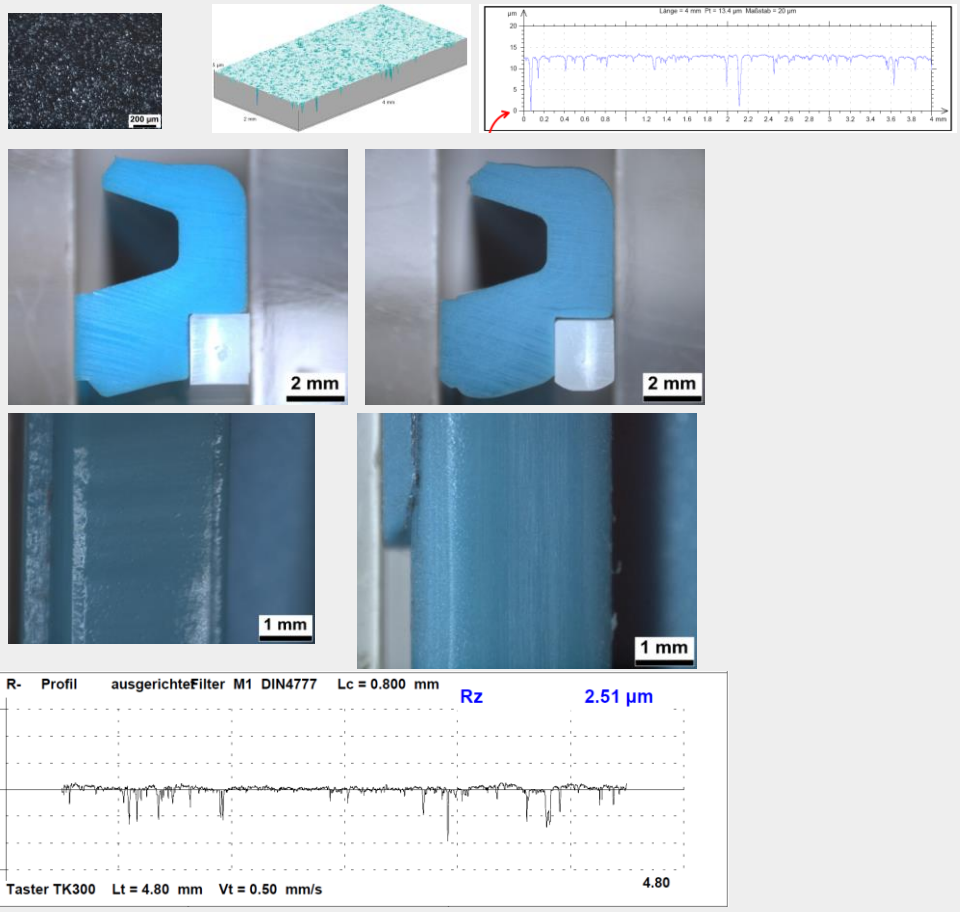
Standard System PUR



LM System PUR



Test auf Al2O3 Stange



Zusammenfassung

- Optimale Schmierung der druckbelasteten Primärdichtung **und** optimale Schmierung der Sekundärdichtung
- Reduzierte Belastung bei Primär und Sekundärdichtung
- Stark reduzierte Reibung
- Stark reduzierter Verschleiß
- Weniger Energieverbrauch
- Erhöhte Robustheit
- Erweiterte Einsatzgrenzen


TRELLEBORG