



Welcome to the World of Trelleborg

Utěsnění pracovních kapalin hydraulických mechanismů

Novotného lávka, 20.11.2024

David Král, Account Manager

Agenda

- 1 Trelleborg Group
- 2 Trelleborg Sealing Solutions
- 3 Products & Materials
- 4 Research & Development
- 5 Bio-Lubricants
- 6 Bio HFC in Stepseal® Test



Trelleborg Group



5 Excellence programs

Sustainability

Trelleborg Group University

Core values

CUSTOMER FOCUS

INNOVATION

RESPONSIBILITY

PERFORMANCE

Year 2023

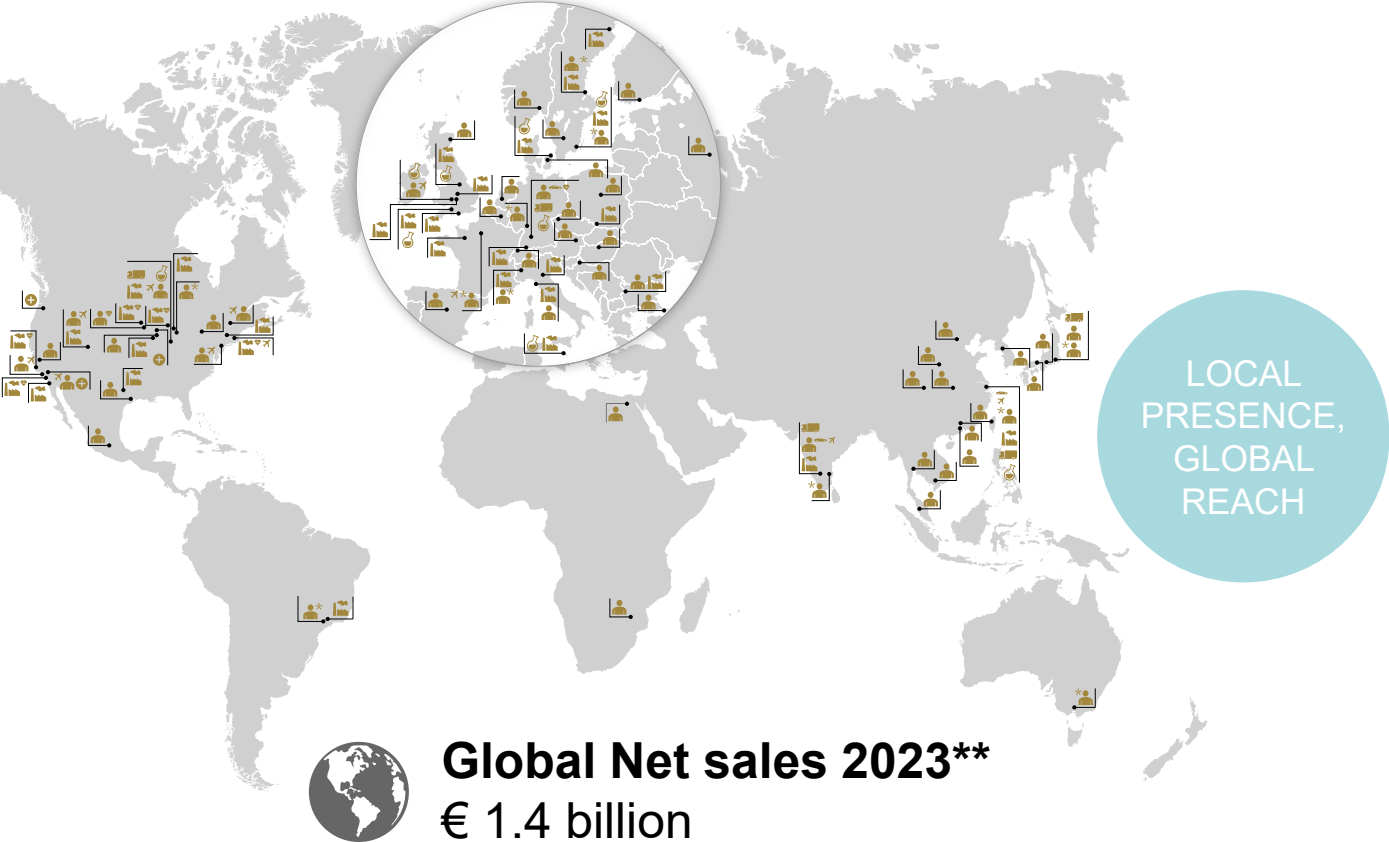


About Trelleborg Sealing Solutions

Trelleborg Sealing Solutions Profile

Together We Shape a Sustainable Future

We are one of the world’s leading developers, manufacturers and suppliers of precision seals, bearings and custom-molded polymer components. We collaborate closely with customers to develop unique, innovative solutions to tomorrow’s challenges.



Employees 2023*
~9,500 (globally)



* At year-end, including insourced staff and temporary employees.



Global Net sales 2023**
€ 1.4 billion



** Excluding items affecting comparability.

Leading global supplier of Sealing Solutions

Industrial



Key Segments:

Off-highway, Semicon, Food, Beverage & Water, Fluid Power

Auto, Truck & Transportation



Key Applications:

fuel systems, steering, air conditioning, exhaust, ride control

Aerospace

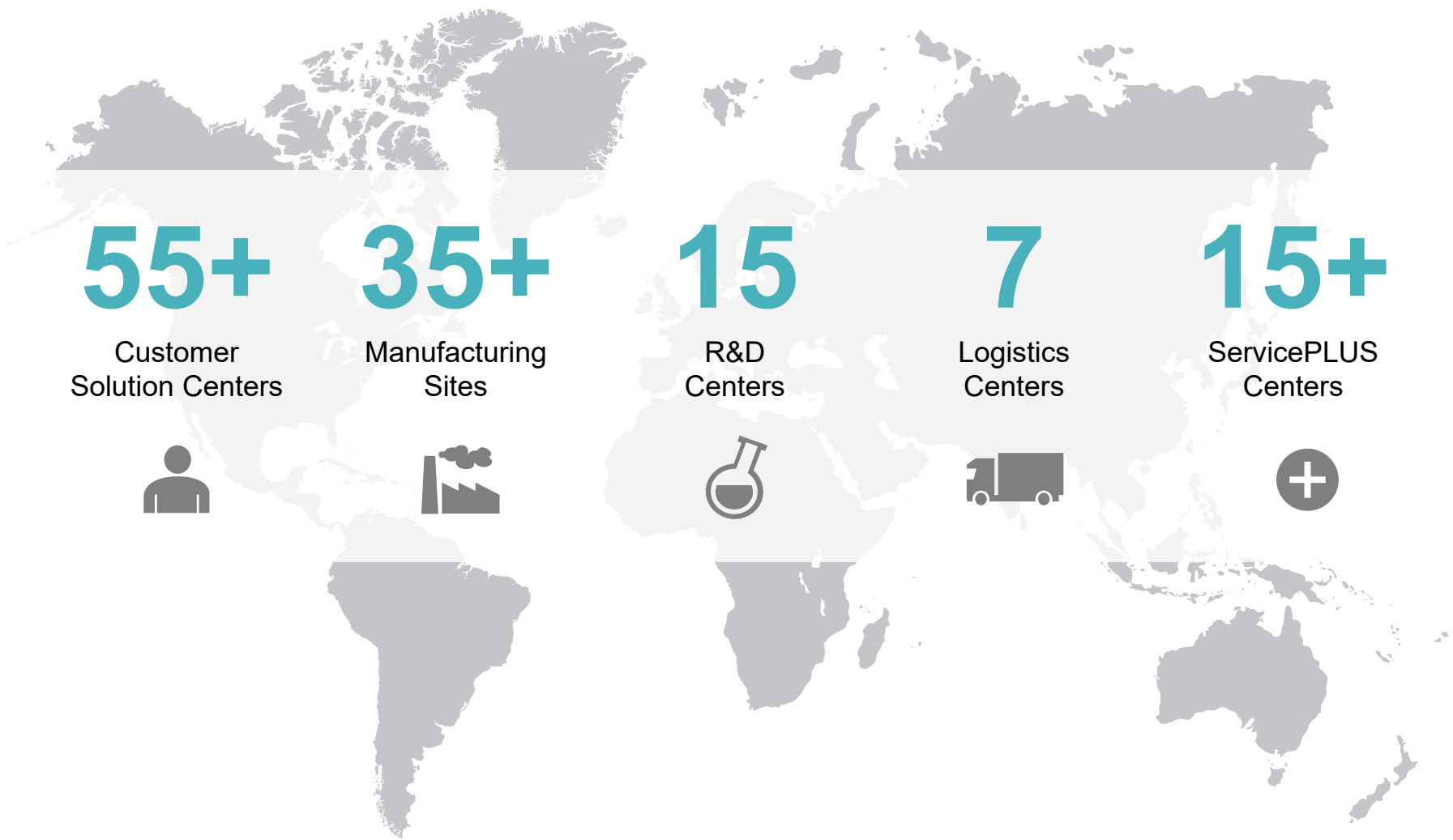


Key Applications:

engines, flight control actuators, landing gear, airframes, wheels, brakes, interiors

**Note: Healthcare & Medical, 14% in 2023.*

Global Resources





Products & Materials

Product Range



Fluid Sealing Systems



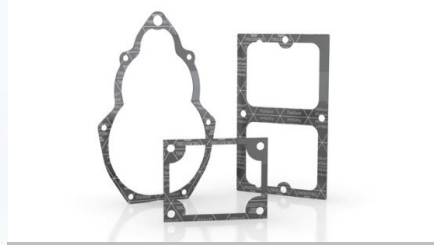
Static Seals



Bearings and Bushings



Rotary Seals



HMF FlatSeal™



Pneumatic Seals



O-Rings



Engineered Molded Parts



Mechanical Face Seals
(Heavy Duty Seals)



Brake Shims, Tuned Absorbers,
Rubore® Seals



Assembly Units



Liquid Silicone 0,25
Rubber (LSR)



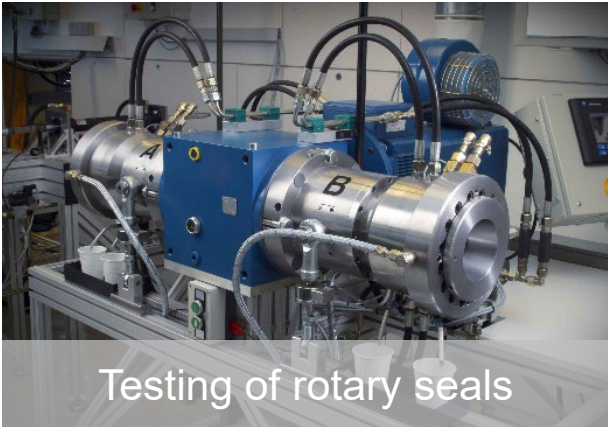
Customized Aerospace Sealing



Research & Development

GLOBAL RESEARCH & DEVELOPMENT

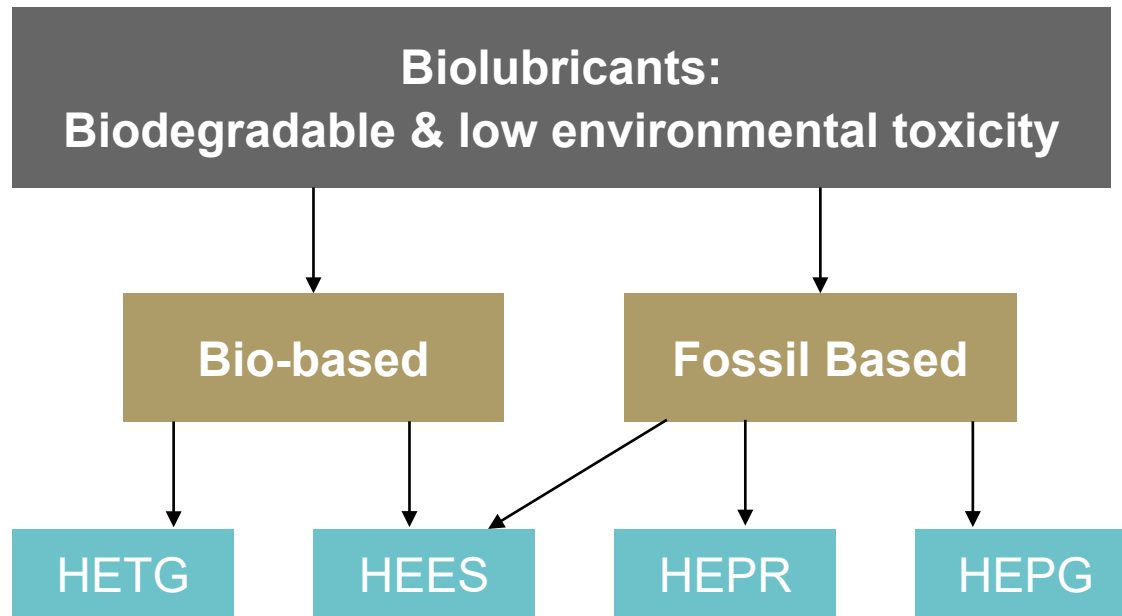
Product & Material Testing Highlights





Bio-Lubricants

Bio-Lubricants



- Bio-based/Bio-product: Greater than 50% of formulation is of natural biomaterials.
- Non-toxic (Low Environmental Toxicity): not poisonous to the environment.
- Biodegradable: material has the proven capability to decompose in the most common environment where the material is disposed of.
- HETG: Hydraulic Environmental Triglycerid lubricant (Vegetable oil based)
- HEES: Hydraulic Environmental Ester oil synthetic lubricant (Synthetic ester-based fats)
- HEPG: Hydraulic Environmental Polyalklene glykol lubricant (Synthetic glycol based)
- HEPR: Hydraulic Environmental Polyalpha-olefins lubricant (Synthetic hydrocarbon based)

Bio-Lubricants

Performance

- Disadvantages
 - Oxidation stability
 - Sensitivity to hydrolysis
 - Restricted fluidity behaviour at minimal temperatures
- Advantages
 - Better lubricity compared to mineral oils
 - Biodegradable
 - Low-toxicity
 - Higher flashpoints
 - Smaller carbon footprint

Lubricant Application

Hydraulic Fluid

Turbine oil

Gear oils

Various process oils

Engine & Transmission oil

Power Steering fluid

Grease

Metalworking fluid

Biolubricants

- Attack standard FKM materials
- Can swell NBRs and HNBRs
- Increased lubricity compared to mineral oils
- Sensitive to hydrolysis and temperature
- Change with time due to biodegradability

Change in
Seal
Configurations

TECHNICAL CHALLENGE
DEFINE MATERIALS
AND
SEALING SYSTEMS

Compatibility of bio based fluids with sealing materials

- **HETG and HEES:**

- N7000 or N7083 showed in most biodegradable oils in viscosity 46 and temperature range from -30 to +80°C (HETG) / +100°C (HEES) good results
- If viscosity is just 15, the swelling increases sometime to a level which is no longer good.
- Low temp NBR's often show high swelling.
- Above 100°C it is better to switch to H7503.
- Standard FKM's are only good as long as the fluid is not hydrolyzed!
- If the risk for such a reaction is given, better go for a high end FKM out of the XLT class or VC303

- **HFC:**

- In case of water glycol mixes the following EPDM's showed good results up to 60°C (above, HFC should normally not be used as too much water will evaporate): E7T70, E7T41, E762A

- **HFD-U fluids:**

- Same materials as for HETG/HEES

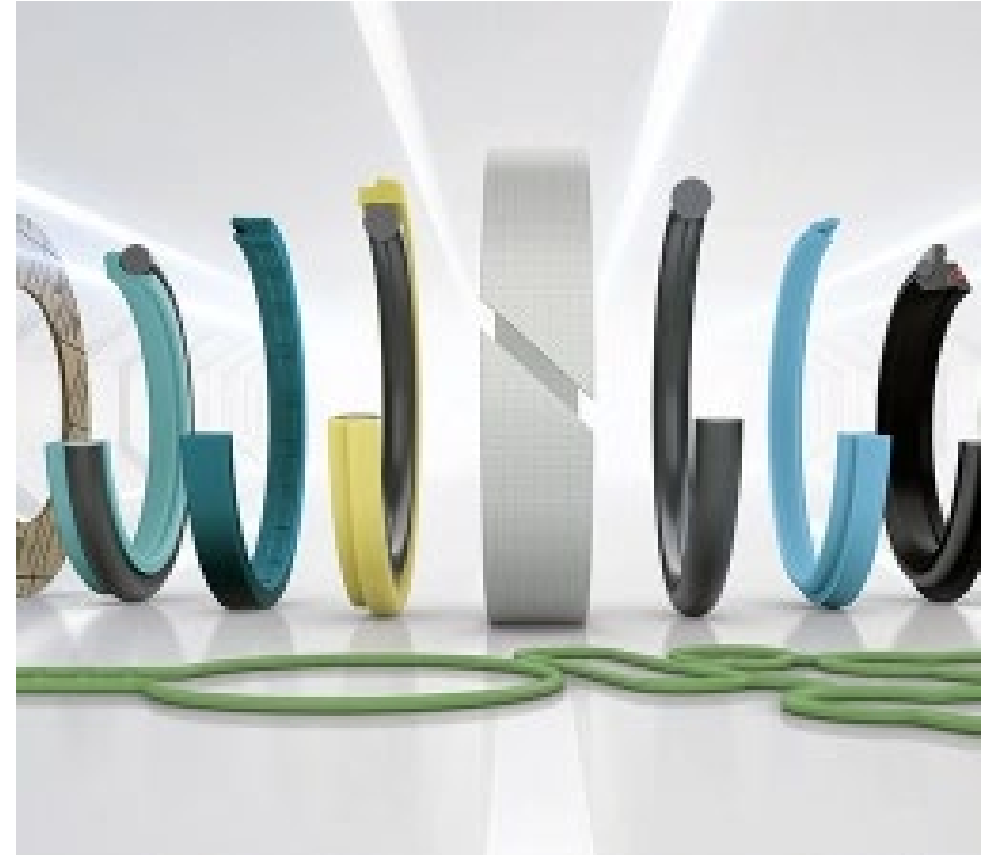
- **HFD-R fluids:**

- We need to find out if they are based on a Arylester (FKM is better) or Alkylester (EPDM is better)



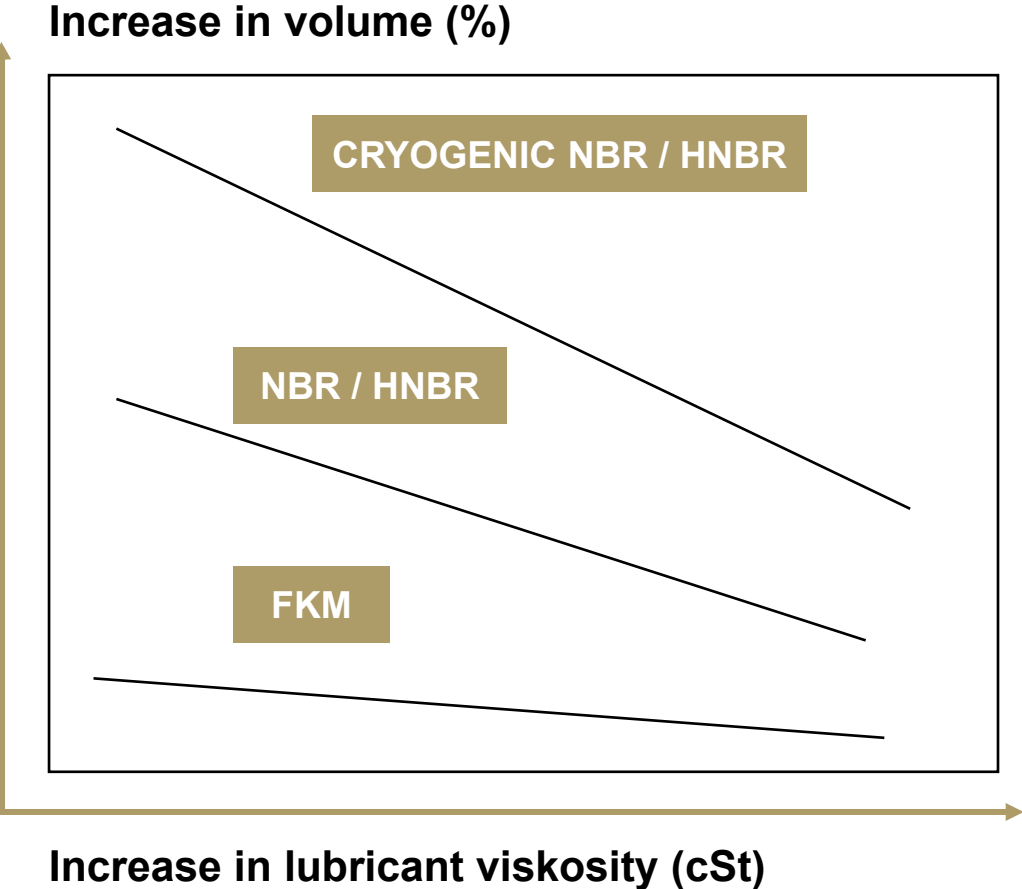
Compatibility of bio based fluids with sealing materials

- **PFAS free materials:**
 - For all Hydraulic fluids based on Hydrocarbons (Hydraulic oil, Engine oils, Gear box oils), ACT70 or A7T40 are good alternatives for FKM.
 - Unfortunately those 2 does not work in Esters.
 - Only option for Esters will be high-end HNBR's as H7T40 or H7503.



Influence of the rubber formulation

Effect of the viscosity of the fluid (tendency)



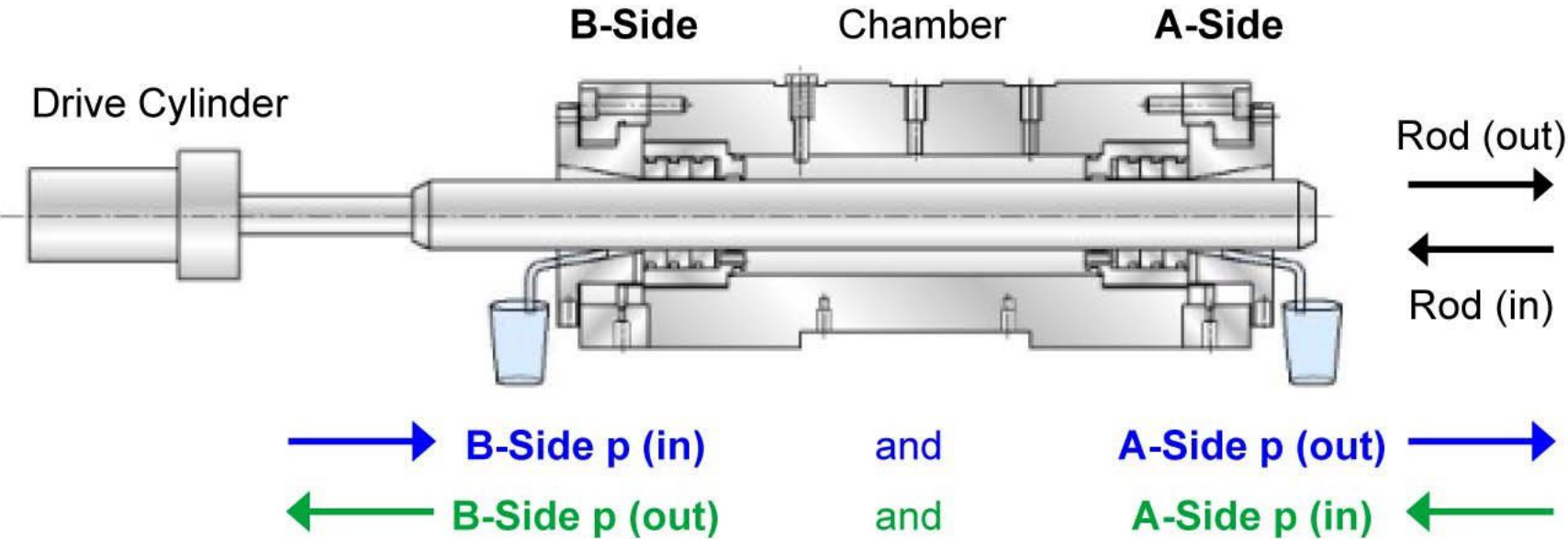
	HEES 15	HEES 46
TT-NBR 1	+79%	+46%
TT-NBR 2	+20%	+10%
Standard NBR	+12%	+6%
XLT-FKM	+4%	+3%



The background of the entire page is a dense field of blue O-rings, shown from various angles, creating a textured, repetitive pattern. The lighting is soft, highlighting the circular shapes and the slight ridges on the rings.

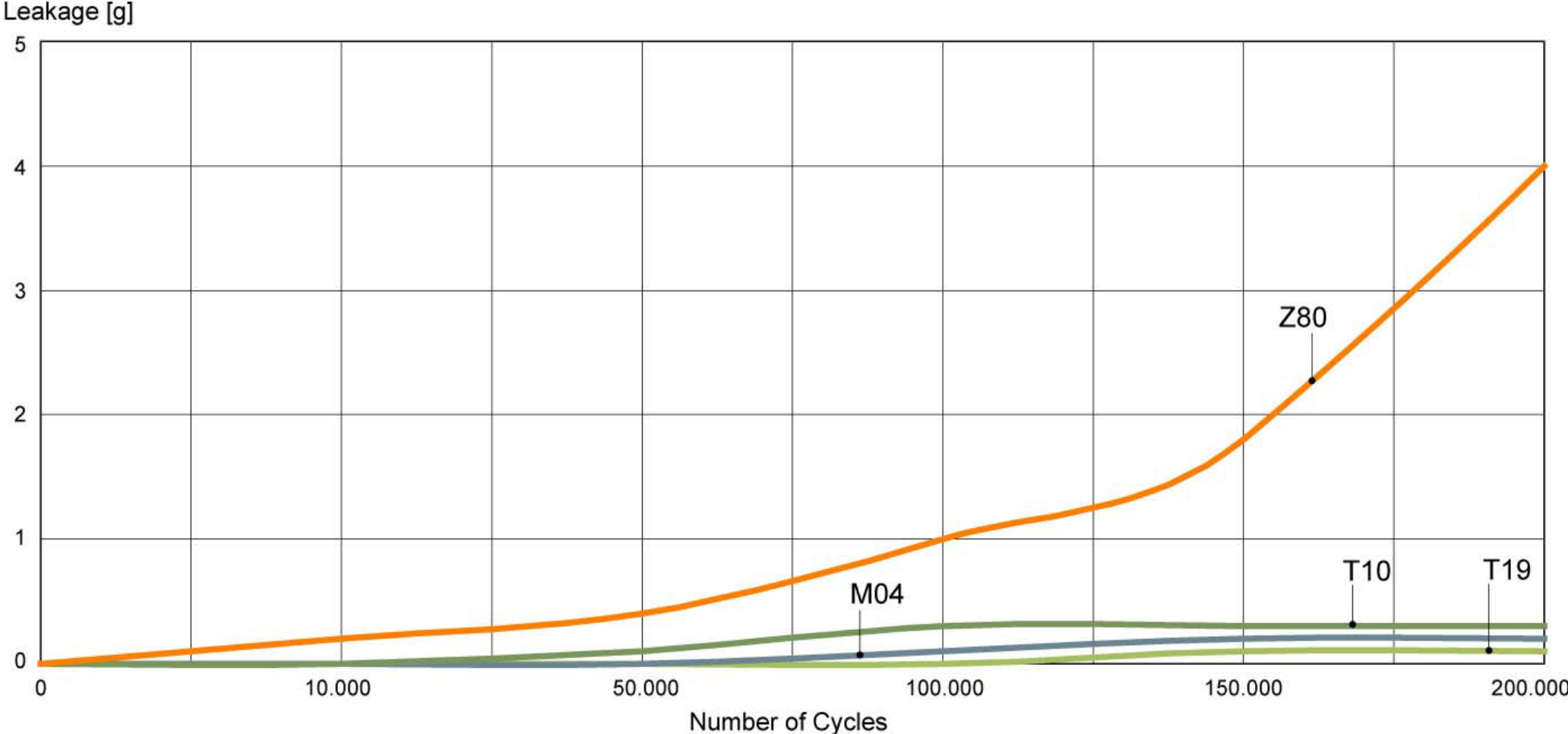
Bio-HFC in Stepseal® Test

Bio HFC in Stepseal® Test



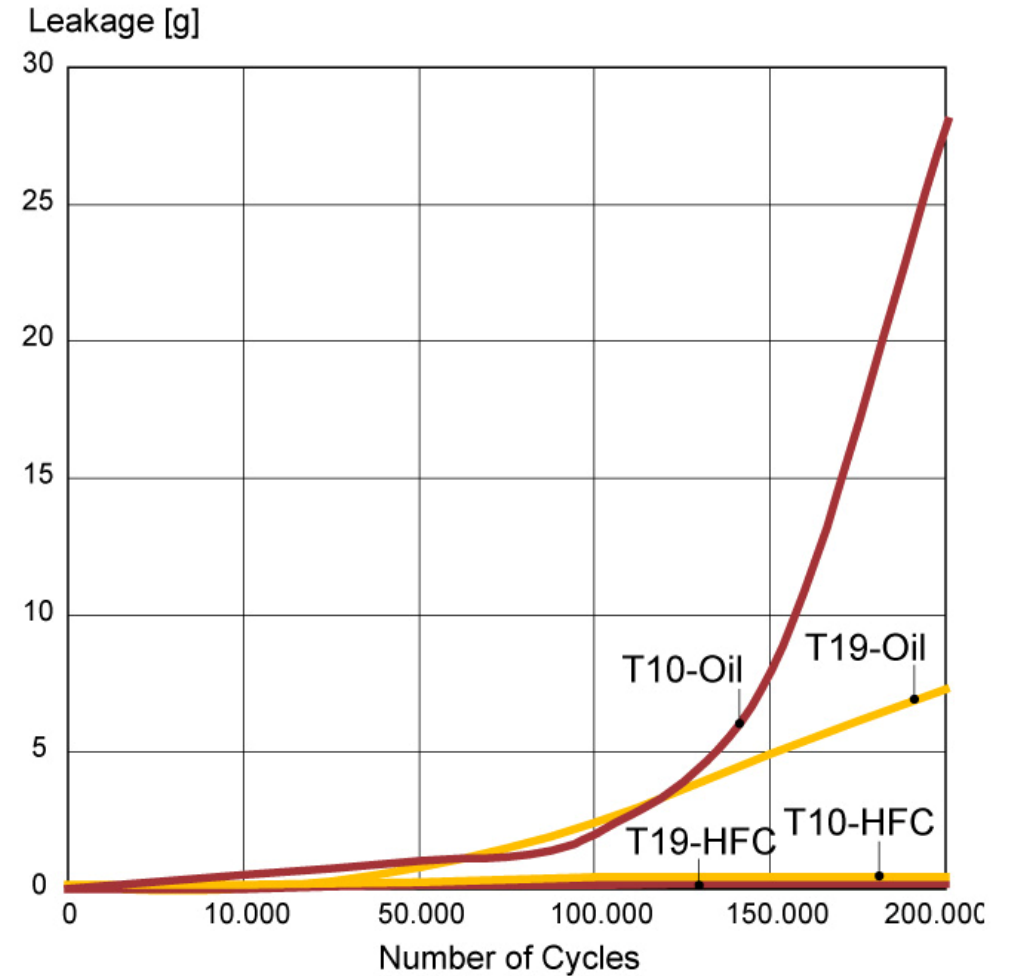
Leakage Measurement

The leakage is monitored throughout the test runs



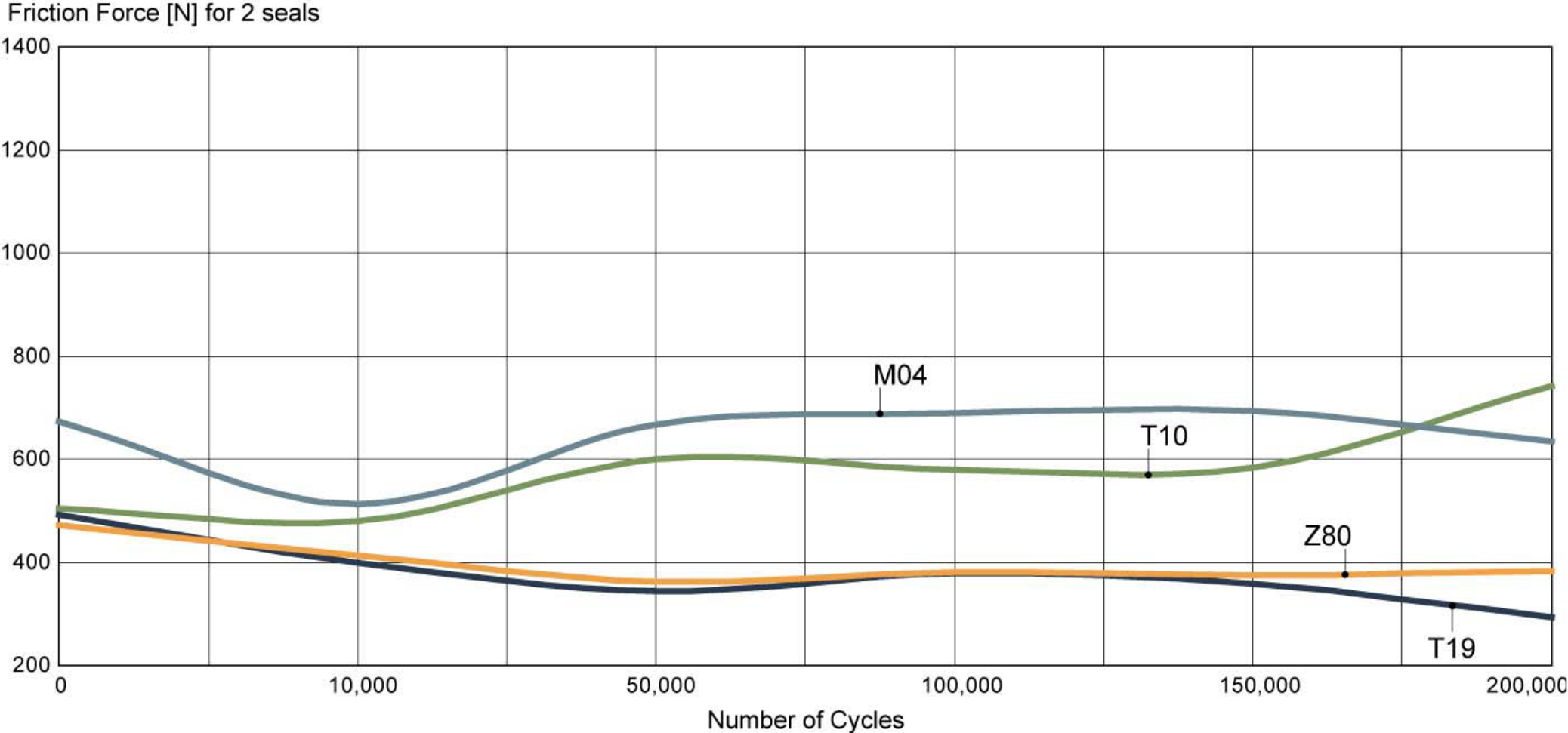
Comparison between Leakage in HFC and Mineral Oil

- Comparable test results for T10 and T19 in HFC (at 40°C) and in mineral oil, 46cSt (at 60°C).
- The difference in fluid temperature, and because of that in viscosity, has influence on the leak rate.



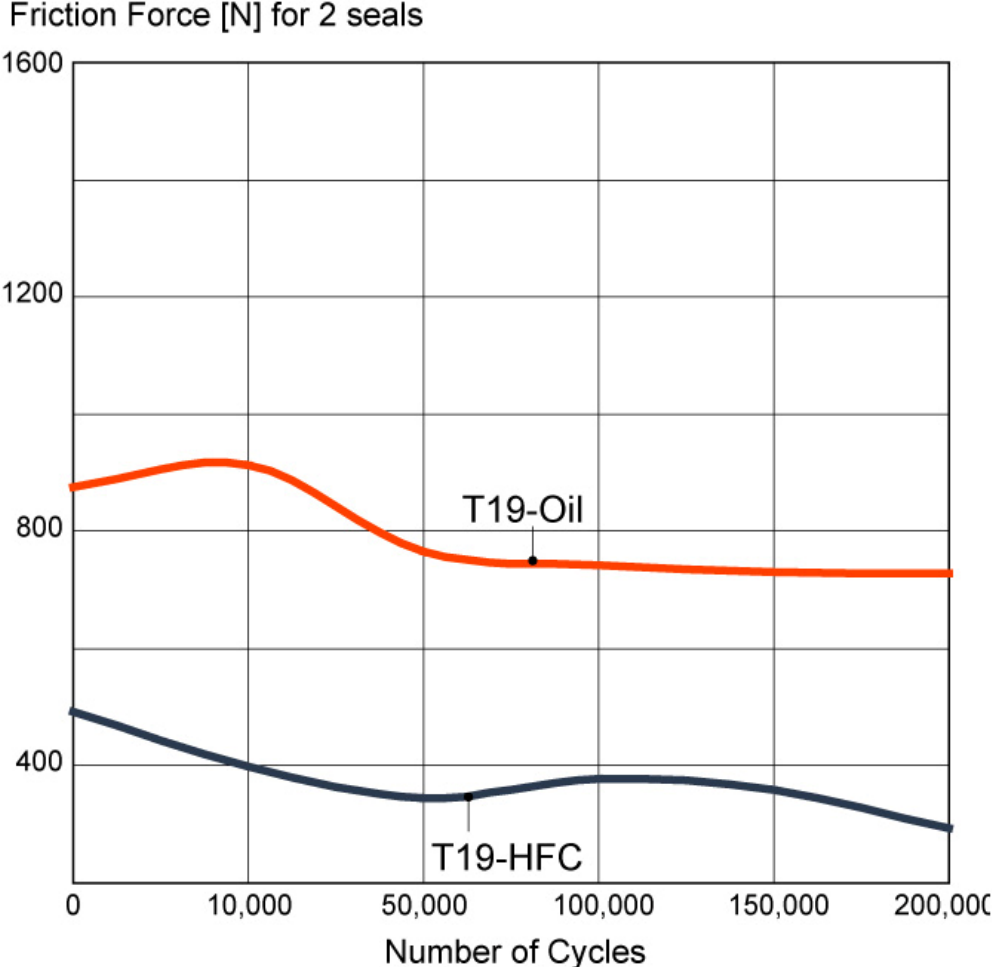
Friction Measurement

The dynamic friction at 30 MPa and 0.2 m/s is measured at regular intervals during the test runs



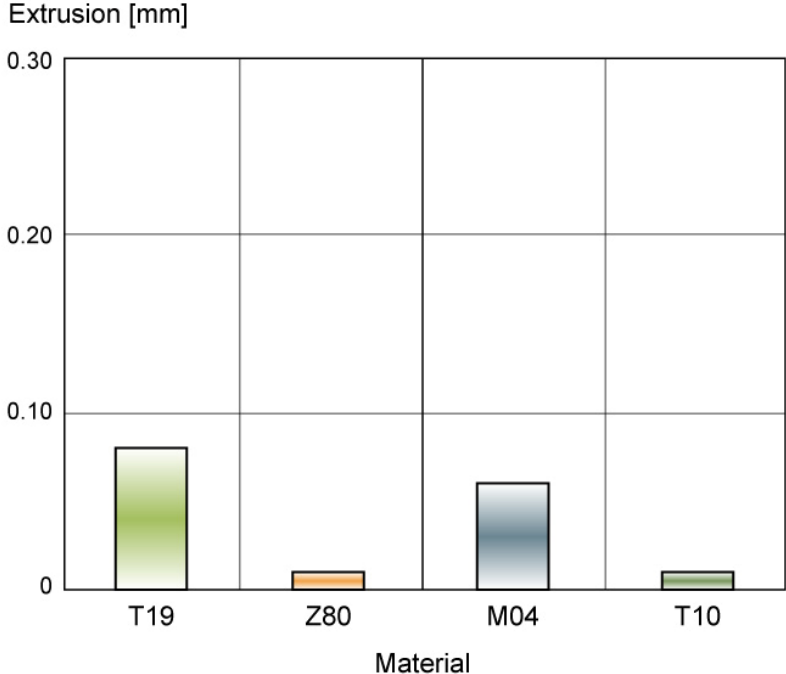
Comparison of Friction for Stepseal[®] 2K and in Mineral Oil

Friction of Stepseal[®] 2K in HFC at 40°C and in mineral oil at 60°C for Turcon[®] T19

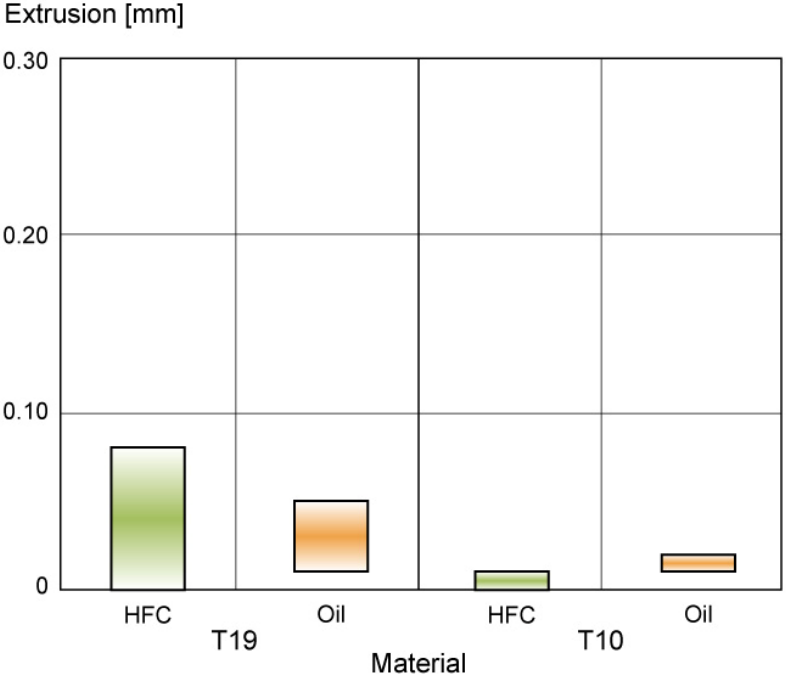


Extrusion Measurement

Stepseal® 2K in HFC: Extrusion after 200.000 cycles, mean value +/- 1 standard deviation

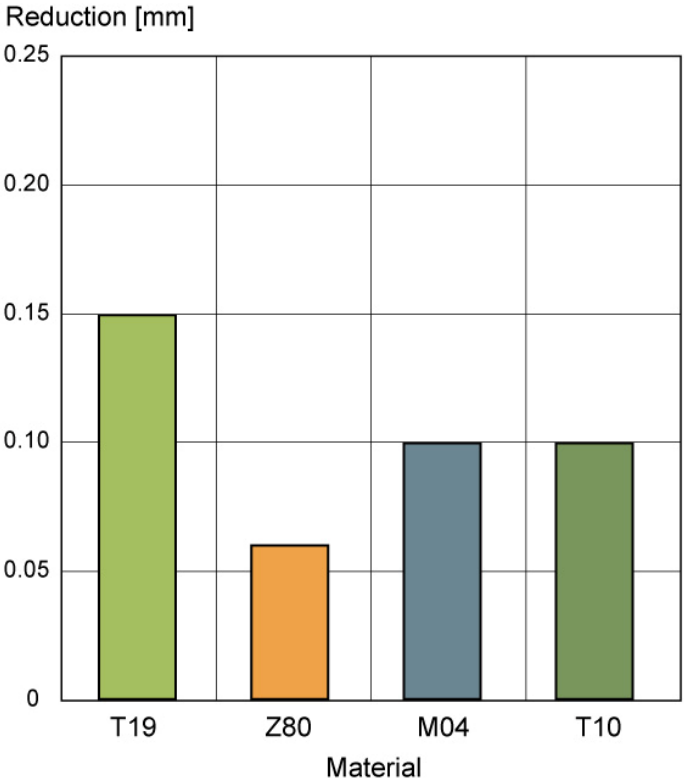


Comparison of Extrusion of Stepseal® 2K in HFC at 40°C and in mineral oil at 60°C for Turcon® T10 and T19

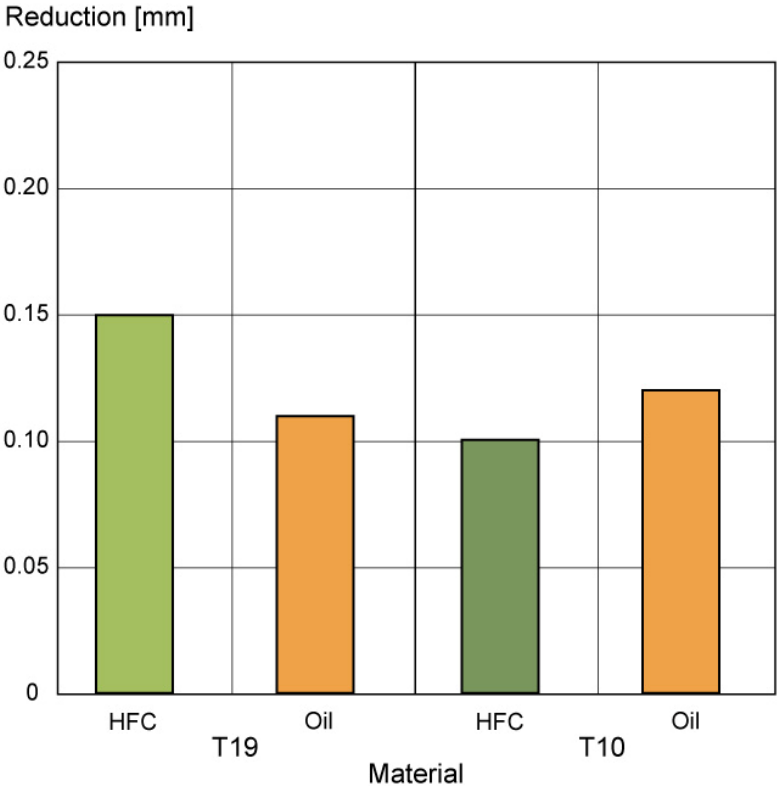


Reduction of Thickness W

Stepseal® 2K in HFC: Reduction of W-measure

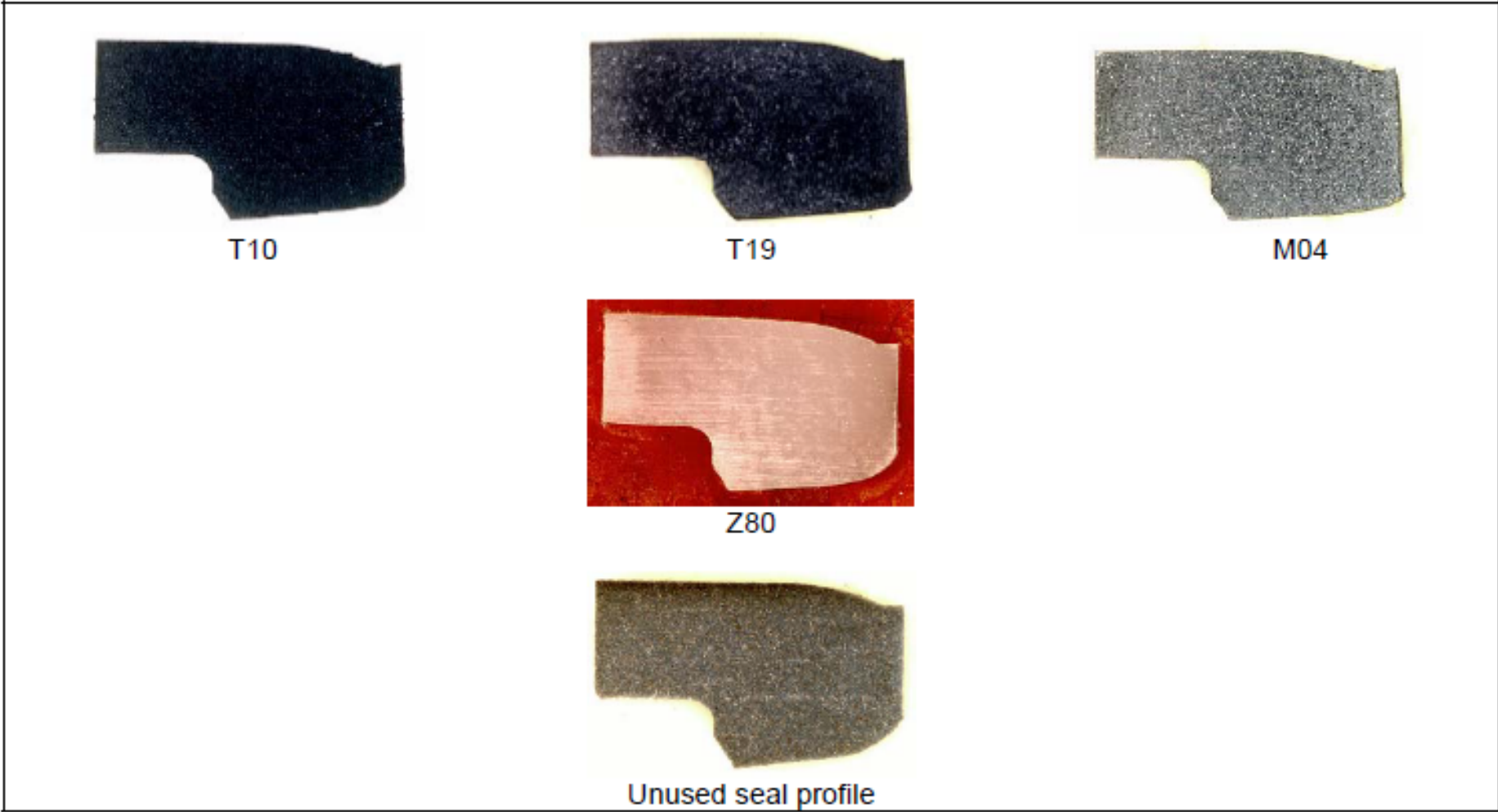


Stepseal® 2K in HFC at 40°C and in mineral oil at 60°C for Turcon® T10 and T19



Cross Section of Tested Seals

4 Stepseal[®] 2K from test in HFC plus one unused Stepseal[®] 2K



Compatibility of Elastomers with Pressure Fluids

	NBR	HNBR	AU	FPM (FKM)	EPDM oil free
	Approximately constant working temperature for elastomers in °C				
	-30(-40)/+100	-20(-30)/+140	-30/+80(+100)	-20/+200**	-50/+150**
HL/HLP/HLPD Mineral oil	+	+	+	+	-
HFD	-	-	-	+*	+*
HFC	+	+	+*	-	+
HFB	+	+	-	+	-
HFA	+	+	+*	+	-
HETG	+	+	+	+	-
HEES	+*	+	+	+	-
HEPG	+*	+*	+*	+	-
+ is recommendable, - is not recommendable					
* at dynamic function seals have to be tested ** Max. temperature in air					



TRELLEBORG

www.trelleborg.com