

PFAS regulation and its potential impact on the
machine tool industry
Sealing types and materials in machine tools

Applications and Consequences

LIEBHERR

Power cable and control cable

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

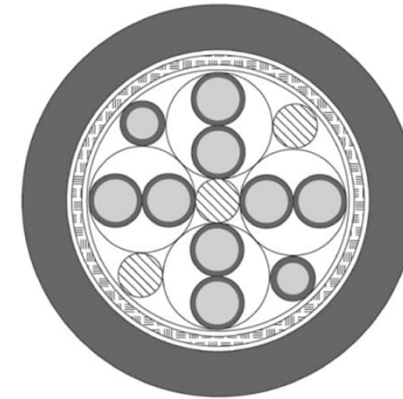
Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

10° C to +70° C

linear speed up to 3 m/ sec

PUR outer sheath, low adhesion, extremely abrasion resistant, halogen-free, resistant to UV-, oil-, hydrolysis and microbial attack, Resistant to cleaning and disinfecting agents



Changeover to other elastomers possible, in which case the chemical resistance, resistant to UV, low adhesion, the linear speed must be taken into account.

The different components in the environment like additives in the cooling lubricants and other components in the air are usually critical, as they can cause changes in the cable jacket. These changes are sometimes critical for the application.

In-depth investigations are necessary for this

Pneumatic applications

O-ring pre-stressed PTFE seals

Public consultation:

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For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

-10° C to +50° C

up to 1m/ s

Dry or oiled air

Influence of MWF and of CGLP Lubricating oil, fluid grease xxx

Target same lifetime

Kolbendichtungen,
doppeltwirkend



Possible alternative material combinations

UHMW-PE / NBR → Temperature limit <80° C

Polyurethane / NBR → Temperature limit <100 ° C

Note increased friction values

Pure elastomer seals → Temperature limitation

Für high pressure hydraulic application

Backing rings based on PTFE

Public consultation:

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Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

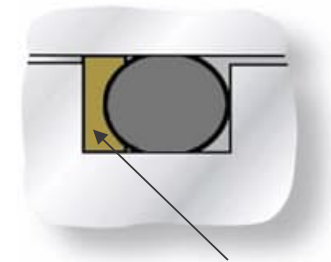
+10° C to +70° C

static

High pressure up to 240 bar

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime



O-Ring mit Stützring

Image source: VDMA teaching material

Possible alternatives:

UHMW-PE (<80° C) ,

Elastomers, TPU (<100° C)

generally thermoplastics → more difficult assembly and observe assembly limits

Disadvantages:

Assembly

Universal resistance to operating materials is lost

PTFE-based guide elements

Public consultation:

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For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

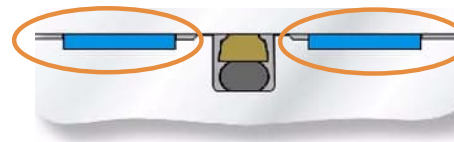
+10° C to +70° C

1 m/ s

No pressure resistance, surrounded by pressure on all sides depending on the application,

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime



**Kolbendichtung, PTFE
doppeltwirkend mit Führungen**

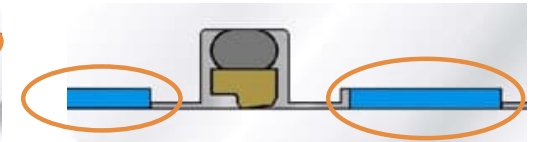


Image source: VDMA teaching material

Possible alternatives:

UHMW-PE (<80° C) ,

Thermoset (fabric composites)

Thermoplastic materials such as POM, PA ...

Disadvantages:

Universal resistance to operating materials is lost

Increased friction values are to be expected (higher energy input necessary)

O-rings on FKM and FFKM basis

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

0° C to +70° C static

High pressure up to 240 bar

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime

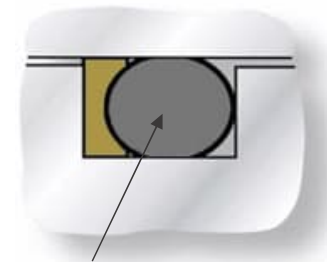


Image source: VDMA teaching material

O-Ring mit Stützring

Possible alternative:

NBR, HNBR

The different additives in the cooling lubricants are usually critical, as they can sometimes cause critical changes in NBR and HNBR for the application.

In-depth studies are necessary for this

Max. application temperatures
depending on the media to be sealed

NBR approx. 100° C
HNBR approx. 140° C

X-rings on FKM and FFKM basis

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, Spare parts in old constructions/ machines (Special spare parts require special shapes)

Boundary conditions for alternatives:

0° C to +70° C

Static + Quasistatic

High pressure up to 240 bar

Influence of MWF and of flowing grease xxx

Target same lifetime

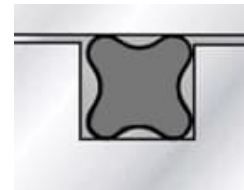


Image source: VDMA teaching material

Possible alternative:

NBR, HNBR

The different additives in the cooling lubricants are usually critical, as they can sometimes cause critical changes in NBR and HNBR for the application.

In-depth studies are necessary for this

Maximum application temperatures NBR approx. 100° C

depending on the media to be sealed

HNBR approx. 140° C

O-ring preloaded translational hydraulic seals

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

10° C to +70° C

1 m/ s

High pressure up to 240 bar

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime

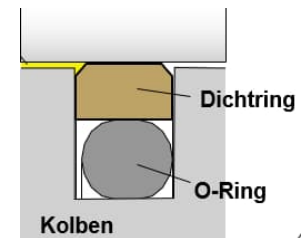
Affected material combinations

PTFE filled / NBR

PTFE filled / FKM

UHMW-PE (Z80) / FKM

Polyurethane / FKM



Possible alternative material combinations

UHMW-PE / NBR → Temperature limitation up to 80° C and
pressure limitation up to 350 bar

Polyurethane / NBR → Temperature limitation up to 100 ° C
Note increased friction values

Thermoplastics such as PEEK or similar / NBR → Temperature limitation up to 100° C

Friction and mounting possibility must be checked

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

O-ring preloaded rotary seals

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

10° C to +70° C

1 m/ s

High pressure up to 240 bar

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime

Affected material combinations

PTFE filled / NBR

PTFE filled / FKM

UHMW-PE / FKM

Possible alternative material combinations

UHMW-PE / NBR → Temperature limitation up to 80° C and

pressure limitation up to 300 bar

Polyurethane / NBR → Temperature limitation up to 100 ° C

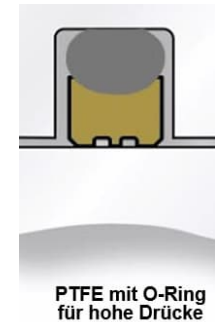
Note increased friction values

Thermoplastics such as PEEK or similar / NBR → Temperature limitation up to 100° C

Friction and mounting possibility must be checked

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this



Radial shaft seal

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

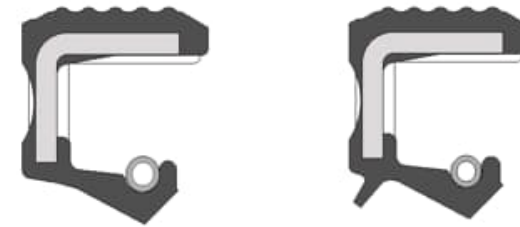
10° C to +70° C

Up to 30000 RPM

Almost pressureless

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime



Changeover to other elastomers possible, in which case the chemical resistance and also the circumferential speed must be taken into account. At high circumferential speeds, the frictional heat rises sharply, which makes the use of NBR and possibly also HNBR impossible.

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

Lip seal ring

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

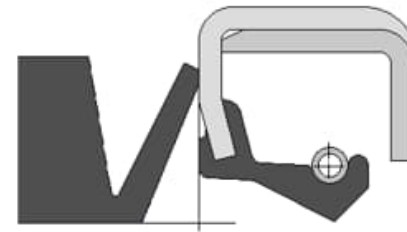
10° C to +70° C

Circumferential speed up to 2 m/ sec

Almost pressureless (1 bar overpressure)

Influence of MWF, lubricating oil and fluid grease xxx

Target same lifetime



V-Ring Standard

Changeover to other elastomers possible, in which case the chemical resistance and also the circumferential speed must be taken into account. At high circumferential speeds, the frictional heat rises sharply, which makes the use of NBR and possibly also HNBR impossible.

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

O-ring preloaded PTFE wiper

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

-10° C to +50° C

up to 1m/ s

pressureless

Environmental influences

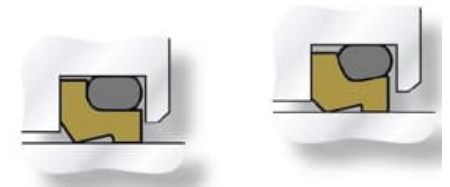
Influence of MWF and of CGLP Lubricating oil, fluid grease xxx

Target same lifetime

Affected material combinations

PTFE filled / NBR

PTFE filled / FKM



Possible alternative material combinations

UHMW-PE / NBR → Temperature limitation up to 80° C and

Polyurethane / NBR → Temperature limit up to 100 ° C,

observe increased friction values

Thermoplastics such as PEEK or similar / NBR → Temperature limitation up to 100° C

Friction and mounting possibility must be checked

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

O-ring preloaded hydraulic rod seals

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

10° C to +70° C

1 m/ s

High pressure up to 240 bar

Influence of HLP46, MWF and of CGLP lubricating oil, fluid grease xxx

Target same lifetime

Affected material combinations

PTFE filled / NBR

PTFE filled / FKM

UHMW-PE (Z80) / FKM

Polyurethane / FKM



Possible alternative material combinations

UHMW-PE / NBR → Temperature limitation up to 80° C and
pressure limitation up to 350 bar

Polyurethane / NBR → Temperature limitation up to 100 ° C
Note increased friction values

Thermoplastics such as PEEK or similar / NBR → Temperature limitation up to 100° C

Friction and mounting possibility must be checked

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

Special rotation seal

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

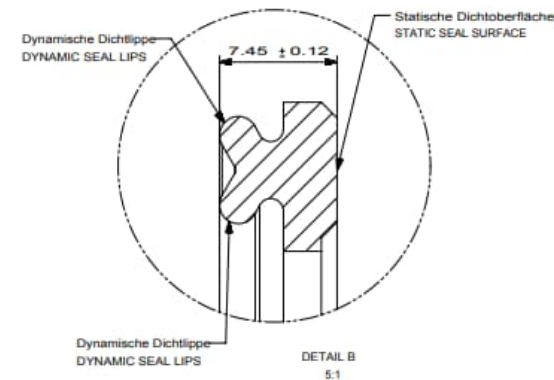
10° C to +70° C

Circumferential speed up to 2 m/ sec

Almost pressureless (1bar overpressure)

Influence of MWF, lubricating oil and fluid grease xxx

Target same lifetime



Changeover to other elastomers possible, in which case the chemical resistance and also the circumferential speed must be taken into account. At high circumferential speeds, the frictional heat rises sharply, which makes the use of NBR and possibly also HNBR impossible.

The different additives in the cooling lubricants are usually critical, as they can cause changes in NBR and HNBR that are sometimes critical for the application.

In-depth investigations are necessary for this

Special rotation and linear guideways

Public consultation:

Fluoropolymers such as PTFE and FKM generally have long chain “large molecules”

→ organised recycling at the end of life, closed loop, abrasion does not enter the environment ...

For prohibition:

Limitation Lifetime, tightness, friction, energy consumption, sustainability, safety
Spare parts in old constructions/ machines
(Special spare parts require special shapes)

Boundary conditions for alternatives:

10° C to +80° C

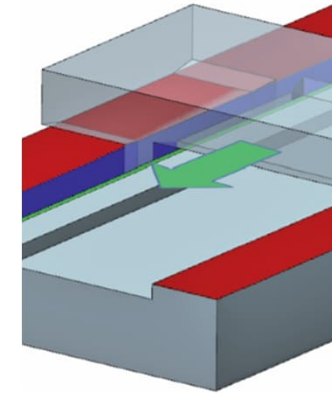
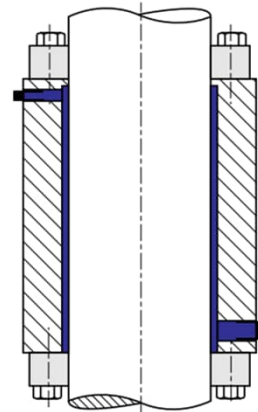
Sliding speed up to 10 m/ min

High surface load up to 50 N/ mm²

Excellent Anti-stick-slip and damping behaviour

Influence of MWF, lubricating oil and fluid grease xxx

Target same lifetime and physical characteristics



Changeover to other guideways because of the accuracy, load and damping characteristics impossible. Efficiency and economy decreases.

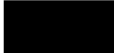
With lower efficiency and economy roller linear guide could be used.

In-depth investigations are necessary for this



Contact

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