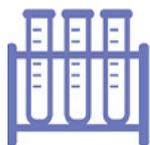




## Seals in PTFE & Thermoplastic materials



**PTFE seals are used to enhance friction capabilities, withstand high pressure applications, and extend seal life in applications outside the parameters of elastomeric seal use. We offer a range of PTFE seals in various different profiles for static, dynamic, rotary and reciprocating applications.**



Extraordinary chemical resistance and suitable for low and high temperature extremes.



Self lubrication allows continuous dry running ability in dynamic sealing applications, low friction and high wear resistance.



Huge variety of material combinations; including virgin and filled PTFE compounds



Complete seal design service from experienced application engineers.



## What is PTFE?

PTFE is a fluoropolymer consisting at atomic level of a carbon backbone fully surrounded by fluorine atoms. It has a friction coefficient amongst the lowest of all solids, and has outstanding chemical resistance, flexibility and a very wide operating temperature range.

These unique set of properties make PTFE ideal for use as a sealing material. Because of very limited elasticity most PTFE seal designs will incorporate an energising element, such as an elastomer o-ring or metal spring.

Virgin PTFE has a limited range of applications due to relatively poor extrusion, creep and wear resistance but the addition of fillers can dramatically improve these properties. PTFE does not tend to be moulded or extruded, and most seals in PTFE based compounds are manufactured by machining from a block or billet which has been produced by compressing and sintering powder-based raw polymer.

## Properties of PTFE

Although PTFE remains flexible down to  $-269^{\circ}\text{C}$  and does not melt until  $+327^{\circ}\text{C}$ , thermal shrinkage effects drive the use of special seal designs at cryogenic temperatures ( $-150^{\circ}\text{C}$  and below), and material softening limits the practical upper working temperature to around  $260^{\circ}\text{C}$ . It is immune to any heat ageing affects resulting from temperature cycling.

PTFE offers near universal chemical resistance and does not exhibit any change when subjected to practically all known chemicals. Moisture and ultraviolet radiation (sunlight) cause neither volumetric change, disintegration nor brittleness and it benefits from an unlimited shelf life when stored correctly. It can be broken down by high strength gamma radiation, alkali metals or fluorinating agents at high temperature, and thus can be bonded to a substrate only once the PTFE surface has been subject to a chemical or plasma etch process.

In addition to a very low friction coefficient (which varies slightly with filler content) the static (or breakout) friction is only slightly higher than the dynamic (or running) friction with PTFE materials. This significantly reduces the stick-slip effect seen with many elastomer sealing solutions, giving advantages in overall system design and performance. In conjunction with the high temperature capability, the low friction levels (and low heat generation) associated with dynamic PTFE seals allows them to be used at high surface loads and speeds or in poorly lubricated conditions. Selection of the appropriate filled grade can optimise the wear and extrusion resistance to suit the application.

The low outgassing, purity and non-toxicity of PTFE makes it a suitable material choice in semiconductor, healthcare, medical and food applications, with numerous grades meeting FDA and USP requirements. Virgin PTFE is an excellent electrical insulator but with correct filler specification the material can conversely display good conductivity if required.

# Material Overview

In order to provide optimum sealing performance, our thermoplastic materials can be mixed with fillers to meet the specific requirements of individual applications. This table shows a selection of common fillers, or combination of fillers, and the key features of these compounds. Depending on the fillers used, some PTFE materials are FDA and USP Class VI compliant. A wider range of specialist fillers are available – please discuss with our Materials Engineers.

Compound	Temperature		Characteristics suitable for:	Products
	Min.	Max.		
Virgin PTFE	-190°C	+ 230°C	High chemical resistance, improved creep and wear resistance, smooth surface finish, high density, low gas permeability.	Back-up rings, spring energised seals
PTFE + glass fibre	-190°C	+ 290°C	High creep resistance, good electrical resistance, good chemical resistance, medium duty hydraulic applications.	Slide rings, back-up rings, guide rings, gaskets
PTFE + glass + MoS2	-150°C	+ 260°C	High wear resistance, good wear life rotary sealing material (hardened shaft material required).	Rotary lip seals
PTFE + carbon	-190°C	+ 290°C	Smooth seal surface for gas sealing, moderate wear and extrusion resistance. Water/oil emulsions with poor lubricity. Pneumatic sealing.	Spring energised seals
PTFE + carbon + graphite	-190°C	+ 315°C	High mechanical strength. High wear and creep resistance. Water/oil hydraulics. Good chemical resistance.	Slide rings, back-up rings
PTFE + graphite	-190°C	+ 230°C	Low mechanical strength. Suitable for soft sealing surfaces.	Spring energised seals
PTFE + bronze	-156°C	+ 260°C	High mechanical strength. Excellent wear and extrusion resistance. Oil based hydraulics.	Slide rings
PTFE + aromatic polymer	-260°C	+320 °C	Medium mechanical strength, ideal for soft sealing surfaces and light duty rotary sealing.	Spring energised seals, rotary glide rings, lip seals
PTFE + carbon fibre	-260°C	+ 310°C	Good wear properties in water hydraulics and seawater. Poorly lubricated applications (eg short strokes at high frequency).	Slide rings, spring energised seals
<b>Plastic Materials</b>				
UHMW-PE	-200°C	+ 80°C	Excellent wear resistance, particularly in water and air. Limited to +80°C maximum operating temperature.	Slide rings, spring energised seals, guide rings
Cast Polyurethane	-30°C	+140°C	Good wear resistance particularly in abrasive media. Numerous grades with varying chemical, hydrolysis and temperature resistance.	Seals, wipers/scrapers
PVDF	-30°C	+ 140°C	Good chemical resistance, smooth surface finish, can be injection moulded. Ideal for gas sealing and valve seats.	Spring energised seals, back-up rings
PEEK	-120°C	+250°C	Rigid thermoplastic with excellent compressive strength, extrusion resistance and chemical resistance. Ideal for back-up rings and guide rings in heavy duty applications.	Back-up rings, slide rings



# Standard Profile Overview

Our PTFE lip seals and PTFE cap seals are available for rod, piston, and rotary applications, and can be manufactured in a variety of PTFE and elastomer material combinations depending on each application requirement. Standard catalogue PTFE seal sizes are listed for installation in grooves to ISO7425-2, but we manufacture bespoke sizes and profile designs if required, in sizes ranging from 3mm to 3200 mm in diameter. Alongside PTFE seals, we offer a range of PEEK and UHMWPE seals profiles and PTFE and PEEK back-up rings are available in a variety of materials and designs including solid, split and contoured profiles.

## Rod Seals



FROD single-acting rod sealing set. Particularly suitable for sealing rods in control cylinders, servo-assisted equipment, machine tools and quick-acting cylinders.



FRCR double-acting rod sealing set. Suitable for dynamic applications as an alternative to an o-ring and for situations where sealing performance and friction have to be optimised.



FRON single/double-acting rod sealing set. Good sealing performance in extremely small assembly conditions.



FROA single/double-acting rod sealing set. Particularly suitable for sealing rods in pneumatic cylinders. Suitable for use in oiled as well as oil-free air.



FROM double-acting rod sealing set. Particularly suitable for sealing rods in control cylinders, servo-assisted equipment and in quick-acting cylinders.

## Piston Seals



FPOA double-acting piston sealing set. Particularly suitable for double-acting pneumatic pistons. Assembly on one part piston is possible.



FPON single/double-acting piston sealing set. Particularly suitable for double-acting pistons in control cylinders, in servo-controlled systems, machine tools, quick-acting and steering cylinders.



FPOD single-acting piston sealing set. Asymmetrical cross section is designed for best drag oil performance during stroke in both directions.



FPOM double-acting piston sealing set. Particularly suitable for double-acting pistons in control cylinders, in servo-controlled systems, machine tools, quick-acting and steering cylinders.



FPCR double-acting piston sealing set. Appropriate for dynamic applications as an alternative to an o-ring in situations where sealing performance and friction have to be optimised.

## Wiper Seals



FWAT consists of PTFE wiper ring and elastomer o-ring as a pre-loading element. This profile is suitable for a wide range of applications, especially for aggressive media and/or high temperatures.



FWAD consists of a PTFE wiper ring and an elastomer o-ring as a pre-loading element. It combines two functions: wiping against pollution from outside and a sealing function which reduces the residual oil film.

## Rotary Seals



FTOR is suitable for applications where the pressure alternates from one side of the seal to another, such as pivots for rotating track rings, swivel joints, hose reels and in machine tool hydraulics.



FTOP profile should be used instead of the FTOR if there are housing limitations.

## Special Profile Seals



FPCQ double-acting sealing set is suitable for sealing between two media such as fluids/gases. Energised with an o-ring and incorporates an X-ring inset into the dynamic sealing face.



FPCQ with BU rings is used for higher pressure applications to prevent extrusion and can act as scraper function with more aggressive application media.



Flexilip rotary lip seal features an ID lip that seals dynamically on a shaft and an elastomeric o-ring on the OD to seal statically in a bore.



Flexicase rotary lip seal features an ID lip that seals dynamically on a shaft, and metal casing on the OD to seal statically press-fit into a bore.

# Spring Energised Seals

Spring energised PTFE seals can be tailored to any existing customer groove geometry and in numerous jacket material and spring energiser material combinations. We use helical, cantilever and canted coil springs with a variety of different load options, and springs are available in corrosion resistant metal alloys including stainless steels, cobalt-chromium-nickel alloy, Inconel®, and Hastelloy®.



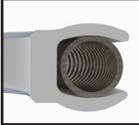
FRBA for sealing reciprocating actuator rods. Features helical spring for high load and small deflection range.



FRNA is excellent for both static & intermittently dynamic applications. Can be used for reciprocating or rotating movements on either ID or OD.



FPBA is ideal for reciprocating piston sealing. Features helical spring for high load and small deflection range.



FFAE for sealing externally pressurized static and intermittently dynamic flange applications. Features helical spring for high load & small deflection range.



FRBH for sealing high pressure, reciprocating actuator rods. Features helical spring for high load & small deflection range and extended heel reduces effects of extrusion.



FFRE for sealing externally pressurized flanges, in particular cryogenic static and intermittently dynamic applications.



FPBH for high pressure piston sealing. Features helical spring for high load & small deflection range and extended heel that reduces effects of extrusion.



FRNH is excellent for both static & intermittently dynamic applications at high pressures. Can be used for reciprocating or rotating movements on either ID or OD.



FTFR for sealing rotating shafts such as in pumps, motors and rotary actuators.



FFHE for sealing internally high pressurized static & intermittently dynamic flange applications.



FWFR for sealing rotating shafts with abrasive media such as in pumps, motors and rotary actuators.



FFHI is excellent for sealing internally high pressurized static & intermittently dynamic flange applications.



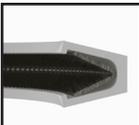
FTNR is ideal for sealing rotating shafts without the possibility of a flange cavity in the groove. Can be used in low pressure reciprocating applications.



FTNP is ideal for sealing outside rotating housings. Can also be used in low pressure reciprocating piston applications.



FFAI is excellent for sealing internally pressurized static & intermittently dynamic flange applications. Features helical spring for high load & small deflection range.



FFRI for sealing internally pressurized flanges, in particular cryogenic static and intermittently dynamic applications.



FTNR is ideal for sealing abrasive media for rotating shafts without the possibility of a flange cavity in the groove. Can be used in low pressure reciprocating applications.



FTNP is ideal for sealing abrasive media with outside rotating housings. Can also be used in low pressure reciprocating applications.



SACAO Anti-blowout seals used where rapid fluid flow may dislodge a non trapped seal from its groove. Also used where seals need to pass port holes.



Spiral grooved seals are Ideal for sealing mineral oil applications. Hydrodynamic spiral feature enhances sealing efficiency and service life.

# Design & Development

Unrivalled technical and engineering support means our customers benefit from the best possible seal performance at optimum cost.

Experienced application engineers support every project; from concept to approval ✓

Complete seal design service ✓

Seal geometry and profile choice ✓

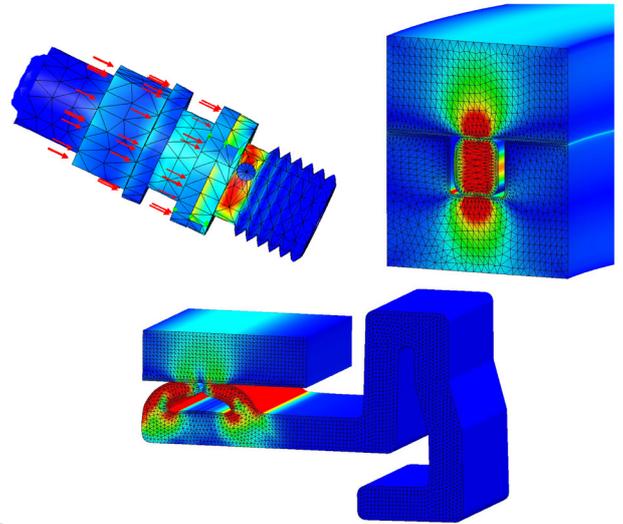
Material selection and development ✓

3D CAD modelling and FEA Simulation ✓

3D printing for concept testing ✓

Prototyping through to final production ✓

Online Technical Hub and interactive tools ✓



# Quality Assurance

Strict quality procedures at all stages of our design, development and manufacturing processes.

We are ISO9001:2015, ISO13485:2016 and ISO14001:2015 approved ✓

Manufacturing approved to IATF16949:2016 & AS9100 ✓

ISO13485 accredited cleanroom production ✓

Worldwide network of global manufacturing facilities ✓

Advanced product quality planning ✓

Proactive and preventative expertise ✓



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