Seals in PTFE & Thermoplastic Materials
Company profile

Ceetak Ltd is a leading UK designer, developer and supplier of seals and sealing solutions. Established for over 40 years, and part of the Ceetak Holdings Group, our Head Office is based in Bedford, England.

Our products and systems are used throughout all major industries, from the most technically demanding applications, to high quality, high volume precision components.

Ceetak’s Application Engineers are able to assist in the design of seals for all applications and our engineers fully understand the variety of technical challenges when designing and manufacturing components for critical conditions.

Engineering Design and Quality Assurance

We provide unrivalled technical and engineering support to ensure our customers benefit from the best possible seal performance at optimum cost. Ceetak is dedicated to providing a complete design service; from initial seal geometry and profile choice, to material selection and prototyping, through to final production.

We work closely with your engineers to provide the most effective sealing solution for each bespoke application. Our Application Engineers utilise years of seal design experience and materials expertise, alongside technology such as 2D/3D CAD and FEA analysis programs to simulate performance before finalising each individual seal design.

We provide both in-house and on-site technical support and have the skills, experience and resources to assist customers in all industries; regardless of the complexity or challenges involved in each application.

To meet the required standards and approvals demanded by industry, strict quality procedures are maintained at all stages of our design service, development and manufacture. We are ISO9001:2008 and ISO14001:2004 approved, with our manufacturing partners approved to TS16949:2009. Ceetak has a dedicated team of Quality Engineers and Quality Inspectors ensuring that advanced product quality planning is at the heart of our quality function.

Fundamental activities include; mitigation of risk during all manufacturing processes, anticipating potential risks, regular review of process controls and stability, PPAP review, continuous monitoring of production SPC data, regular audits of manufacturing facilities and monthly manufacturing performance monitoring.

We regularly challenge our manufacturing facilities for continuous improvements to processes including follow up-audits to ensure implementation of adequate prevention measures to avoid repeat issues, analysis and review of similar products to prevent future issues, effective root cause analysis and preventative actions review.

Our stringent quality principles and proactive controls mean our customers have reduced claims and associated costs, increased change control and prevention of productivity loss and line-stops.

Strategic Sourcing Partners

Ceetak has been in partnership with Parker Hannifin Seal Group for over 35 years, and is the accredited and recognised UK distributor of their seals.

Our unique partnership allows us to offer extensive product knowledge and applications expertise. Our engineering team has the backing of the Parker global manufacturing network, providing you with the latest developments in seal technology.

Parker’s portfolio of materials include a wide range of both virgin and filled thermoplastics, and include 11 materials approved to NORSOK M-710 for sour gas service specifically for use in the Oil & Gas industry.
Introduction to Polytetrafluoroethylene (PTFE)

PTFE does not exhibit any change when subjected to practically all known chemicals. Moisture and solar radiation (sunshine) cause neither volumetric change, nor disintegration and brittleness. The crystalline change associated with the melting point of the material starts at 327°C without there being any typical thermoplastic liquefaction.

PTFE is resistant to almost all known chemicals - the material offers lowest coefficient of friction for a solid as well as unlimited shelf life when stored correctly.

For the above reasons, process technology similar to powder metallurgy is utilised. PTFE powder is compressed into blocks, rods or tubes, sintered and then mechanically machined into the required shapes.

Based on experience of the last 30 years, the materials industry has developed PTFE types that can also be thermoplastically processed for certain applications. This process allows bespoke sizes and designs without tool or mould costs.

Special Characteristics of PTFE

At cryogenic temperatures:
Even at -269°C (boiling point of helium) PTFE still has residual extensibility, so that it can also be used under extreme conditions, e.g. outer space. The material does require strong spring forces to counteract shrinkage - PCTFE (PolyChloroTriFluoroEthylene) can also be used.

At high temperatures:
PTFE has exceptional thermal resistance, so that it can be used at prolonged temperatures of 260°C and up to 320°C for limited periods. Fillers have no influence on the PTFE's own thermal resistance. Furthermore, most fillers are themselves stable up to 400°C so that they do not restrict high temperature use.

It should be observed that mechanical strength does reduce with high temperatures, and a backing ring (e.g. PEEK - PolyEtherEtherKetone) may be required.

Behaviour under vacuum:
There are no problems associated with the use of PTFE under vacuum as it has an extremely low vapour pressure (< \(10^{-5}\) mbar at 120°C). There are however restrictions when using graphite fillers with static seals.

In addition to the described (advantageous) properties of PTFE and its use for seals and guide elements, other typical characteristics are as follows:

Adhesion properties with compound components:
On account of its exceptional anti-adhesion characteristics, Virgin PTFE resists adhesives unless a special surface treatment is used. Filled compounds improve adhesion properties, but it is recommended that the surface is etched before application of the adhesive. Carbon/Graphite filled compounds have the best adhesion properties.

Contact with foodstuffs:
Generally PTFE is suitable for contact with foodstuffs and satisfies FDA requirements. However it remains the responsibility of the component manufacturer (e.g. in the case of seals, the cylinder manufacturer) to ensure the finished product complies with the standards specified by the FDA.

Electrical properties:
PTFE is an excellent insulator with a high dielectric strength, low permittivity and a very high electrical resistance. Some carbon and bronze fillers can impair electrical properties, however some carbon fillers can still be used. Our Application Engineers can advise these.

Tribological properties:
The coefficient of friction is only marginally influenced by fillers. The lowest value is achieved by compounds containing graphite or MoS\(_2\) alone, or in combination with glass fibres.

The type of filler material strongly influences the wear characteristics. Less wear is experienced with fibrous fillers than with particulates.

PTFE compounds can be used without lubrication. However, when sealing dynamically against lubricating fluids (mineral oils etc) the coefficient of friction can be reduced depending upon surface velocity, surface finish, pressure etc.

Some compounds behave better in water; carbon fibre filled PTFE and UHMW-PE in particular.
## Material Overview

<table>
<thead>
<tr>
<th>Compound</th>
<th>Temperature Min.</th>
<th>Temperature Max.</th>
<th>Application</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin PTFE</td>
<td>-190°C</td>
<td>+ 230°C</td>
<td>- Chemical industry</td>
<td>- High chemical resistance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Food industry</td>
<td>- FDA Compliant</td>
</tr>
<tr>
<td>Virgin TFM</td>
<td>-190°C</td>
<td>+ 230°C</td>
<td>- Chemical industry</td>
<td>- High chemical resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Food industry</td>
<td>- High mechanical strength</td>
</tr>
<tr>
<td>Modified PTFE</td>
<td>-190°C</td>
<td>+ 230°C</td>
<td>- Low duty hydraulic applications</td>
<td>- Improved wear resistance</td>
</tr>
<tr>
<td>PTFE + glass fibre</td>
<td>-190°C</td>
<td>+ 290°C</td>
<td>- Medium duty hydraulic applications</td>
<td>- High chemical resistance</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>- High creep resistance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Electrical properties like Virgin PTFE</td>
</tr>
<tr>
<td>PTFE + glass + MoS2</td>
<td>-150°C</td>
<td>+ 260°C</td>
<td>- Crankshaft and gearbox seals</td>
<td>- High wear resistance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- For use only on hardened surfaces</td>
</tr>
<tr>
<td>PTFE + Calcium Silicate (FDA)</td>
<td>-200°C</td>
<td>+ 260°C</td>
<td>- Mixers</td>
<td>- FDA Compliant</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Volumetric filling machines</td>
<td></td>
</tr>
<tr>
<td>PTFE + carbon</td>
<td>-190°C</td>
<td>+ 290°C</td>
<td>- Medium mechanical stress</td>
<td>- Chemical resistance limited by carbon</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Hard sealing surfaces</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Water/Oil emulsions</td>
<td></td>
</tr>
<tr>
<td>PTFE + carbon + graphite</td>
<td>-190°C</td>
<td>+ 315°C</td>
<td>- Heavy mechanical stress</td>
<td>- High wear and creep resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Water/Oil hydraulics</td>
<td></td>
</tr>
<tr>
<td>PTFE + graphite</td>
<td>-190°C</td>
<td>+ 315°C</td>
<td>- Pneumatics</td>
<td>- High wear and creep resistance</td>
</tr>
<tr>
<td>PTFE + bronze</td>
<td>-156°C</td>
<td>+ 260°C</td>
<td>- Heavy mechanical stress</td>
<td>- Chemical resistance limited by graphite</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Soft sealing surfaces</td>
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<td></td>
<td></td>
<td></td>
<td>- Hydraulic sealing surfaces</td>
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<td></td>
<td></td>
<td></td>
<td>- Rotary sealing</td>
<td></td>
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<tr>
<td>PTFE + ekonol</td>
<td>-260°C</td>
<td>+320°C</td>
<td>- Medium mechanical stress</td>
<td>- Limited chemical resistance</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Soft sealing surfaces</td>
<td>- Limited use in hot water</td>
</tr>
<tr>
<td>PTFE + stainless steel</td>
<td>-190°C</td>
<td>+ 260°C</td>
<td>- Heavy mechanical stress</td>
<td>- Chemical resistance from stainless steel filler (AISI 316)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Applications in chemical industry</td>
<td></td>
</tr>
<tr>
<td>PTFE + carbon fibre</td>
<td>-260°C</td>
<td>+ 310°C</td>
<td>- Water hydraulics</td>
<td>- Very good wear properties in water</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Seawater</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>- Short strokes with high frequency</td>
<td></td>
</tr>
<tr>
<td>PTFE + Polymide</td>
<td>-200°C</td>
<td>+ 260°C</td>
<td>- Rotary sealing</td>
<td>- Very good wear properties</td>
</tr>
<tr>
<td>PTFE + mineral fibre + molybdenum disulphide</td>
<td>-200°C</td>
<td>+ 260°C</td>
<td>- Hydraulics</td>
<td>- Does not score rods</td>
</tr>
<tr>
<td>Plastic Materials</td>
<td></td>
<td></td>
<td></td>
<td>- Preferred material for hydraulic systems</td>
</tr>
</tbody>
</table>

### Note:
Depending on fillers used, some PTFE materials are FDA and USP Class VI compliant. Please check with our Materials Engineers for further details.
# Standard Profile Overview

## Rod Seals
- **(SCCR)** 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.
- **(SOCM)** Double-acting rod sealing set. Particularly suitable for sealing rods in control cylinders, servo-assisted equipment and in quick-acting cylinders.

## Piston Seals
- **(SOCA)** Double-acting piston sealing set. Particularly suitable for double-acting pneumatic pistons. Assembly on one part piston is possible.
- **(SOCO)** Single acting piston sealing set. Asymmetrical cross section is designed for best drag oil performance during stroke in both directions.
- **(SCCP)** 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
- **(SACT)** Consists of PTFE wiper ring and elastomer o-ring as pre-loading element. This profile is suitable for a wide range of applications, especially for aggressive media and/or high temperatures.
- **(SACD)** 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
- **(SOCR)** Suitable mainly 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.
- **(SOCQ)** If housing limitations are given the SOCQ profile should be used instead of the SOCR.

## Special Profile Seals
- **(SCCO)** A double-acting sealing set suitable for sealing between two media such as fluids/gases. Energised with an o-ring and incorporates and X-ring inset into the dynamic sealing face.
- **(SCCO with BU rings)** Back-up rings with SCCO profile used for higher pressure applications to prevent extrusion and can act as scraper function with more aggressive application media.
- **(Flexilip)** Rotary lip seal that features an ID lip that seals dynamically on a shaft and an elastomeric o-ring on OD to seal statically in a bore.
- **(Flexicase)** Rotary lip seal that features an ID lip that seals dynamically on a shaft and metal casing on the OD to seal statically press-fit into a bore.

Our PTFE rod, piston and rotary seals can be manufactured in a variety of thermoplastic (see reference table) and elastomer material combinations depending on the individual application requirements.

Seal diameters from 3 mm-3000 mm can be produced. Standard catalogue seal sizes are listed for installation in grooves to ISO7425-2, but special sizes and designs are available upon request.

Anti-extrusion rings are available in a variety of materials and designs including; solid, split, spiral and contoured.
Spring Energised Seals

(SBCAI) For sealing reciprocating actuator rods. Features helical spring for high load and small deflection range

(SBCAO) Ideal for reciprocating piston sealing. Features helical spring for high load and small deflection range

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

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

(SFCLO) Best choice for sealing rotating shafts such as in pumps, motors and rotary actuators

(SFCLS) Best choice for sealing rotating shafts with abrasive media such as in pumps, motors and rotary actuators

(SNCLI) Ideal for sealing rotating shafts without the possibility of a flange cavity in the groove. Can be used in low pressure reciprocating applications

(SNCAI) Excellent for sealing internally pressurized static & intermittently dynamic flange applications. Features helical spring for high load & small deflection range

(SNCLI) 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

(SNCAI) Excellent for sealing internally pressurized static & intermittently dynamic flange applications. Features helical spring for high load & small deflection range

(SNCAO) 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.

(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.

(SNCRE) For sealing externally pressurized flanges, in particular cryogenic static and intermittently dynamic applications

(SNCHA) Excellent for both static & intermittently dynamic applications at high pressures. Can be used for reciprocating or rotating movements on either ID or OD

(SNCHI) Excellent for sealing externally pressurized static & intermittently dynamic flange applications

(SNCLI) Ideal for sealing abrasive media with outside rotating housings. Can also be used in low pressure reciprocating applications.

(SNCHI) Excellent for sealing internally high pressurized static & intermittently dynamic flange applications

(SNCHE) For sealing internally high pressurized static & intermittently dynamic flange applications

(SNCHI) Excellent for sealing internally high pressurized static & intermittently dynamic flange applications

(SNCL) Ideal for sealing outside rotating housings. Can also be used in low pressure reciprocating piston applications

(SNCRI) For sealing internally pressurized flanges, in particular cryogenic static and intermittently dynamic applications

(SNLCO) Ideal for sealing abrasive media with outside rotating housings. Can also be used in low pressure reciprocating applications.

(SNCRE) For sealing externally pressurized flanges, in particular cryogenic static and intermittently dynamic applications

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

Spring energised seals are available in a large variety of profiles, a virtually unlimited number of sizes and numerous jacket material and spring energiser material combinations. Spring energised seals can be tailored to any existing customer groove geometry.

Many different spring designs are available in corrosion resistant metal alloys including stainless steels, cobalt chromium nickel alloy, Inconel® and Hastelloy®