

PTFE – a material with an almost universal chemical resistance

What is PTFE?
What features
does it offer?

PTFE is the abbreviation for the material polytetrafluorethylene which is a fully fluorinated **polymer** with an extraordinary high melting viscosity. Thus, PTFE has a tremendous thermal stability. Even if used persistently in demanding application environments with temperatures of 260 °C, this material remains fully usable after many thousands of hours.

The very high bond energy between the carbon and fluor atoms provide for an almost universal chemical resistance. PTFE is resistant to almost all solvents and chemicals available on the market today. Even aggressive acids such as aqua regia (nitrohydrochloric acid) cannot corrode PTFE.

Moreover, PTFE has many further positive characteristics, such as for example excellent electrical insulation, a distinct anti-adhesive behaviour, good dry-running properties and a low heat conductivity.

These outstanding features make the PTFE seal material of COG a uni-versally usable material for most different industries. Thus, PTFE is used in applications of vacuum technology, food industry or in the measuring and control technology. Further areas of applications are, among others, medical and electrical engineering, pharmaceutical and automobile and sanitary industry and the general mechanical engineering.



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The most important advantages at a glance:

- Chemical resistance to almost all media inclusive of bases, acids and solvents
- Temperature resistant between -200 °C to + 260 °C
- Optimal dielectric characteristics



COG offers a very high availability from stock for many PTFE O-ring dimensions and thus can cope with very short delivery times. Apart from most different O-ring sizes, the product range comprises other PTFE seals as well, such as e. g. flat seals, piston and piston rod seals, sheaths, support rings and more.



- Low friction coefficient, even without lubrication (absolutely non-adhesive)
- High mechanical resistance achieved by special fillers
- Impermeable to water
- Low heat conductivity
- Physiological harmlessness
- Excellent weather and ageing stability

Important:

Already during design it is required to provide for free access to the installation spaces since PTFE cannot be stretched or compressed.



FEP-encapsulated O-rings

Resistance and elasticity on technically highest level

Conclusion:

A multi-component O-ring of COG does not only provide more components, but above all more positive features.

Thanks to the two-components system of these O-rings, FEP-encapsulated O-rings offer both: great resistance to most different media and good elasticity.

FEP-encapsulated O-rings consist of an elastic core of fluorinated rubber (FKM) or silicone (VMQ) that is completely covered with a seamless sheath of FEP fluoropolymer.

This combination of excellent resistance and good elasticity provides completely new application possibilities for these multi-component O-rings. While the O-ring of silicone or FKM offers the required elasticity, the FEP-coating protects the core against chemicals. FEP-encapsulated O-rings are used in very different application areas in the fields of petrochemistry, chemical industry, pharmaceutical and food industry.

In general, FEP-encapsulated O-rings with an FKM or silicone core are available in a thickness of between 1,5 and 19 mm

Installation instructions

The installation of FEP- and PFA-encapsulated O-rings is subject to almost the same recommendations as standard elastomeric O-rings. However, during fitting it must be taken into account that due to the coating the O-rings can be stretched and compressed just to a limited extent.

Installation spaces for FEP-encapsulated O-rings

Cord thickness	Groove depth T	Groove width B
1,78	1,30	2,30
2,62	2,00	3,40
3,53	2,75	4,50
5,33	4,30	6,90
7,00	5,85	9,10





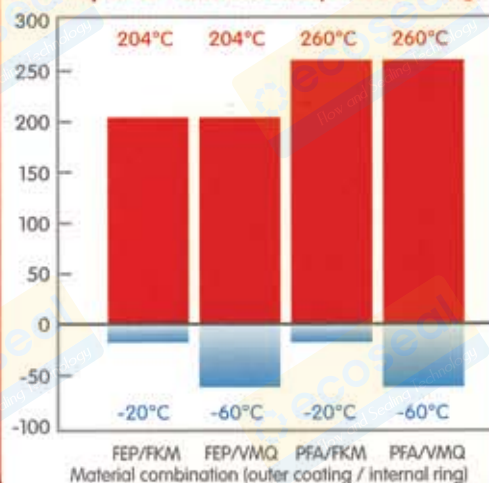
PFA - for highest temperatures

Apart from FEP-coatings, COG offers PFA-coatings as well. PFA stands for perfluoroalkoxy. PFA is used the same way like FEP for the coating of FKM or silicone O-rings. The PFA-material has almost the same chemical resistance and features like PTFE. Therefore, PFA-encapsulated O-rings can be exposed to higher working temperatures than FEP-encapsulated O-rings and this with the same low-temperature flexibility. The diagram opposite represents an overview about the operating temperature ranges.

! FDA-recommendation

Good to know: FEP is an approved material (according to FDA requirement 21 CFR 177.1550) for parts or components which have contact with foodstuffs and used for the production, processing, carrying or the storage of foodstuffs.

Heat resistance and low-temperature flexibility of FEP- and PFA-encapsulated O-rings



Highest precision Up to 6,000 mm in diameter

New production procedure for endless vulcanised precision O-rings

In a special production procedure, precision O-rings according to DIN 3771 can be produced at COG up to a length of 3,000 mm in different cord diameters and material qualities. The procedure developed by COG themselves enables an endless vulcanisation of the O-ring material. Thus, O-rings produced this way correspond to small-sized precision O-rings of conventional production procedures.

enables very low tolerances and accordingly high precision. The greatest advantage over the conventional procedure is that due to the consistent vulcanisation weak points at the body moulding can no longer occur. This enables a long-term and substantially higher-quality sealing in different scopes of application, e. g. even under high-vacuum conditions or under usage of gaseous media.

At present, endless vulcanised O-rings in FKM and EPM quality in the cord thicknesses 5 to 14 mm and NBR in cord thicknesses of 8 to 14 mm with an interior diameter of 1,400 mm to 3,000 mm are available. In individual cases it is possible to produce O-rings with larger interior diameters as well.

Why endless vulcanised O-rings?

In contrast to conventional production procedures of special O-ring sizes, such as e. g. O-rings vulcanised or glued edge to edge, this production method

Advantages of the new production procedure at a glance:

- Very close dimensional tolerances according to DIN 3771
- Consistent cord thickness over the overall O-ring
- Very good surface condition
- Lower tool costs than form-compressed O-rings
- Any interior diameter adjustable from approx. 1,400 mm to 3,000 mm

The following materials and dimensions are currently produceable within the endless vulcanisation procedure:

FKM

- **Vi 465:** brown FKM-material with a hardness figure of 67 Shore A
- **Vi 500:** dark brown FKM-material with a hardness figure 80 Shore A
- **Vi 650:** green FKM-material with a hardness figure of 75 Shore A

NBR

- **P 465:** black NBR-material with a hardness figure of 65 Shore A

EPM

- **EP 380:** black EPM-material with a hardness figure of 80 Shore A

Round cord



Endless vulcanisation



Round cord

Not just suitable for round installations. Round cords for very different applications.

COG round cords are always a good alternative if the material subject to sealing is not too aggressive or under too high pressure. In these cases, round cords can be used without reservation. On this occasion, the installation space is not required to be circular. Round cords can be installed extremely well in grooves with a shift in direction and if required can be glued together at the cord ends. As for the glue, we recommend the high-performance glues of Henkel or the Sicomet glue of Sichelwerke, depending on the field of application. Thanks to sufficient resistance and elasticity in the sealing application they both provide for a good material behaviour.

Note:

Glued O-rings are extruded cords whose cord ends are glued together at the even joint. Its disadvantage is that the glue may probably harden under the influence of heat which causes the round cord losing elasticity.

Round cords allow higher tolerances. Round cords offered by COG are produced according to DIN standard 3302 part 1 E2. Within the product range of round cords, COG currently offers the materials NBR 70, EPDM 65, VMQ 60 and FKM 75.

! Round cords are not suitable for dynamic applications or high requirements to the sealing, e. g. in vacuum applications!

ADVICE:

Examples for glue:
Sicomet 8400 of company Sichelwerke, Hanover (www.sichel.de)

Loctite 401 and 406 of company Henkel, Munich (www.loctite.com)



Something more special – Mouldings

*Please contact us
directly to discuss
together which
mouldings we can
produce for you!*

You should know: Apart from the core business of precision O-rings, COG produces mouldings as well. Thus, production of mouldings is based on decades of competence in the environment of elastomeric sealant materials as well. Rotation-symmetric geometries can be produced of almost all standard materials according to customer drawings in small number of pieces up to approx. 1,000.

Here, our own tool design and construction enables a cost-effective production even in case of very small numbers of pieces. The external diameter of the mouldings to be produced must not exceed 1,400 mm.

Mouldings of rotation-symmetric geometries include among others: flat seals, lip seals, profiled seal rings, dairy pipe screw connections, sealing collars etc.

Special: Rings for dairy pipe screw connections

Sealing rings for dairy pipe screw joints are applied in very different industries where they are subject to highest demands. For example, within the DIN 11851 standard for "Fittings for food, chemicals and pharmaceutical industry; Stainless-steel screwed pipe connections", the relevant dimensions, executions and materials of screwed pipe connections are explained, which colloquially are called "dairy pipe screw connections" as well. Unlike in many other screwed pipe connections, no O-ring is used as a seal element in dairy pipe screw connections, but a type G seal ring as demonstrated in the picture above.

Components with food approval?

All elastomers utilized here are required to comply with the FDA standard (§177.2600) or the instructions of the BfR (Federal Institute for Risk Assessment) (Recommendation XXI category 4 or recommendation XV silicone/paragraph 3 "Silicone elastomers"). Using the following materials both you as well as your customers play it safe.

All materials with FDA or BfR admission (Federal Institute for Risk Assessment)!

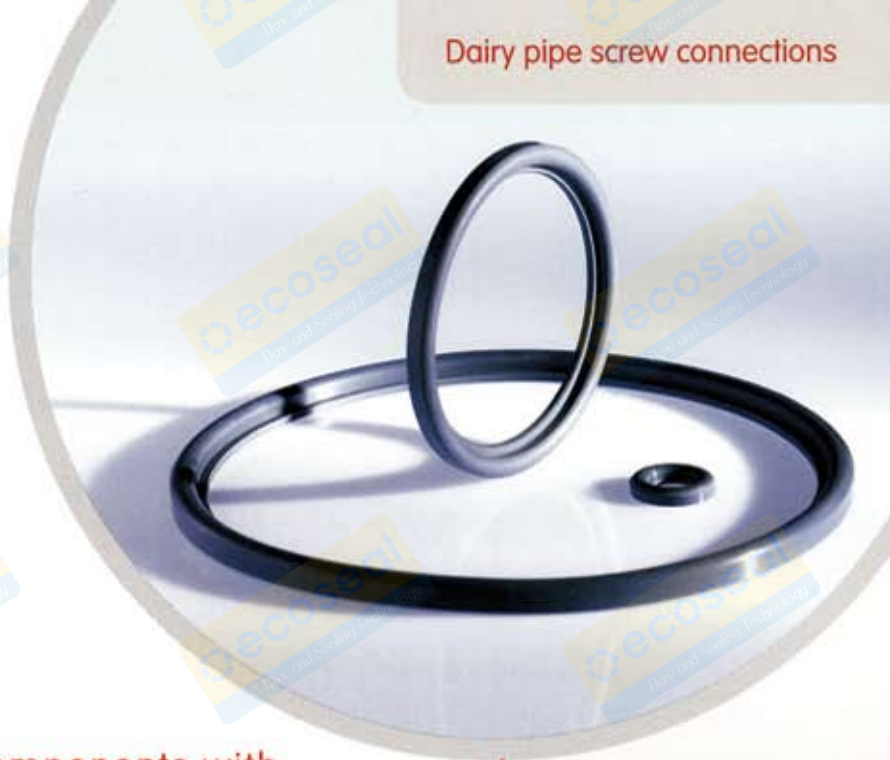
The following dimensions are produced as standard:

COG production range - all dimensions of seal rings according to DIN 11851

Nominal values DN	Interior diameter d9	External diameter	Height s	Radius r3
10	12	20	4,5	2,3
15	18	26	4,5	2,3
20	23	33	4,5	2,8
25	30	40	5	2,8
32	36	46	5	2,8
40	42	52	5	2,8
50	54	64	5	2,8
66	71	81	5	2,8
80	85	69	5	2,8
100	104	114	6	2,8
125	130	142	7	3,5
150	167	155	7	3,5

COG offers the following materials for seal rings for dairy pipe screw connections according to DIN 11851:

- **EPDM:** AP 310, AP320
- **EPM:** EP 390
- **FKM:** Vi 665
- **HNBR:** HNBR 410 und 420
- **VMQ:** Si 50, 820, Si 840, Si 870
- **FFKM:** Perlast® G75S





d_1



d_2



Special treatment? Of course! O-ring surface treatment

Sometimes it is necessary that installed machine components are required to have a certain characteristic breaking the standard. This can happen to O-ring seals as well, of course. For this purpose, COG offers a wide range of special treatments.

O-rings can undergo a special surface treatment, for example for the avoidance of adhesion, reduction of the frictional coefficient or simplification of installation. Depending on the coating procedure and the individual case, this can involve the following advantages:

- Better separation
- Easier installation
- Anti-adhesive effect
- Reduction of frictional resistance
- Reduction of breakaway torques
- Improvement of lubricating characteristics
- Stick-slip reduction
- Simplification of automatic assembly

"Labs-free" O-rings

"Labs-free" O-rings means these O-rings are free of substances causing paint cross-linking malfunctions. Such O-rings are particularly suitable in compressed-air systems used in industrial painting engineering, about all in the automotive supplier industry. Elastomers may contain substances causing paint cross-linking to malfunction. Impairing substances then can be released into the air or by contact of elastomers, can get on the surface to be painted and there cause craters on the painted surface. This is why O-rings provided for this purpose are subject to special treatment to ensure they are free of such interfering substances.

*O-ring surface
treatment
to the installation
simplification*



Coating treatments and their typical applications

Designation	Type of coating	Coating purpose
PTFE-ME	Anti-adhesion coating (PTFE transparent)	Installation simplification
PTFE-FDA	Anti-adhesion coating (PTFE milky-white)	Mounting aid
PTFE-transparent	Anti-adhesion coating (PTFE transparent)	Limited dynamic use
PTFE-black	Anti-adhesion coating (PTFE black)	Dynamic use
PTFE-grey	Anti-adhesion coating (PTFE grey)	Dynamic use
PTFE-coloured	Coloured anti-adhesion coating	Coloured coding
Polysiloxane	Silicone resin	Mounting aid
Siliconisation	Silicone oil	Installation simplification
Talcum coating	Talcum powder	Installation simplification
Molycoting	MoS ₂ -powder	Installation simplification
Graphiting	Graphite powder	Installation simplification