C. OTTO GEHRCKENS
SEAL TECHNOLOGY

Elastomer seals

for industrial applications

COG.de/en

For our customers' advantage

The world's largest O-ring warehouse

COG is your independent manufacturer and leading supplier of precision O-rings and elastomer seals. As an owner-managed family business now in its fifth generation, we draw on more than 150 years' expertise. Because only with in-depth knowledge of the subject can we respond to our customers' complex requirements – and satisfy you with our solutions.

Our dialogue with you forms our central focus. Your wishes and challenges provide our impetus. At the same time, our experience in the development and manufacture of materials forms the basis for being able to offer you proven products in dependable high quality – And at the same time to notch up innovations that set new standards for your sector.

More than 270 employees are committed to this objective, monitoring the market and tackling relevant topics, in order to be able to rapidly react to new challenges with solutions-based approaches. In addition, delivery capability and flexibility are of highest importance. We serve our customers from the world's largest O-ring warehouse. The manufacture of the smallest series also forms part of our service, in order to realise the perfect product for your requirements.

There's always lots involved. We will assist in your success. And delight you with our unparalleled expertise.

Jan Metzger
Managing Director

Ingo Metzger
Managing Director

Please visit our website ***www.cog.de/en*** *for more information or contact our sealing experts directly.*

COG at a glance

- Founded in 1867 in Pinneberg, near Hamburg
- Independent family business employing over 270 staff
- Supplier and independent manufacturer of O-rings and precision seals
- World's largest O-ring warehouse (over 45,000 items kept in stock for immediate delivery)
- State of the art logistics centre for maximum delivery capability
- Tools available for over 23,000 different O-ring dimensions
- Close cooperation with leading manufacturers of raw materials
- Approvals/certifications for a wide variety of materials, including among others DVGW, NORSOK Standard M-710, ISO 23936-2, BAM, FDA, USP, 3-A Sanitary Standard, BfR, Elastomer Guideline, NSF/ANSI and many more
- Our own mixing and compound development facilities
- Our own toolshop
- COG's technology centre for material development
- Quality management to DIN EN ISO 9001
- Environmental management to DIN EN ISO 14001
- Climate-neutral business operations according to PRIMAKLIMA

Sustainability plays an important role at COG:
For many years we have been working successfully on minimizing the environmental impact and were one of the first companies in the industry to receive the "climate-neutral business operation" certification in 2020.

Content

Highest demands on modern seals

Due to the continuous improvement of the manufacturing processes regarding effectiveness and efficiency the demands on elastomer seals are also constantly increasing. The demands however differ greatly depending on the utilisation, the application area as well as the industry.

Standards overview for industrial applications

In many applications different standards apply for the materials used. This can also apply to elastomer sealings. In such cases certificates for the employed materials in those fields are indispensable.

Release/Test certificate/Regulation	Application	Criteria/Standards	Appropriate COG material
Recommendation made by Germany's Bundesanstalt für Materialforschung und -prüfung (BAM) (Federal Institute for Material Research and Testing)	Seals for oxygen armatures and different parts of oxygen plant	Regulation B 7 'oxygen' of the professional association for chemical industry	Vi 376, Vi 564, Vi 576, Vi 780 (applies for plants for gaseous oxygen)
DVGW release for gas (German Association for Gas and Water)	Sealing material made of elastomers for gas appliance and gas plants	DIN EN 549	HNBR 702, P 549, Vi 549, P 550, Vi 569, P 582
DVGW release for gas (German Association for Gas and Water)	Sealing material made of elastomers for gas supply lines and gas pipelines	DIN EN 682	P 550, P 682, Vi 569, Vi 840

Even within a precisely determined industrial sector it is not uncommon to have various definitions of requirements for the sealings. Only high-quality and precisely processed materials can meet the many individual requirements. Due to the decades of experience, our exquisite knowledge of the industry and last but not least our extraordinary customer relations, we at COG master that challenge. And on more than one occasion we have been able to pleasantly surprise our customers with new sealing solutions.

Standards for precision O-rings: ISO 3601

The basic prerequisite for our premium products is a continuously high quality in both the choice of materials as well as the manufacturing of the final products. COG exclusively produces and sells precision O-rings abiding by the standard ISO 3601, which defines the geometric requirements, dimensions and tolerances.

Selecting the correct material

Especially with regard to critical components in machine construction, such as for example the seals, the question of which material to use is often the first that must be addressed. To be on the safe side, developers must often choose an extremely high quality material for the initial installation, for example FFKM. This material demonstrates outstanding resistance to most media – even in the high temperature range – and its physical properties guarantee optimum sealing performance.

However, the cost of this material is usually higher than planned, which in certain circumstances can lead to the price of the end product not being competitive. Precise tests are therefore essential when selecting the material, in order to provide the optimum sealing solution for the respective application.

Ask us!

For a competent consultation you are welcome to contact our application technology department and harness our know-how.
Email: applicationtechnology@cog.de

Four requirements profiles must be examined before selecting the material:

1. Operating temperature:
At what temperature range will the seal be used in? How high are the minimum and maximum temperatures? Are these temporary peaks or will the seals be continuously exposed to these temperatures?

2. Chemical resistance:
Which media must the seal be resistant against yet seal perfectly? Will there be interactions, such as for example use in both acids and alkalis? Will oils or grease be used when fitting?

3. Mechanical properties:
How will the seal be used? Will this be an inactive, stationary seal or will it be active and dynamic? For dynamic seals: How great is the mechanical stress? How often will the seal be moved? Seldom, regularly or continuously?

4. Approvals:
Which regulations and approvals apply to the respective production process, which must therefore apply to the seal materials used?

The type of seal is decisive

As well as selecting the correct material, questions relating to the very best type of seal, such as its construction, geometry, seal size or design of the groove can also be decisive factors. If you do not have precise specifications for your project, or should any other questions occur, our application technology department would be delighted to provide you with comprehensive expert advice!

Resistant to highest demands

Developers, engineers and users often encounter difficulties when a technical equipment or machine comes into contact with especially aggressive media. Often enough this damages the more sensitive parts, such as e. g. the elastomer seals, resulting in shorter maintenance intervals, unplanned machine shutdowns or in the worst case even leakages, which may lead to production stop. COG has designed various different materials for use in aggressive environments and can fulfil the most diverse requirements with their large product range.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FKM	BF 750	75 Shore A	black	from -15 °C to +200 °C	high resistance to biogenic media
	Vi 250	75 Shore A	black	from -25 °C to +250 °C	heat resistant to +250 °C
	Vi 480	80 Shore A	black	from -15 °C to +200 °C	high resistance to hot water and vapour
	Vi 840	80 Shore A	black	from -46 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2, standards-compliant to DIN EN 14141 and API 6A & 6D, NACE TM0187
	Vi 970	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 970, GF	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance
FEPM	Vi 982	75 Shore A	black	from -10 °C to +230 °C	high resistance to chemicals
	AF 275	75 Shore A	black	from -10 °C to +230 °C	Basic polymer Aflas®, high chemical resistance

Vi 982 (FEPM)

This Viton® Extreme-ETP sealing material is an interesting solution for users with very high demands. The Vi 982 compound is multi-purposely applicable due to its good physical and excellent mechanical properties. Moreover, the outstanding chemical resistance of fluoric rubber is improved further by the compound Vi 982. At the same time heat resistance and low-temperature flexibility persist.

- High quality FEPM compound
- Very good resistance to chemicals
- Excellent mechanical values
- Excellent ageing resistance
- Good heat resistance and low-temperature flexibility
- Outstanding resistance to hot water and vapour
- Very good resistance to acids, bases, complex solvent mixtures, amine-containing additives and corrosion inhibitors
- Extremely multi-purposely applicable, e. g. in the chemical and lacquer industry

BF 750 (FKM)

This high performance material has been specially designed for use with aggressive media, and tests have proven its outstanding chemical resistance under extreme conditions. Even after contact with nitric acid, sodium hydroxide or biogenic media, only the very slightest changes could be determined, all of which lie within all tolerance values. With a wide operating temperature range and the best mechanical properties, BF 750 is versatile in its possible uses and, compared to FFKM compounds, is also convincing in terms of costs.

- Multi-purposely applicable all-rounder
- Excellent properties when in use with biogenic and conventional fuels
- Excellent resistance to chemicals
- Good solvent resistance
- Very good resistance to vapour
- Low compression set
- High mechanical properties

Special-compounds from COG

COG has designed various different materials for use in aggressive environments and can fulfil the most diverse requirements with their large product range.

Vi 840 (FKM)

This FKM compound, with its low temperature flexibility, is perfectly suited to the wide range of applications in the valve industry. The material complies with all industry-relevant standards such as DVGW DIN EN 682, NACE TM0187 and its low temperature resistance down to -46 °C means it complies with DIN EN 14141 and the API 6A and 6D norms. Its other certifications and approvals include NORSOK Standard M-710 and ISO 23936-2, which means the material can also be used in applications in the oil and gas sector.

- Excellent material for the valve, oil and gas industry
- Extremely broad operating temperature range from -46 °C to +200 °C
- Outstanding low temperature stability: TR-10 value: -40 °C
- Excellent low temperature compression set
- Excellent media resistance
- High chemical resistance
- Low gas permeability

Vi 250 (FKM)

With an operating temperature range of up to +250 °C, the FKM material Vi 250 has been specially developed to be ideal for applications demonstrating constant high temperatures, such as for example in plant construction and engineering, with a focus on compressor and compactor technology. Thanks to its extremely specific polymer structure, this top compound also reliably withstands the medium air at this temperature, even in continuous use.

- Constant high temperature resistance up to +250 °C in the medium air
- Low temperature flexibility to -25 °C
- Excellent media resistance
- High resistance to oils, fats, fuels and solvents
- Excellent chemical resistance
- Low gas permeability

Highclass all-rounder: COG Resist®

This material group is based on perfluorelastomers (FFKM/FFPM). These premium compounds have been designed for high-performance applications, special applications and also for very long periods of use where there is often no alternative material available: COG Resist® is extremely resistant, even with changing media.

This is especially important in applications where a single seal is exposed to various different chemicals. In such applications, the extreme operating temperatures, which range from extremely cold to extraordinarily hot, often place the greatest demands on the seals used.

COG Resist® RS 75 AL

This all-rounder material for the widest variety of applications impresses with its outstanding temperature resistance combined with excellent resistance to chemicals and acids and superb mechanical properties. This high-performance elastomer is also resistant to vapour and hot amines, and is ideal for use in vacuum applications.

- Heat resistant to +325 °C
- Outstanding chemical resistance
- Good mechanical properties
- Highly resistant to vapour
- High thermal expansion coefficient
- Excellent behaviour in vacuums

Advantages of COG Resist®

- *The highest chemical resistance of all the flexible seal materials*
- *Stable at high temperatures of up to +325 °C, depending on type used*
- *Low compression set*
- *Excellent vacuum behaviour*
- *Flexible in its application*
- *Suitable materials for the widest variety of requirements*
- *Large number of certifications*
- *Ring diameters of up to 2,000 mm possible*

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FFKM	COG Resist® RS 75 AL	76 Shore A	black	from -15 °C to +325 °C	excellent chemical resistance, good mechanical properties, highest thermal load capacity
	COG Resist® RS 80 AL	79 Shore A	black	from -15 °C to +260 °C	excellent chemical resistance, good mechanical properties

Further FFKM compounds can be found on page 10/11.

COG Resist® RS 80 AL

This high performance FFKM material demonstrates excellent resistance to acids, amines and media containing chlorine and solvents. It is heat resistant up to +260 °C and has excellent mechanical properties. What's more, its range of applications is correspondingly broad: whether in pressure tanks or diesel engines, couplings or valves – COG Resist® RS 80 AL demonstrates the necessary resistances.

- Heat resistant to +260 °C
- Excellent chemical resistance
- Outstanding mechanical properties
- High coefficient of thermal expansion
- Can be used universally in the chemical industry and also in refineries

COG Resist® – Performance that pays for itself

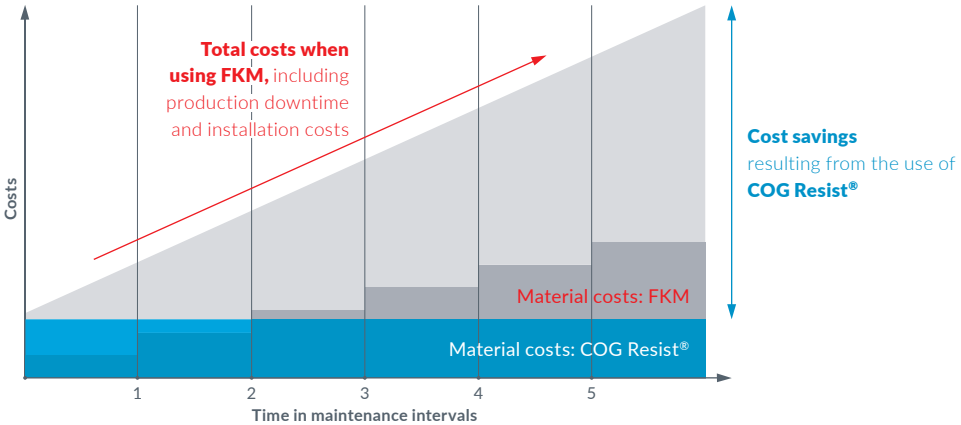
Not only quality assurance is paramount, but also the efficiency of the processes which make up the production flows. An important requirement for this is that production systems are in perfect technical condition, and therefore work flawlessly. In applications which make maximum demands of the seals used in them, the decision to choose the high-performance material COG Resist® therefore doubly pays off.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FFKM	COG Resist® RS 92 AED	92 Shore A	black	from -15 °C to +260 °C	NORSOK M-710 (Annex B), NACE TM0297
	COG Resist® RS 175 AL	75 Shore A	black	from -15 °C to +230 °C	excellent chemical resistance

Further FFKM compounds can be found on page 8/9.

A one-off investment with long-term cost savings

The COG Resist® compound's initially higher material costs balance themselves out in use, thanks to the material's extreme durability and high levels of resistance. Less suitable types of elastomer seals need to be replaced after just a short time in use, resulting in not only material and installation costs, but also expensive production downtime. An optimally adapted COG Resist® seal, on the other hand, extends the maintenance interval and therefore plays an important role in keeping costs down.



Ask us!

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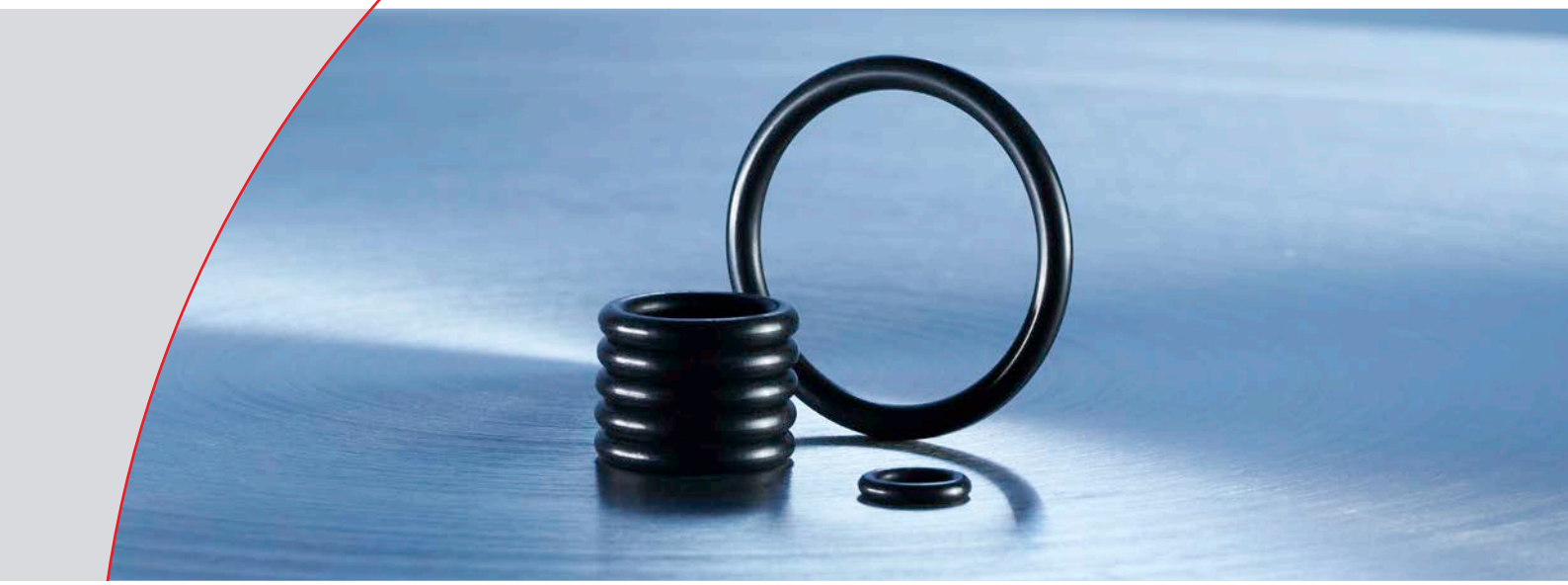


COG Resist® RS 92 AED

The COG Resist® RS 92 AED material is high tech: it was especially developed and tested for use in environments where explosive decompression can occur. Wherever seal materials are exposed to high pressure and aggressive media, COG Resist® RS 92 AED provides the security you need. Because the compound combines extraordinary chemical resistance with excellent thermal resistance. These high-end properties, along with its low compression set, make it the number one choice for deep seavalves, pumps and compressor construction. In short, a material that satisfies the very highest demands.

- Excellent resistance to explosive decompression
- Tested to NORSOK standard M-710 (Annex B) and NACE TM 0297
- Operating temperature range from -15 °C to +260 °C
- Excellent chemical and thermal resistance
- Extraordinary resistance to methanol, hot water, vapour and oils
- High chemical resistance
- Very good compression set

COG Resist® RS 175 AL

As an attractively priced starter FFKM, COG Resist® RS 175 AL is suitable for series production of medium and large batch sizes. With excellent chemical resistance combined with extraordinary mechanical properties and excellent performance in vacuums, COG Resist® RS 175 AL proves its worth as a versatile high-performance material. This FFKM compound is universally used in the widest range of industrial systems, including in valves, pumps, valve fittings, diesel motors and pressure tanks, among other items.

- Excellent chemical resistance
- Outstanding mechanical properties
- Operating temperature range from -15 °C to +230 °C
- High thermal expansion coefficient
- Excellent behaviour in vacuums
- Suitable for medium and large batch sizes

Materials for high temperature applications

In many areas, seals must be resistant even at very high temperatures more than +200 °C, e. g. when used in industrial furnaces, emission control systems or combined heat and power plants. For safety reasons too, it is absolutely essential that the material used is the perfect match for the respective requirements. For this reason, COG stocks a comprehensive range of high-performance compounds.

Operating temperature is not the same as maximum temperature

The specified operating temperature ranges are always based on constant temperatures. In peaks, significantly higher temperatures can therefore also be reached. For more information and if you have specific enquiries, please contact us directly –
email: applicationtechnology@cog.de

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FEPM	**AF 275**	75 Shore A	black	from -10 °C to +230 °C	Basic polymer Aflas®, high chemical resistance
FFKM	**COG Resist® RS 75 AL**	76 Shore A	black	from -15 °C to +325 °C	excellent chemical resistance, good mechanical properties, highest thermal load capacity
	COG Resist® RS 80 AL	79 Shore A	black	from -15 °C to +260 °C	excellent chemical resistance, good mechanical properties
	COG Resist® RS 92 AED	92 Shore A	black	from -15 °C to +260 °C	high resistance to explosive decompression, NORSOK M-710 (Annex B), NACE TM 0297
FKM	**Vi 250**	75 Shore A	black	from -25 °C to +250 °C	heat resistant to +250 °C
	Vi 564	72 Shore A	black	from -15 °C to +230 °C	use to +230 °C, BAM tested (when used with gaseous oxygen, max. application until 150 °C/2 bar)
	Vi 899	90 Shore A	black	from -46 °C to +210 °C	NORSOK M 710 (Annex B), API 6A & 6D, excellent low-temperature flexibility,
	Vi 990	90 Shore A	black	from -46 °C to +230 °C	AED/RGD compatible

PFA and PTFE materials can be found on page 34/35.

The special compounds for applications in extremely hot environments all demonstrate especially high thermal resistance. At the same time, they also include ideally tailored expert materials for use in the widest range of applications, and which possess specific material properties in respect of chemical and mechanical resistance. You will also find among them NORSOK-approved materials and specialist materials for use in the semiconductor industry.

Experts for maxium safety for low temperatures

Sealing materials used in cold environments need to meet special requirements. Even in these conditions the seals used must possess the necessary flexibility in order to seal properly.

For customized elastomer solutions, COG offers a wide range of low temperature specialists from different material groups.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
EPDM	AP 300	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, excellent resistance to ageing
	AP 370	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, excellent resistance to ageing
	AP 490	90 Shore A	black	from -50 °C to +140 °C	excellent resistance to hot water and vapour, good low temperature flexibility
FKM	LT 170	70 Shore A	red	from -50 °C to +200 °C	excellent chemical resistance, outstanding resistance to ageing, excellent low temperature flexibility
	Vi 100,S	70 Shore A	black	from -30 °C to +200 °C	good chemical resistance
	Vi 110, S	80 Shore A	black	from -30 °C to +200 °C	good chemical resistance
	Vi 120, S	90 Shore A	black	from -40 °C to +200 °C	outstanding chemical resistance
	Vi 170	90 Shore A	black	from -50 °C to +200 °C	ECE-R 110, Annex 5D, 5F, 5G
	Vi 175	75 Shore A	black	from -35 °C to +200 °C	good temperature flexibility
	Vi 840	80 Shore A	black	from -46 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2, standards-compliant to DIN EN 14141 and API 6A & 6D, NACE TM0187
	Vi 899	90 Shore A	black	from -46 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, meets API 6A & 6D standards, outstanding low temperature flexibility
	Vi 900	90 Shore A	black	from -55 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, ISO 23936-2
FVMQ	Si 771, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 971, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent cold temperature flexibility and chemical resistance
NBR	P 583, RF	70 Shore A	black	from -30 °C to +120 °C	good resistance to oil and fat, good mechanical properties
	P 584, RF	70 Shore A	black	from -50 °C to +120 °C	good resistance to oil and fat, good mechanical properties
	P 700	70 Shore A	black	from -46 °C to +120 °C	good resistance to oil and fat, good mechanical properties
	P 780, RF	80 Shore A	black	from -60 °C to +120 °C	good resistance to oil and fat, good mechanical properties
VMQ	*Silicone compounds can be found on page 28/29.*				excellent low temperature flexibility to -60 °C
PTFE	*PTFE compounds can be found on page 35.*				excellent low temperature flexibility to -180 °C
FEP/VMQ	*FEP/VMQ compounds can be found on page 35.*				excellent low temperature flexibility to -60 °C
PFA/VMQ	*PFA/VMQ compounds can be found on page 35.*				excellent low temperature flexibility to -60 °C

Clarity for low temperatures

When it comes to low temperature flexibility, in practice, users are confronted with various definitions. This makes it difficult to compare materials from different manufacturers. There are various different test procedures for characterising behaviour in cold temperatures, which usually lead to different measurement results. This makes it important to choose a test procedure whose results provide a clear statement on a seal type's operational performance. Unless expressly stated otherwise, COG's material specifications use the 'TR-10 value', which describes a material's behaviour at low temperatures, enabling it to be easily compared with others. In certain applications, some materials can also be used significantly below this value. The TR-10 value forms the dependable basis of our temperature specifications, enabling us to provide users with clear and reliable statements in this regard.

The TR-10 value – a short explanation

The so-called TR-10 value, in accordance with ASTM D 1329/ISO 2911, is determined by a test which establishes the temperature at which an elastomer elongated by 25 % or 50 % recovers its original shape by 10 % after being frozen. The TR-10 value is therefore the most meaningful benchmark for assessing the low temperature flexibility of elastomer seals.

Experts in contact with gases and oxygen

Sealing materials for gas and/or oxygen applications must meet special requirements. In Germany as well as other countries release certificates or certificates of approval are required. COG offers a range of materials which were especially designed for the use in those applications.

AU

- Basic elastomer: Polyester urethane rubber
- Good mechanical properties
- Very good resilience
- High gas density
- Good resistance to fuels and many technically common oils, especially to oils with higher aromatic content
- Good low-temperature flexibility
- Excellent oxygen and ozone resistance

FKM

- Basic elastomer: Fluoroelastomer rubber
- Bisphenol crosslinked or peroxide crosslinked
- Very good media resistance
- Any kind of hydrocarbons (oils, fats, solvents)
- High chemical resistance
- Good hydrolysis resistance

BAM and DVGW

For comparable safety standards in applications with gas or oxygen, the materials used in Germany are tested and approved primarily by the Federal Institute for Materials Research and Testing (BAM) and the German Technical and Scientific Association for Gas and Water.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
AU	PU 50	75 Shore A	black	from -30 °C to +125 °C	excellent oxygen and ozone resistance
	PU 460	90 Shore A	black	from -30 °C to +125 °C	excellent oxygen and ozone resistance
FKM	Vi 376	75 Shore A	black	from -15 °C to +200 °C	BAM-tested
	Vi 564	72 Shore A	black	from -15 °C to +230 °C	BAM-tested (for applications in gaseous oxygen; max 150 °C/2 bar)
	Vi 569	80 Shore A	black	from -15 °C to +200 °C	DVGW DIN EN 682 – GB and DIN EN 549 – H3/E1
	Vi 576	80 Shore A	black	from -15 °C to +200 °C	BAM-tested (for applications in gaseous oxygen; max 150 °C/25 bar)
	Vi 840	80 Shore A	black	from -55 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2
HNBR	HNBR 702	70 Shore A	black	from -25 °C to +150 °C	DVGW DIN EN 549 – H3/C1
NBR	P 549	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 549 – H3/B2
	P 550	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 – GBL and DIN EN 549 – H3/B1
	P 682	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 – GBL

HNBR

- Basic elastomer: Hydrated nitrile butadiene rubber
- Peroxidically cross-linked
- High resistance to additive containing mineral oils
- Low gas and vapour permeability
- Good ozone resistance

NBR

- Basic elastomer: Acrylnitrile butadiene rubber
- Sulphur cross-linked
- Good mechanical properties
- Good resistance to oil and fat
- Good physical values, e.g. high abrasion and stability

Powerful against explosive decompression

Many manufacturers and operators in the oil and gas industries as well as in the compressor manufacturing business and in compressed air conditioning have difficulties with explosive decompression and its consequences. This phenomenon is known as “explosive decompression” and poses a major challenge in sealing technology. High-performance seals are an absolute must for the safety of people, the environment and the system.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
HNBR	**HNBR 899**	90 Shore A	black	from -20 °C to +150 °C	NORSOK M-710 (Annex B)
FFKM	**COG Resist® RS 92 AED**	92 Shore A	black	from -15 °C to +260 °C	NORSOK M-710 (Annex B), NACE TM0297
FKM	**Vi 840**	80 Shore A	black	from -46 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2, standards-compliant to DIN EN 14141 and API 6A & 6D
	Vi 890	90 Shore A	black	from -20 °C to +200 °C	NORSOK M-710 (Annex B) and NACE TM0187, suitable for endless vulcanisation
	Vi 899	90 Shore A	black	from -46 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, meets API 6A & 6D standards, outstanding low temperature flexibility
	Vi 900	90 Shore A	black	from -55 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, ISO 23936-2
	Vi 990	90 Shore A	black	from -46 °C to +230 °C	AED/RGD-compatible

Special materials for extreme pressure changes

For the high demands on elastomer seals against explosive decompression (AED/Anti Explosive Decompression) COG offers with various tested compounds a wide range of AED products which were especially developed for use in this sector. All compounds have been tested successfully according to the NORSOK Standard M-710 – the leading international standard for this field of application and renowned for safety for applications where explosive decompression may occur. These materials have already successfully prevented O-rings used in natural gas production of being damaged by explosive decompression, there fore also avoiding expensive leaks.

HNBR AED-materials

The **HNBR 899** has passed the NORSOK test with the top mark of ‘0000’ impressively demonstrating its suitability for applications with explosive decompression. Thanks to its high chemical resistance, for instance to mineral oils containing additives and to oil and fat, combined with its low levels of gas and vapour permeability, this special material from COG offers excellent performance in numerous applications in the widest variety of industrial sectors.

NORSOK

*The NORSOK Standard M-710 was developed by the Norwegian oil and gas industry and is a test method for the resistance of sealing material to **explosive decompression**. Another part of the test is the examination of the effects of sour gas on the polymer.*

FFKM AED materials

With **COG Resist® RS 92 AED**, COG offers a high-performance, top-class FFKM compound for use in applications involving explosive decompression. As an FFKM material, the compound demonstrates the very highest chemical resistance of all sealing materials. **COG Resist® RS 92 AED** has been tested to both NORSOK Standard M-710 (Annex B) and NACE TM 0297 (explosive decompression). This high-tech material also possesses excellent heat resistance, and can be used wherever seal materials come into contact with high pressure and/or aggressive media.

FKM AED materials

Several of COG's FKM materials are suitable for use with gases, also performing strongly where there are sudden releases of pressure. The FKM compound **Vi 890** is one of the most proven top-performing products in this category, receiving the outstanding NORSOK '1100' rating. For extreme challenges in the oil and natural gas industry, there is also the high-performance **Vi 900** compound, which successfully passed the NORSOK test to Standard M-710 with the top mark '0000', as well as having been tested according to NACE TM0187 and ISO 23936-2. The special FKM **Vi 899** can be used at temperatures to -46 °C and in valves and valve fittings where the API 6A and 6D standards apply. We also have available a selection of additional materials to meet the special requirements of the valves and valve fittings industry.

Elastomer seals in vaccum technology

When O-rings are used in vacuum applications, special requirements apply. Maximum sealing performance is required, in order to maintain the vacuum and prevent air flowing in.

Therefore, only materials with the lowest possible gas permeability must be used, and which have been optimally selected for their respective environment.

We are happy to advise you!

There are many aspects to consider when choosing the right material, especially in vacuum technology. Therefore, please contact our application technology department and harness our know-how!

Email: applicationtechnology@cog.de

Proven and effective

Our customers can choose from variety of tried and tested materials for applications in vacuum technology. Due to their low gas permeability in combination with good temperature, aging and chemical resistance, FKM materials are particularly suitable for vacuum applications.

For O-rings with large inside diameter (min. 1,400 mm) we recommend the endless vulcanisation process (see p. 32). Our experienced engineers from the application technology department will gladly assist you in choosing the ideal material for your purposes.

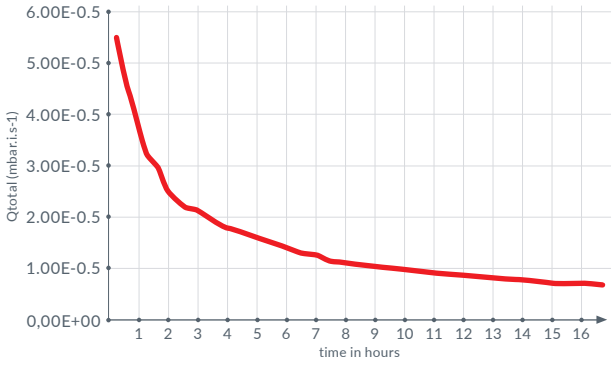
ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FKM	Vi 370	70 Shore A	black	from -20 °C to +200 °C	low gas permeability
	Vi 400	65 Shore A	black brown	from -15 °C to +200 °C	good chemical resistance
	Vi 455	55 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 460	60 Shore A	black	from -25 °C to +200 °C	good chemical resistance
	Vi 500	80 Shore A	black	from -15 °C to +200 °C	suitable for endless vulcanisation
	Vi 564	70 Shore A	black	from -15 °C to +230 °C	can be used up to +230 °C, BAM-tested
	Vi 580	80 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 580, G	80 Shore A	green	from -15 °C to +200 °C	good chemical resistance
	Vi 580, R	80 Shore A	red	from -15 °C to +200 °C	good chemical resistance
FFKM	COG Resist® RS 75 AL	76 Shore A	black	from -15 °C to +325 °C	outstanding chemical resistance, heat resistant to +325 °C

Outgassing with elastomer seals

In general every material emits gas, no matter what the ambient pressure. However the emission rate generally increases as the ambient pressure is reduced. The highest emission occurs in a vacuum, there fore the lower the emission, the better the material is suited for applications in vacuum technology. Sealing materials applied in this field must meet exceptionally high demands. Our customers can choose from variety of tried and tested materials for applications in vacuum technology.

Outgassing of an FFKM

at room temperature using RGA measurement



Hydrogen technology sealed for the future

As a versatile energy source Hydrogen is central and provides new possibilities as a chemical raw material for production processes. All over the world, experts from science and business are researching the extensive field of hydrogen technologies refining their practical application. Among the most important factors for success are perfectly compatible components, whereby in particular the seals are of utmost importance for proper functioning.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
EPDM	**AP 208**	70 Shore A	blue	from -55 °C to +140 °C	good hydrogen permeation coefficient, H_2 Sealing-tested
FKM	**Vi 208**	80 Shore A	blue	from -10 °C to +200 °C	good hydrogen permeation coefficient, H_2 Sealing-tested

Permeability professionally certified

The H_2 gas permeability was measured in a rising pressure method based on DIN 53380. The hydrogen permeation coefficient was determined for three specimens each of AP 208 and Vi 208. The material sample thickness was determined at ten different points on the sample and then, in accordance with DIN 53380, was specified as the arithmetic mean of the individual measurements carried out.

H_2 permeation at 23 °C/pressure 5 bar	AP 208	Vi 208
T/°C	23,0	23,0
Δp/bar	1,0	1,0
P coefficient/Ncm^3 mm m^{-2} day^{-1} bar^{-1}	1317	281

Ncm^3: standardised volume at 237,15 K and 1,01325 bar
Δp: partial pressure differential

Highest demands on seals

Hydrogen is used as a colourless, odourless gas which easily evaporates and is extremely flammable. For this reason, H_2 applications present seals with an enormous challenge on safety grounds. Hydrogen production using electrolysis is a complex and energyintensive process. For financial reasons, losses from H_2 evaporation should be prevented at any cost. The lowest possible H_2 permeability is the central requirement of the materials used in these applications.

COG has designed the high-performance H_2 range of materials to be used in the widest range of applications involving hydrogen.

As experienced sealing experts, COG can draw on its strong expertise when developing tailor-made solutions for H_2 applications. For maximum dependability, these special materials exhibit especially low levels of hydrogen permeability, which has been certified in extensive series of tests.

H_2 Sealing

AP 208 (EPDM)

Robust, long-lasting and flexible at low temperatures – this AP 208 material, developed specially for H_2 applications, combines the properties of EPDM with hydrogen impermeability that is above average in its class. This blue compound also performs well with a compression set of < 15 % and an operating temperature of right down to -55 °C.

- H_2 Sealing-tested
- Good hydrogen permeation coefficient
- Peroxidically cross-linked
- Operating temperature from -55 °C to +140 °C
- Very low compression set: < 15 %

Vi 208 (FKM)

This blue material Vi 208 offers the wide range of uses of an FKM in combination with an excellent H_2 impermeability that goes far beyond the normal level expected from a conventional FKM. Good resistance to chemicals and an operating temperature range of -10 to +200 °C make Vi 208 a powerful all-rounder for H_2 applications.

- H_2 Sealing-tested
- Very good hydrogen permeation coefficient
- Excellent resistance to chemicals
- Operating temperature from -10 °C to +200 °C
- Low compression set < 15 %

Reliability under the toughest conditions

High resistance to the widest variety of media and chemicals, a broad operating temperature range or good temperature flexibility too –

COG offers a wide range of high-performance materials containing fluorine, in order to meet the most demanding challenges.

FEPM

Ideally suited for use in industrial applications where especially aggressive chemicals demand outstanding resistance.

- Basic elastomer: Viton® Extreme-ETP or Aflas®
- Peroxidically cross-linked
- Applicable in temperatures: -10 °C to +230 °C, depending on the type
- Very good resistance to acids, bases, ammonia, H_2S gases or Amine-containing additives and corrosion inhibitors, alloyed motor and gear oils, brake fluids, etc.
- Very high resistance to hot water and vapour
- High resistance to chemicals

*More information about **FFKM-materials** can be found on **pages 8 – 11.***

FKM

Perfect for a wide range of uses in demanding industrial applications that require high levels of chemical resistance.

- Basic elastomer: Fluoroelastomer rubber
- Bisphenol or peroxidically cross-linked
- Very good media resistance
- Carbohydrates of all kinds (oils, fats, solvents)
- Low gas permeability
- Moderate resistance to vapour > +150 °C
- High resistance to chemicals

FVMQ

Well-suited for production processes that require a combination of good low temperature flexibility and high levels of chemical resistance.

- Basic elastomer: Fluorosilicone rubber
- Mostly peroxidically cross-linked
- Compared to silicone rubber an improved resistance against oils, fuels and solvents, especially when used in aromatic and chlorinated carbohydrates and alcohols, petrol and alcohol mixtures
- Resistance to aromatic und naphthenic oils and a number of chlorinated solvents

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FEPM	AF 275	75 Shore A	black	from -10 °C to +230 °C	Base polymer Aflas®, especially high chemical resistance
	Vi 982	75 Shore A	black	from -10 °C to +230 °C	high chemical resistance
FFKM	*COG Resist® materials can be found on pages 8 – 11.*				
FKM	BF 750	75 Shore A	black	from -15 °C to +200 °C	high resistance to biogenic media
	HF 875	75 Shore A	grey brown	from -15 °C to +200 °C	high chemical resistance
	LT 170	70 Shore A	red	from -50 °C to +200 °C	excellent low temperature flexibility
	Vi 100, S	70 Shore A	black	from -30 °C to +200 °C	good low temperature flexibility
	Vi 110, S	80 Shore A	black	from -30 °C to +200 °C	good low temperature flexibility
	Vi 120, S	90 Shore A	black	from -40 °C to +200 °C	outstanding chemical resistance
	Vi 170	90 Shore A	black	from -50 °C to +200 °C	ECE-R 110, Annex 5D, 5F, 5G
	Vi 175	75 Shore A	black	from -35 °C to +200 °C	good low temperature flexibility
	Vi 220	75 Shore A	blue	from -15 °C to +200 °C	suitable for cylinder liners
	Vi 370	70 Shore A	black	from -20 °C to +200 °C	good chemical resistance
	Vi 399	90 Shore A	black brown	from -15 °C to +200 °C	good chemical resistance
	Vi 400	65 Shore A	black brown	from -15 °C to +200 °C	good chemical resistance
	Vi 455	55 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 460	60 Shore A	black	from -25 °C to +200 °C	good chemical resistance
	Vi 480	80 Shore A	black	from -15 °C to +200 °C	good resistance to hot water and vapour
	Vi 500	80 Shore A	black	from -15 °C to +200 °C	suitable for endless vulcanisation
	Vi 549	70 Shore A	black	from -20 °C to +200 °C	high chemical resistance, DVGW DIN EN 549 – H3/E1, ADI-free
	Vi 564	72 Shore A	black	from -15 °C to +230 °C	BAM-tested (for applications in gaseous oxygen)
	Vi 569	80 Shore A	black	from -15 °C to +200 °C	DVGW DIN EN 682 – GB, DVGW DIN EN 549 – H3/E1
	Vi 576	80 Shore A	black	from -15 °C to +200 °C	BAM-tested (for applications in gaseous oxygen)
	Vi 580	80 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 580, G	80 Shore A	green	from -15 °C to +200 °C	good chemical resistance
	Vi 580, R	80 Shore A	red	from -15 °C to +200 °C	
	Vi 590	90 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 600	70 Shore A	green	from -15 °C to +200 °C	increased chemical resistance
	Vi 650	75 Shore A	green	from -15 °C to +200 °C	suitable for endless vulcanisation
	Vi 670	80 Shore A	green	from -15 °C to +200 °C	good chemical resistance
	Vi 675	75 Shore A	red	from -15 °C to +200 °C	good chemical resistance
	Vi 691	90 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 691, G	90 Shore A	green	from -15 °C to +200 °C	good chemical resistance
	Vi 700	90 Shore A	green	from -15 °C to +200 °C	good chemical resistance
	Vi 840	80 Shore A	black	from -55 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2, standards-compliant to DIN EN 14141 and API 6A & 6D, TM0187
	Vi 900	90 Shore A	black	from -55 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, ISO 23936-2
	Vi 965, GF	65 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 970	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 970, G	70 Shore A	green	from -20 °C to +200 °C	good chemical resistance
	Vi 970, GF	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance
	Vi 975	75 Shore A	black	from -20 °C to +200 °C	good chemical resistance
	Vi 975, G	75 Shore A	green	from -20 °C to +200 °C	good chemical resistance
FVMQ	Si 771, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 971, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent cold temperature flexibility and chemical resistance

High performance in use, proven in practice

In the food industry, in sanitary engineering, in the construction sector or in hydraulic applications, EPDM and EPM materials are used in all manner of ways. These materials are characterised by high resistance to wind and weather, hot water, water vapour and many acids.

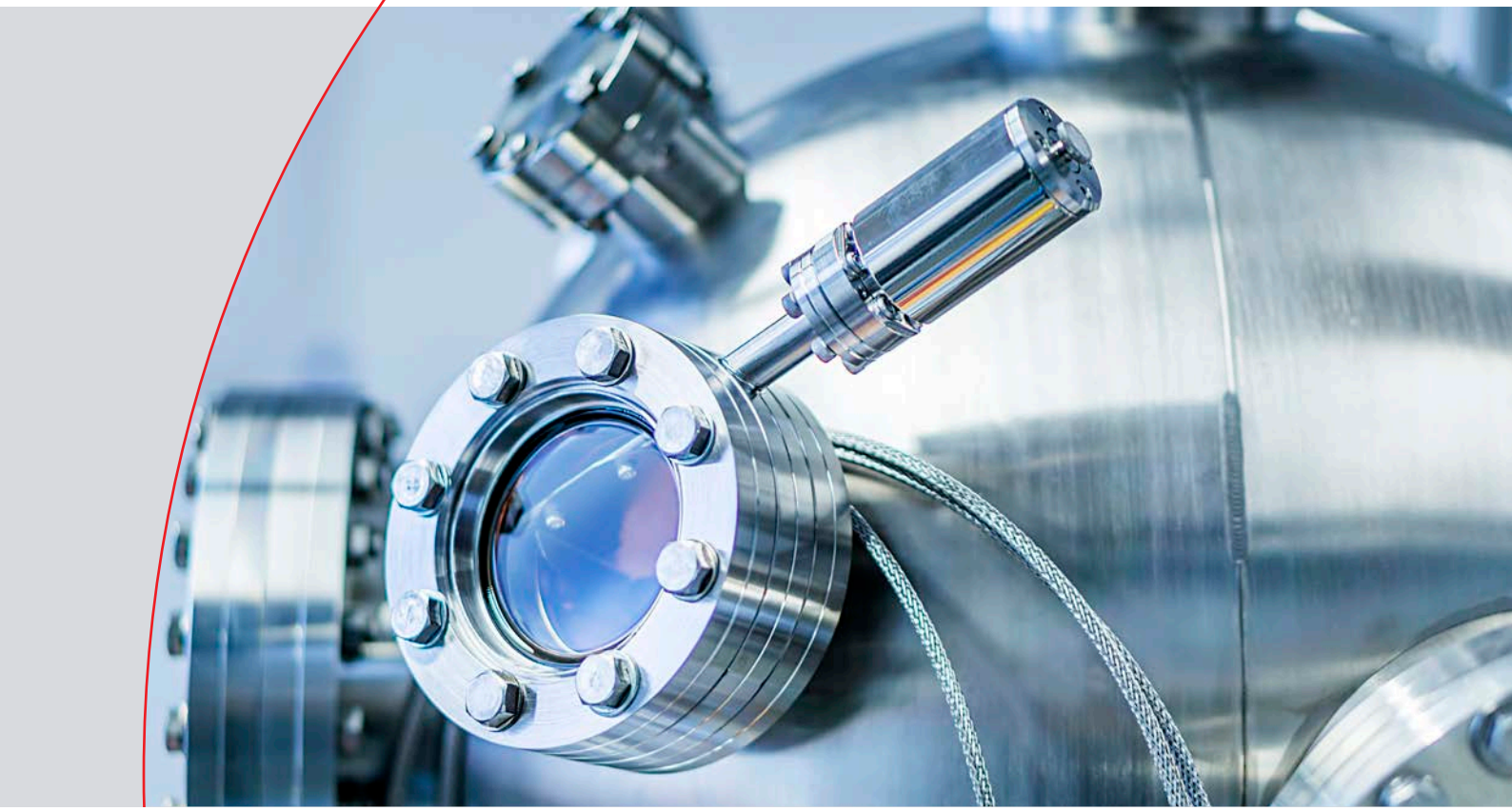
ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
EPDM	AP 208	70 Shore A	blue	from -55 °C to +140 °C	excellent hydrogen permeation coefficient, H_2 Sealing-tested
	AP 300	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 301	70 Shore A	violet	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 350	82 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 370	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 375, V	75 Shore A	violet	from -40 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 380	80 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 490	90 Shore A	black	from -50 °C to +140 °C	excellent resistance to hot water and vapour, good low temperature flexibility
	AP 540	70 Shore A	black	from -50 °C to +130 °C	sulphur-cured – can be used in dynamic applications
	AP 545	45 Shore A	black	from -45 °C to +140 °C	sulphur-cured – can be used in dynamic applications
	AP 550	50 Shore A	black	from -40 °C to +140 °C	sulphur-cured – can be used in dynamic applications
	AP 560	60 Shore A	black	from -40 °C to +130 °C	sulphur-cured – can be used in dynamic applications
EPM	EP 380	80 Shore A	black	from -35 °C to +180 °C	excellent resistance to hot water and vapour, good low temperature flexibility

Exceptionally robust in use

Their high resistance in particular makes EPDM materials a sought-after sealing material for a wide range of applications. At the same time, EPDM combines excellent resistance to hot water and water vapour and also many organic or inorganic acids and bases with extraordinary resistance to ageing. To ensure seals are perfectly suited to your specific requirements, COG offers numerous EPDM materials.

EPDM and EPM

The use of unconjugated dienes makes the difference between ethylene propylene rubber (EPM) and ethylene propylene diene monomer (EPDM), meaning EPDM can be vulcanised with sulphur. EPM materials, on the other hand, are solely peroxide-cured.



EPDM

Multi-purposely applicable, wherever high resistance to hot water and vapour is required.

- Basic elastomer: Ethylene propylene diene rubber
- Peroxidically or sulphur cross-linked
- Good resistance in watery media
- Good resistance in many CIP-media
- Good resistance to hot water and vapour
- Very good ageing and ozone resistance
- Good low-temperature flexibility
- Partially unresistant to vegetable and animal oils/fats

EPM

Multi-purposely applicable material, also very good capabilities for the food industry.

- Basic elastomer: Ethylene propylene rubber
- Peroxidically cross-linked
- Good resistance in watery media
- Good resistance to acids and bases
- Good resistance in many CIP-media
- Good resistance to hot water and vapour
- Partially unresistant to vegetable and animal oils/fats
- Very good ageing, UV and ozone resistance
- Good low-temperature flexibility

Dependability at a wide range of temperatures

Silicone O-rings are perfect for use in sealing components for wide temperature range applications. This versatile material withstands temperatures from -60 °C to +200 °C, therefore offering a range of possible uses in the widest variety of industrial areas and sectors. COG offers a wide range of silicone O-rings, in order to meet applications' specific requirements in optimum fashion.

Good to know!

The material silicone offers numerous practical benefits, however, it only demonstrates reduced mechanical properties. VMQ seals should therefore not be used in dynamic applications.

A specialist for cold environments

COG's VMQ materials are characterised by their outstanding low temperature flexibility, which enables them to be used in static sealing applications to -60 °C. They also demonstrate excellent resistance to ozone and UV, as well as good resistance to hot air, alcohols and animal and plant fats and oils.

A distinguishing feature of silicone materials is their high degree of purity. VMQ compounds are odourless and tasteless, meaning they are perfect for use in the food processing industry, amongothers.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
VMQ (Silicone)	Si 810, S	70 Shore A	black	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 850, B	50 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 850, R	50 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 850, TR	50 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 855, R	55 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 860, B	60 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 860, R	60 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 860, TR	60 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 865, TR	65 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 880, R	80 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 970, B	75 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 970, R	70 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility
	Si 970, TR	70 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility

VMQ

Ideally suited to static production processes with a wide operating temperature range, such as in food processing or the chemical industry.

- Basic elastomer: Silicone rubber
- Mostly peroxidically cross-linked
- Physiologically inert
- Limited mechanical properties
- Weakness in certain acid media
- Weakness in the SIP-process
- Very good low-temperature flexibility

Robust all-rounder for heavy use

Hydraulic and pneumatic applications represent complex industrial applications for seals. NBR and HNBR materials are ideally suited for these applications, as they combine good mechanical properties with dependable levels of resistance. COG offers a wide range of products for the varying requirements in these application areas.

CR

Multi-purposely applicable material for a variety of industrial areas.

- Basic elastomer: Chloroprene rubber
- Similar properties to NBR, yet slightly less resistant against acids, bases and media

NBR

Application areas: A material with a comprehensive range of possible uses in numerous sectors, including among others in pneumatic and hydraulic applications, or gas supply.

- Basic elastomer: Acrylnitrile butadiene rubber
- Sulphur and as exception peroxidically cross-linked
- Good mechanical properties
- Good resistance to oil and fat
- Weakness with water vapour

HNBR

A material with a comprehensive range of possible uses in the widest range of industrial applications, including among others in pneumatic and hydraulic applications.

- Basic elastomer: Hydrated nitrile butadiene rubber
- Peroxidically cross-linked
- High resistance to additive containing mineral oils
- Low gas and vapour permeability
- Good mechanical properties
- Good resistance to oil and fat

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
CR	Ne 471	70 Shore A	black	from -40 °C to +120 °C	good resistance to numerous coolants
	Ne 560	60 Shore A	black	from -30 °C to +120 °C	good resistance to numerous coolants
	Ne 560, R	60 Shore A	red	from -20 °C to +100 °C	good resistance to numerous coolants
	Ne 570	70 Shore A	black	from -30 °C to +120 °C	good resistance to numerous coolants
HNBR	HNBR 70	70 Shore A	black	from -25 °C to +150 °C	
	HNBR 580	80 Shore A	black	from -40 °C to +150 °C	
	HNBR 600	70 Shore A	black	from -20 °C to +150 °C	
	HNBR 702	70 Shore A	black	from -25 °C to +150 °C	DVGW DIN EN 549 - H3 / C1
	HNBR 899	90 Shore A	black	from -17 °C to +150 °C	NORSOK M-710 (Annex B)
NBR	P 370	85 Shore A	black	from -20 °C to +120 °C	
	P 427	90 Shore A	black	from -20 °C to +120 °C	
	P 430	45 Shore A	black	from -20 °C to +120 °C	
	P 431, A	75 Shore A	black	from -10 °C to +120 °C	
	P 465	65 Shore A	black	from -20 °C to +120 °C	suitable for endless vulcanisation
	P 520	70 Shore A	black	from -20 °C to +120 °C	Elastomer Guideline, CLP, NSF/ANSI Standard 61, WRAS BS 6920, DVGW W270
	P 549	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 549 - H3 / B2
	P 550	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 – GBL and DIN EN 549 – H3/B1
	P 574	55 Shore A	black	from -20 °C to +120 °C	
	P 583	70 Shore A	black	from -30 °C to +120 °C	
	P 583, RF	70 Shore A	black	from -30 °C to +120 °C	
	P 584, RF	70 Shore A	black	from -50 °C to +120 °C	excellent low temperature flexibility to -50 °C
	P 670	70 Shore A	black	from -20 °C to +120 °C	suitable for endless vulcanisation
	P 682	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 – GBL, suitable for endless vulcanisation
	P 700	70 Shore A	black	from -46 °C to +120 °C	excellent low temperature flexibility to -46 °C
	P740	40 Shore A	black	from -20 °C to +120 °C	
	P 745	45 Shore A	black	from -20 °C to +120 °C	
	P 750	50 Shore A	black	from -20 °C to +120 °C	
	P 755	55 Shore A	black	from -20 °C to +120 °C	
	P 760	60 Shore A	black	from -30 °C to +120 °C	
	P 775	75 Shore A	black	from -25 °C to +120 °C	
	P 780	80 Shore A	black	from -30 °C to +120 °C	
	P 780, RF	80 Shore A	black	from -60 °C to +120 °C	excellent low temperature flexibility to -60 °C
	P 790	90 Shore A	black	from -20 °C to +120 °C	
	P 990	90 Shore A	black	from -20 °C to +120 °C	

Endless top quality and all-round sealing solutions

At COG we employ a special production method to produce precision O-rings according to ISO 3601 with a length of up to 3,000 mm, variable cord sizes and qualities of material. In this special production method of 'endless vulcanisation' the vulcanisation process is carried out in a consistently even and thorough way.

Materials suitable for endless vulcanisation processes

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FKM	Vi 500	80 Shore A	black	from -15 °C to +200 °C	suited for the use in the vacuum technology
	Vi 569	80 Shore A	black	from -15 °C to +200 °C	DVGW DIN EN 682 - GB and DIN EN 549 - H3 / E1
	Vi 650	75 Shore A	green	from -15 °C to +200 °C	
	Vi 890	90 Shore A	black	from -20 °C to +210 °C	NORSOK M-710 (Annex B) and NACE TM0187
	Vi 899	90 Shore A	black	from -46 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, meets API 6A & 6D standards, outstanding low temperature flexibility
NBR	P 465	65 Shore A	black	from -20 °C to +120 °C	
	P 670	70 Shore A	black	from -20 °C to +120 °C	

Cord sizes: HNBR, FKM and NBR qualities in the cord sizes 5 to 12 mm, larger cord sizes possible in agreement.

Other Materials in EPDM, FKM, HNBR, NBR and VMQ available upon request.

Endless vulcanisation

O-rings produced this way match precision O-rings of smaller dimension according to ISO 3601 produced with conventional methods. Compared to the conventional methods of manufacturing special sized O-rings, such as O-rings with vulcanised or glued joints, this method keeps tolerances to a minimum and therefore grants very high precision. Its other big advantage over conventional methods is that, due the consistency of the vulcanisation the joints no longer bear a weakness. This provides a more durable seal of considerably higher quality in a variety of applications, e. g. also in high vacuum areas or in gaseous media.

Advantages of endless Vulcanisation

- Very tight dimension tolerances according to ISO 3601
- Evenly sized cords throughout the O-ring-perimeter
- Very good surface quality
- Low cost of tools compared to compression moulded O-rings
- Any chosen inside diameter from approx. 1,400 mm to 3,000 mm producible

Round cords for very different applications

Round cords are always a good alternative if the material subject to sealing is not too aggressive or under too high pressure. 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. Thanks to sufficient resistance and elasticity in the sealing application the high-performance glues provide for a good material behaviour. COG currently offers EPDM, FKM, NBR and VMQ materials with different cord sizes in the product line for round cords.

Endless vulcanisation

Round cords

Worth knowing about round cords

Glued O-rings are extruded cords whose cord ends are glued together at the straight butt. The disadvantage here is that the adhesive may possibly harden under the influence of heat and the round cord loses its elasticity. For round cords larger tolerances are allowed. The round cords offered by COG are manufactured according to DIN standard 3302 part 1 E2. Round cords are often not suitable for demanding applications.

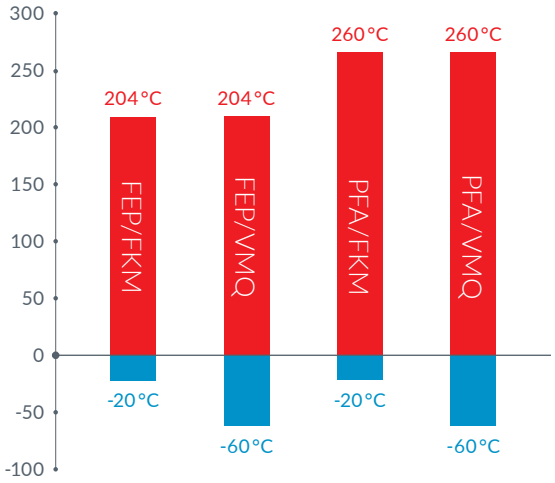
The joints, whether glued or also butt-vulcanized, always represent the weak point when subjected to high loads on the seal. In particular, when bonding the ends of the cord, the adhesive does not have the same material properties as the sealing material. This can then lead to premature damage and failure of the seal. Thus, for example in vacuum chambers preferably endless vulcanized O-rings are installed in order to avoid the weak point of the joint in the round cords and a better sealing result.

Materials for special requirements

Particular requirements of components, a special environment or difficult media – We offer a multitude of special material solutions beyond our broad standard ranges. This also includes our range of FEP and PFA-coated O-rings for special applications.

FEP and PFA-coated O-rings' heat resistance and low temperature flexibility

Material combination external/internal casing



Installation notes

When it comes to fitting FEP and PFA-coated O-rings, virtually the same recommendations apply as for standard elastomer O-rings. However, when fitting them, bear in mind that because of their coatings, the O-rings should be subjected to only minimum stretching and compression.

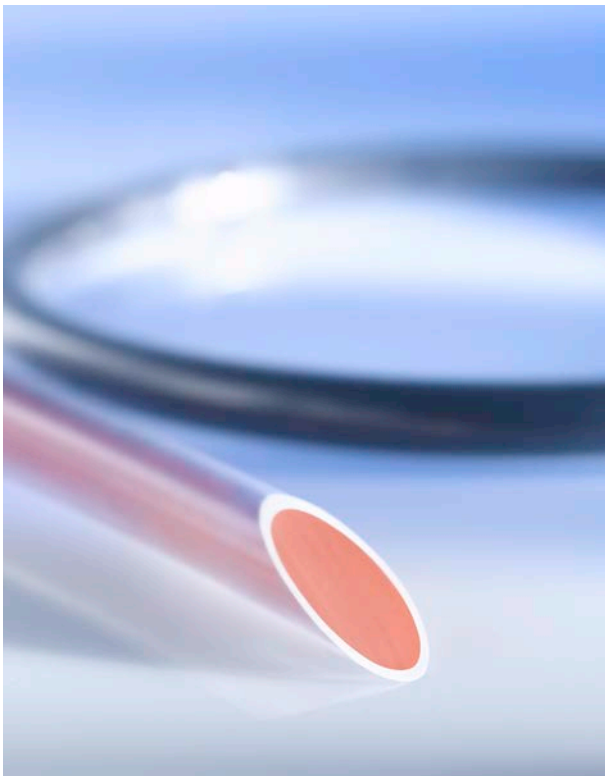
Installation spaces for FEP-/PFA-coated O-rings

cross-section d_2	groove deepth	groove width
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

FEP-coated O-rings

FEP-coated O-rings offer the best of both worlds: Very high resistance to the widest range of media and at the same time good elasticity. This is because of these O-rings' two-component system. FEP-coated O-rings have an elastic core made from FKM or silicone (VMQ). The respective elastic core is seamlessly coated all around with a thin covering of FEP. Thanks to this combination of outstanding resistance and good elastic properties, new types of application are possible. While the O-ring's core provides the necessary elasticity, the FEP coating is resistant to chemical media.

These FEP-coated O-rings can be used in diverse applications, including among others in areas of the petrochemical, chemical, pharmaceutical and food industries.



Benefits of PTFE

- *Chemical resistance to almost all media, including alkaline solutions, acids and solvents*
- *Temperature resistant from -180 °C to +260 °C*
- *Optimum dialectric properties*
- *High mechanical resistance*
- *Low friction coefficient, even without lubrication (absolutely no adhesion)*
- *No water absorption, low thermal conductivity*
- *Physiologically harmless*
- *Outstanding resistance to weather and ageing*

FEP, PFA and PTFE materials

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties
FEP/FKM	**FEP/FKM**	90 Shore A	black	from -26 °C to +205 °C	high resistance to chemicals, high heat resistance, FDA 21. CFR 177.1550
FEP/VMQ	**FEP/VMQ**	90 Shore A	red	from -60 °C to +205 °C	high resistance to chemicals, high heat resistance, good coldness properties, FDA 21. CFR 177.1550
PFA/FKM	**PFA /FKM**	90 Shore A	black	from -26 °C to +205 °C	high resistance to chemicals, high heat resistance, FDA 21. CFR 177.1550
PFA/VMQ	**PFA/VMQ**	90 Shore A	red	from -60 °C to +260 °C	high resistance to chemicals, high heat resistance, good coldness properties, FDA 21. CFR 177.1550
PTFE	**PT 950**	57 Shore D	white	from -180 °C to +260 °C	high resistance to chemicals, wide temperature

PFA-coated O-rings

For the very highest temperatures: As well as FEP coatings, COG also offers PFA coating. PFA possesses virtually the same chemical resistance and the same properties as PTFE. However, PFA-coated O-rings can be used at higher temperatures than FEP-coated O-rings, while their low temperature flexibility is the same. Generally speaking, PFA-coated O-rings with a silicone core are available in ring thicknesses of 1.5 to 19 mm.

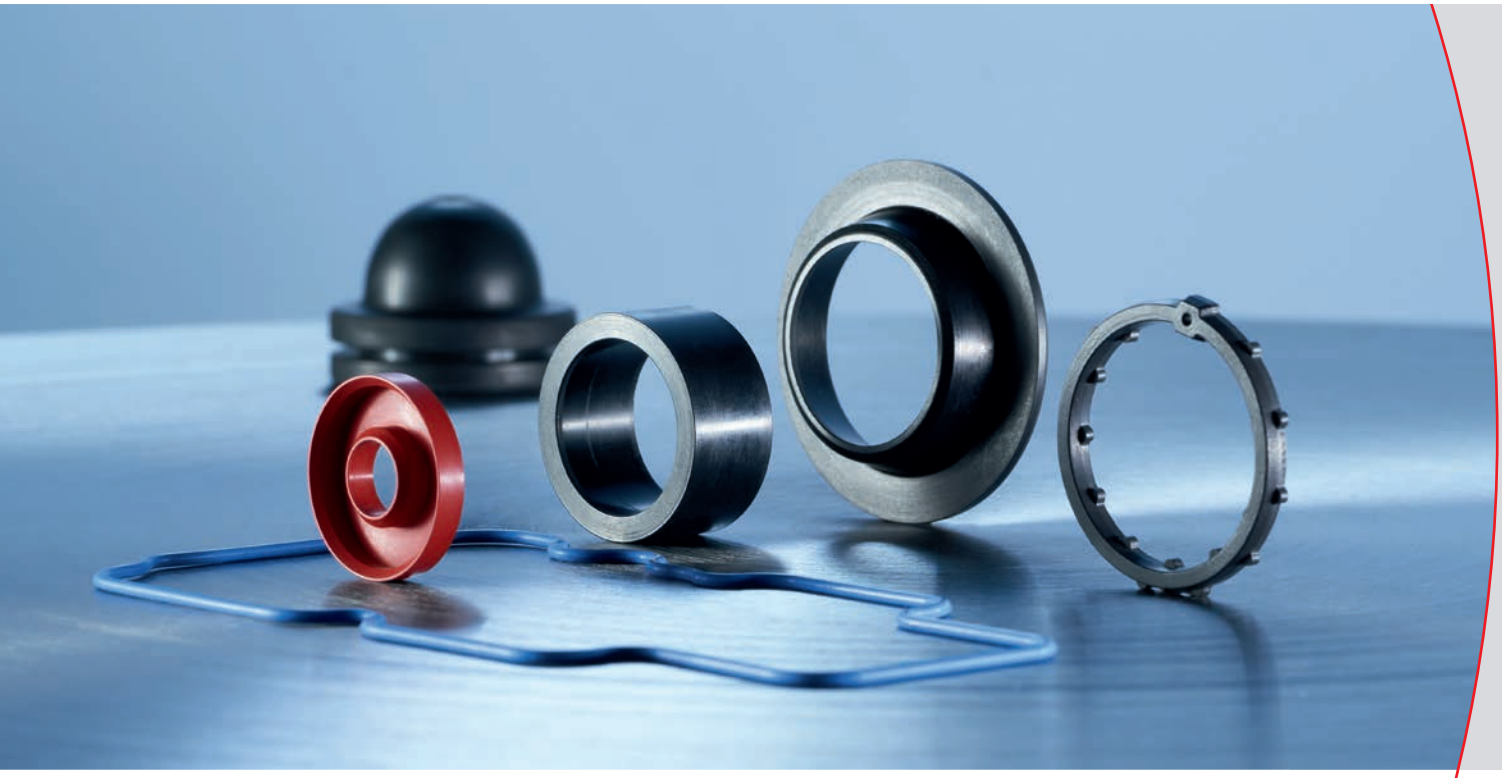
PTFE

PTFE is a full fluoropolymer with an exceptionally high melt viscosity. Therefore the thermic resistance is tremendous even in continuous operation over many thousand hours. Additionally PTFE is nearly universally resistant to chemicals. Even aggressive acids such as aqua regia (nitrohydrochloric acid) cannot corrode PTFE.

Moreover, PTFE has many further positive qualities, such as excellent electrical insulation and anti-adhesive behaviour, good dry-running properties and low heat conductivity. However, since PTFE is a very hard and inelastic material, there are restrictions in the applicability. Furthermore PTFE cannot be elongated – a fact to be considered on assembly.

Much more than just O-rings

What many people don't realise: As well as our core business of precision O-rings, COG decades of expertise in relation to elastomer seal materials are also deployed for the manufacture of moulded parts. We can produce rotation-symmetrical items as well as specific geometries on the basis of customer drawings, and from almost all standard materials.



Our experts working for you

Our own tool-making facilities enable us to produce even smaller quantities economically. Among other things, these moulded parts include flat seals, groove rings, profile seals, dairy pipe connections, clamp connections and sealing collars.

It goes without saying that our application engineers' expertise is available to you even in respect of moul ded parts. As part of comprehensive development meetings, we provide you with continuous advice, from planning to production – for achieving optimum results.

Just ask us!

Whether you are looking for moulded parts or special services – You are always welcome to speak to us directly, so that together we can see how we can help you.

Email: applicationtechnology@cog.de

Customized services

As a specialist in the complex area of elastomer seals, COG also offers you a broad spectrum of special services, even for special requirements. Whether single parts, items in sets or a complete assembly – Working together, we will develop the optimum seal solution for your series production.

Series production expertise

Our experts remain right by your side, providing expert support from the initial idea to the start of production. You can also entrust us with the serial assembly of single components, modules or systems made from the widest variety of materials, spanning right up to complex assemblies. If required, we would also be pleased to assume responsibility for the necessary purchasing management.

Other special services

- Colour coding of O-rings
- Sub-packaging and individual packaging
- Subsequent washing in deionised water
- Other special treatments: Molybdenum coating, graphitisation, Teflon coating, siliconisation, coloured coatings etc.
- 100% automatic optical dimensional check (external diameter AD < 70 mm)
- Special labelling (e. g. for customer-specific barcodes)
- By arrangement, EDI connection for electronic data exchange
- Presentation of various certificates and certification, such as factory certification in accordance with EN 10204-2.2 or manufacturer's certificate M in accordance with DIN 55350 Part 18, and many more

When speed is of the essence

In emergency cases, when a time delay is simply not acceptable, COG offers our customers an express manufacturing service. This special service is designed to help users out of a sticky situation. So we can manufacture high quality precision O-rings that are not kept in warehouse stock within 5 – 7 working days*. These orders are produced in the 'fast lane' of our sophisticated production process, and are supplied to our customers within the shortest possible time.

Delivery times for COG's express production

COG material	ASTM	Hardness in Shore A	Colour	Special properties	Delivery time* on orders placed	
					before 10 a.m.	after 10 a.m.
AP 300	EPDM	70	black	excellent resistance to hot water and vapour, good low temperature flexibility	5	6
LT 170	FKM	70	red	very good low-temperature flexibility	6	7
Vi 500	FKM	80	black	suited for endless vulcanisation and for the use in vacuum technology	6	7
Vi 564	FKM	72	black	use to 230 °C, BAM tested	6	7
Vi 899	FKM	90	black	excellent low-temperature flexibility, NORSOK M-710 (Annex B), API 6A & 6D	6	7
P 586	NBR	70	black		5	6
Si 771, FL	FVMQ	70	blue	very good low-temperature	6	7
FFKM and other materials are also available as part of our express service – please enquire.						

** The company's internal circumstances, such as capacity bottlenecks or company holidays or special holidays, can sometimes mean that production times vary considerably. For more precise information about this, please see cog.de/en/express.*

Maximum quantity

External diameter in mm	Maximum quantity
≤ 220	60
221 - 550	40
551 - 1400	25

You can find our current prices and production times at cog.de/en/express

Straightforward processing: You pay only the normal price for the O-rings, plus a flat rate express surcharge. Minimum item values and order values do not apply to this service.

COG keeps a total of seven materials in continuous stock, especially for express service. These include EPDM, FKM, NBR and FVMQ compounds. Of course, we can also produce other compounds in our express service, provided that the necessary materials are in stock. Our deadline guarantee applies to all express orders – Should we fail to supply by the promised deadline, we will waive the express surcharge, meaning you pay only the value of the goods. If required, please get in touch!

Express production – basic information

- Our current prices and production times can be found at cog.de/en/express
- Continuous stock of a total of 7 material compounds for industrial use
- Maximum quantity depends on the size of the O-rings
- Deadline guarantee: Should COG not keep to the express delivery deadline, you pay only for the value of the goods

Our materials at a glance

For quick access to all COG compounds, you will find each of our materials with the most important characteristics and clearly sorted by base elastomer. Further information and the detailed material table can be found on the pages in the last column. In addition, we present our entire material range on cog.de/en.

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties	Page
AU	PU 50	75 Shore A	black	from -30 °C to +125 °C	highly tear-resistant	16
	PU 460	90 Shore A	black	from -30 °C to +125 °C	highly tear-resistant	16
CR	Ne 471	70 Shore A	black	from -40 °C to +120 °C	good resistance to numerous coolants	30
	Ne 560	60 Shore A	black	from -30 °C to +120 °C	good resistance to numerous coolants	30

Our materials at a glance

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties	Page
CR	Ne 560, R	60 Shore A	red	from -20 °C to +100 °C	good resistance to numerous coolants	30
	Ne 570	70 Shore A	black	from -30 °C to +120 °C	good resistance to numerous coolants	30
EPDM	AP 208	70 Shore A	blue	from -55 °C to +140 °C	excellent hydrogen permeation coefficient, H_2 Sealing-tested	22, 26
	AP 300	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	14, 26, 38
	AP 301	70 Shore A	violet	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	26
	AP 350	82 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	26
	AP 370	70 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	14, 26
	AP 375, V	75 Shore A	violet	from -40 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	26
	AP 380	80 Shore A	black	from -50 °C to +150 °C	excellent resistance to hot water and vapour, good low temperature flexibility	26
	AP 490	90 Shore A	black	from -50 °C to +140 °C	excellent resistance to hot water and vapour, good low temperature flexibility	14, 26
	AP 540	70 Shore A	black	from -50 °C to +130 °C	sulphur-cured – can be used in dynamic applications	26
	AP 545	45 Shore A	black	from -45 °C to +140 °C	sulphur-cured – can be used in dynamic applications	26
	AP 550	50 Shore A	black	from -40 °C to +140 °C	sulphur-cured – can be used in dynamic applications	26
	AP 560	60 Shore A	black	from -40 °C to +130 °C	sulphur-cured – can be used in dynamic applications	26
EPM	EP 380	80 Shore A	black	from -35 °C to +180 °C	excellent resistance to hot water and vapour, good low temperature flexibility	26
FEP/FKM	FEP	90 Shore A	black + translucent	from -26 °C to +205 °C	high chemical resistance, high heat resistance, FDA 21. CFR 177.1550-tested, partially non-EU origin	35
FEP/VMQ	FEP	90 Shore A	red + translucent	from -60 °C to +205 °C	high chemical resistance, high heat resistance, good cold properties, FDA 21. CFR 177.1550-tested, partially non-EU origin	35
PFA/FKM	PFA	90 Shore A	black + translucent	from -26 °C to +205 °C	high chemical resistance, high heat resistance, FDA 21. CFR 177.1550-tested, partially non-EU origin	35
PFA/VMQ	PFA	90 Shore A	red + translucent	from -60 °C to +260 °C	high chemical resistance, high heat resistance, good cold properties, FDA 21. CFR 177.1550-tested, partially non-EU origin	35
FEPM	AF 275	75 Shore A	black	from -10 °C to +230 °C	base polymer: Aflas®, especially high chemical resistance	6, 13, 25
	Vi 982	75 Shore A	black	from -10 °C to +230 °C	base polymer Viton®-Extreme-ETP, high chemical resistance	6, 25
FFKM	COG Resist® RS 75 AL	76 Shore A	black	from -15 °C to +325 °C	outstanding chemical resistance, heat resistant to +325 °C	8 – 9 13, 21
	COG Resist® RS 80 AL	79 Shore A	black	from -15 °C to +260 °C	outstanding chemical resistance, excellent mechanical properties	9, 13

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties	Page
FFKM	COG Resist® RS 92 AED	92 Shore A	black	from -15 °C to +260 °C	NORSOK M-710 (Annex B), NACE TM0297	10, 11, 13, 18,19
	COG Resist® RS 175 AL	75 Shore A	black	from -15 °C to +230 °C	excellent chemical resistance	10, 11
FKM	BF 750	75 Shore A	black	from - 15 °C to +200 °C	high resistance to biogenic media	6, 25
	HF 875	75 Shore A	greybrown	from -15 °C to +200 °C	high chemical resistance	25
	LT 170	70 Shore A	red	from -50 °C to +200 °C	excellent chemical resistance, outstanding resistance to ageing, excellent low temperature flexibility	14, 25, 38
	Vi 100, S	70 Shore A	black	from -30 °C to +200 °C	good low temperature flexibility	14, 25
	Vi 110, S	80 Shore A	black	from -30 °C to +200 °C	good low temperature flexibility	14, 25
	Vi 120, S	90 Shore A	black	from -40 °C to +200 °C	outstanding chemical resistance	14, 25
	Vi 170	90 Shore A	black	from -50 °C to +200 °C	ECE-R 110, Annex 5D, 5F, 5G	14, 25
	Vi 175	75 Shore A	black	from -35 °C to +200 °C	good low temperature flexibility to -35 °C	12, 24
	Vi 208	80 Shore A	blue	from -10 °C to +200 °C	excellent hydrogen permeation coefficient, H_2 Sealing-tested	22
	Vi 220	75 Shore A	blue	from -15 °C to +200 °C	suitable for cylinder liners	25
	Vi 250	75 Shore A	black	from -25 °C to +250 °C	heat resistant to +250 °C	6 – 7, 13
	Vi 370	70 Shore A	black	from -20 °C to +200 °C	suitable for vacuum applications	21, 25
	Vi 376	75 Shore A	black	from -15 °C to +200 °C	BAM-tested	17
	Vi 399	90 Shore A	blackbrown	from -15 °C to +200 °C	good chemical resistance	25
	Vi 400	65 Shore A	blackbrown	from -15 °C to +200 °C	good chemical resistance	21, 25
	Vi 455	55 Shore A	black	from -15 °C to +200 °C	good chemical resistance	21, 25
	Vi 460	60 Shore A	black	from -25 °C to +200 °C	good chemical resistance	21, 25
	Vi 480	80 Shore A	black	from -15 °C to +200 °C	good resistance to hot water and vapour	6, 25
	Vi 500	80 Shore A	black	from - 15 °C to +200 °C	suitable for endless vulcanisation and vacuum applications	21, 25, 32, 38
	Vi 549	70 Shore A	black	from -20 °C to +200 °C	high chemical resistance, DVGW DIN EN 549 – H3/E1, ADI-free	25
	Vi 564	72 Shore A	black	from -15 °C to +230 °C	can be used to 230 °C, BAM-tested (for applications in gaseous oxygen; max 150 °C/2 bar)	4, 13, 17, 21, 25, 38
	Vi 569	80 Shore A	black	from -15 °C to +200 °C	DVGW DIN EN 682 – GB, DVGW DIN EN 549 H3/E1, suitable for endless vulcanisation	4, 17, 25, 32
	Vi 576	80 Shore A	black	from -15 °C to +200 °C	BAM-tested (for applications in gaseous oxygen; max 150 °C/25 bar)	4, 17, 25
	Vi 580	80 Shore A	black	from -15 °C to +200 °C	suitable for vacuum applications	21, 25
	Vi 580, G	80 Shore A	green	from -15 °C to +200 °C	suitable for vacuum applications	21, 25
	Vi 580, R	80 Shore A	red	from -15 °C to +200 °C		21, 25

Our materials at a glance

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties	Page
FKM	Vi 590	90 Shore A	black	from -15 °C to +200 °C	good chemical resistance	25
	Vi 600	70 Shore A	green	from -15 °C to +200 °C	increased chemical resistance	25
	Vi 650	75 Shore A	green	from -15 °C to +200 °C	suitable for endless vulcanisation	25, 32
	Vi 670	80 Shore A	green	from -15 °C to +200 °C	good chemical resistance	25
	Vi 675	75 Shore A	red	from -15 °C to +200 °C	good chemical resistance	25
	Vi 691	90 Shore A	black	from -15 °C to +200 °C	good chemical resistance	25
	Vi 691, G	90 Shore A	green	from -15 °C to +200 °C	good chemical resistance	25
	Vi 700	90 Shore A	green	from -15 °C to +200 °C	good chemical resistance	25
	Vi 840	80 Shore A	black	from -46 °C to +200 °C	DVGW DIN EN 682 – GBL, NORSOK M-710 (Annex B), ISO 23936-2, standards-compliant to DIN EN 14141 and API 6A & 6D, NACE TM0187	4, 6, 14, 17, 18, 25
	Vi 890	90 Shore A	black	from -20 °C to +210 °C	NORSOK M-710 (Annex B) and NACE TM0187, suitable for endless vulcanisation	18, 32
	Vi 899	90 Shore A	black	from -46 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, outstanding low temperature flexibility, suitable for endless vulcanisation	13, 14, 18, 32, 38
	Vi 900	90 Shore A	black	from -55 °C to +230 °C	NORSOK M-710 (Annex B) and NACE TM0187, ISO 23936-2	14, 18, 25
	Vi 965, GF	65 Shore A	black	from -15 °C to +200 °C	good chemical resistance	25
	Vi 970	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance	6, 25
	Vi 970, G	70 Shore A	green	from -20 °C to +200 °C	good chemical resistance	25
	Vi 970, GF	70 Shore A	black	from -15 °C to +200 °C	good chemical resistance	6, 25
	Vi 975	75 Shore A	black	from -20 °C to +200 °C	good chemical resistance	25
	Vi 975, G	75 Shore A	green	from -20 °C to +200 °C	good chemical resistance	25
	Vi 990	90 Shore A	black	from -46 °C to +230 °C	AED/RGD-compatible	13, 18
FVMQ	Si 771, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility	14, 25
	Si 971, FL	70 Shore A	blue	from -60 °C to +200 °C	excellent cold temperature flexibility and chemical resistance	14, 25
HNBR	HNBR 70	70 Shore A	black	from -25 °C to +150 °C		31
	HNBR 580	80 Shore A	black	from -40 °C to +150 °C		31
	HNBR 600	70 Shore A	black	from -20 °C to +150 °C		31
	HNBR 702	70 Shore A	black	from -25 °C to +150 °C	DVGW DIN EN 549 - H3 / C1	17, 31
	HNBR 899	90 Shore A	black	from -20 °C to +150 °C	NORSOK M-710 (Annex B)	18, 31
NBR	P 370	80 Shore A	black	from - 20 °C to +120 °C		31
	P 427	90 Shore A	black	from - 20 °C to +120 °C		31
	P 430	45 Shore A	black	from -20 °C to +120 °C		31
	P 431, A	75 Shore A	black	from -10 °C to +120 °C		31
	P 465	65 Shore A	black	from -20 °C to +120 °C	suitable for endless vulcanisation	31, 32
	P 549	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 549 - H3 / B2	4, 17, 31

ASTM D 1418 ISO 1629	COG material	Hardness	Colour	Operating temperature	Special properties	Page
NBR	P 550	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 – GBL and DIN EN 549 – H3/B1	4, 17, 31
	P 574	55 Shore A	black	from -20 °C to +120 °C		31
	P 583	70 Shore A	black	from -30 °C to +120 °C		31, 38
	P 583, RF	70 Shore A	black	from -30 °C to +120 °C		14, 31
	P 584, RF	70 Shore A	black	from -50 °C to +120 °C	excellent low temperature flexibility to -50 °C	14, 31
	P 670	70 Shore A	black	from -20 °C to +120 °C	suitable for endless vulcanisation	31, 32
	P 682	70 Shore A	black	from -20 °C to +120 °C	DVGW DIN EN 682 - GBL	4, 17, 31
	P 700	70 Shore A	black	from -46 °C to +120 °C	excellent low temperature flexibility to -46 °C	14, 31
	P 740	40 Shore A	black	from -20 °C to +120 °C		31
	P 745	45 Shore A	black	from -20 °C to +120 °C		31
	P 750	50 Shore A	black	from -20 °C to +120 °C		31
	P 755	55 Shore A	black	from -20 °C to +120 °C		31
	P 760	60 Shore A	black	from -30 °C to +120 °C		31
	P 775	75 Shore A	black	from -25 °C to +120 °C		31
	P 780	80 Shore A	black	from -30 °C to +120 °C		31
	P 780, RF	80 Shore A	black	from -60 °C to +120 °C	excellent low temperature flexibility to -60 °C	14, 31
	P 790	90 Shore A	black	from -20 °C to +120 °C		31
	P 990	90 Shore A	black	from -20 °C to +120 °C		31
PTFE	PT 950	57 Shore D	white	from -180 °C to +260 °C	high chemical resistance, broad operating temperature range, FDA 21. CFR 177.1500-tested	35
VMQ	Si 810, S	70 Shore A	black	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 850, R	50 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 850, B	50 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 850, TR	50 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 855, R	55 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 860, R	60 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 860, B	60 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 860, TR	60 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 880, R	80 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 970, B	75 Shore A	blue	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 970, R	70 Shore A	red	from -60 °C to +200 °C	excellent low temperature flexibility	29
	Si 970, TR	70 Shore A	translucent	from -60 °C to +200 °C	excellent low temperature flexibility	29

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