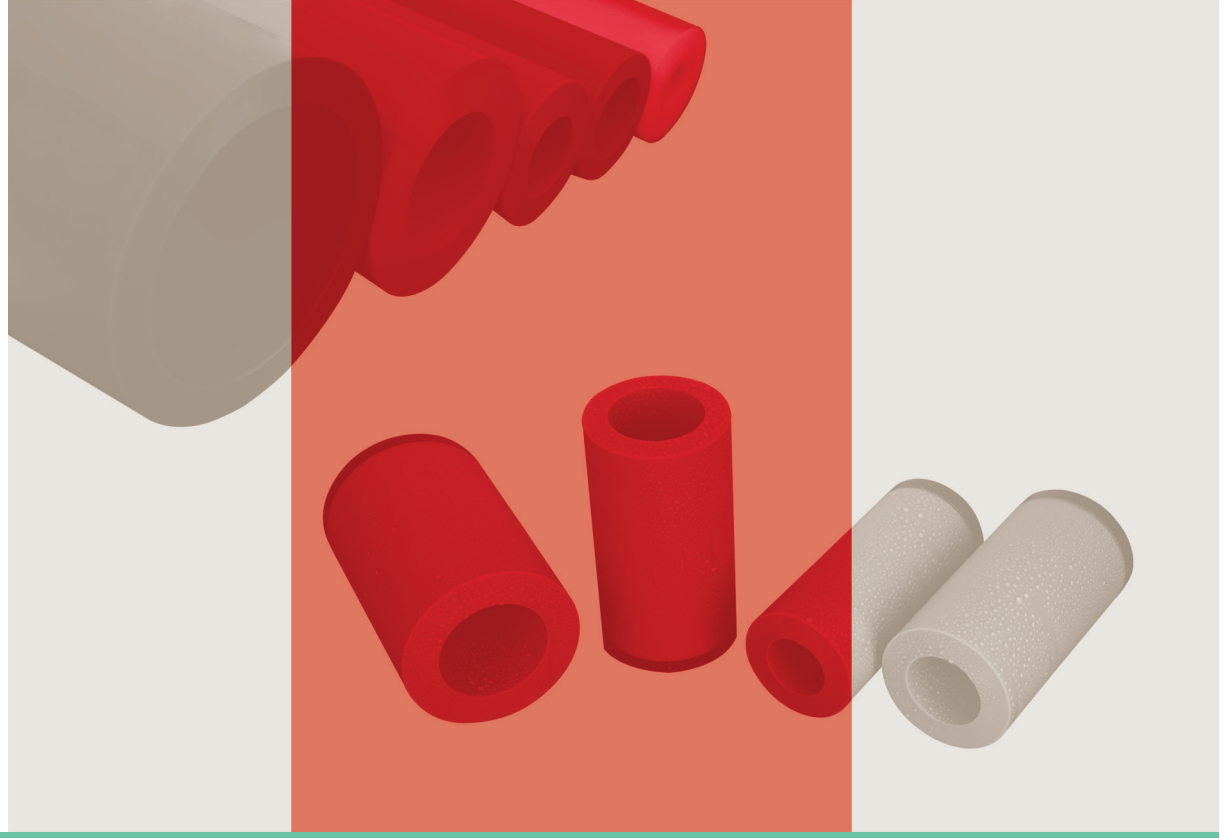


Semi Finished Material

Overview

SEALS

Introduction

With increasing industry demands for sealing technology, the importance of appropriate sealing materials has become imperative. Sealing materials need to withstand increasingly higher temperature and pressure variations, along with higher speeds and the proliferation of poor quality lubricating fluids. The new generations of lubricating fluids, such as HFA and HFB, along with the usage of biologically degradable hydraulic fluids, such as vegetable oils and synthetic esters, combine to pose new challenges in developing innovative sealing materials.

We at 3D seals, having kept abreast of changing industry requirements, and discarding the standard solutions approach, have adopted a more R&D based, client-friendly approach, by providing tailor-made solutions for specific client and industry-based solutions. This approach entails high interaction with clients leading to the best and optimal sealing solutions.

In pursuant of the same innovative approach, 3D seals recognised the advantages of Polyurethane in the use of sealing technologies very early and harnessed the superior characteristics of these materials effectively. With the effectiveness of these materials being proven, we see a much stronger industry trend in their use.

Apart from the speciality, tailor-made solutions, 3D seals also offers various standard materials too and these are featured in this brochure. These materials have all been developed by us, with the same guaranteed 3D seals quality and meet all standard customer requirements. In addition, 3D seals also offers special materials like AFLAS, engineering thermo plastics like POM and hightemperature plastics like PPS, etc.

Sealing Materials

Our sealing technology involves the use of macromolecular substances that withstand the challenges of high temperature, pressure and sliding speeds. Macromolecular substances are high molecular weight organic compounds consisting of many smaller structural units (very large number of atoms) linked together. They can be created in two ways:

Natural: by modifying high-molecular natural materials, such as rubber.

Synthetic: by depositing low-molecular elements, or monomers, through various chemical reactions.

Two groups of macromolecular (polymer) substances are primarily used in sealing technology – elastomers and thermoplastics.



Material Data Properties	Standard	Unit	POLYURETHANES								RUBBER ELASTOMERS						THERMOPLASTICS						
			PU thermoplastic polyurethane elastomer	HPU hydrolisys-resistant polyurethane	GPU polyurethane for giant seals and big cross sections	LTPU low-temperature polyurethane	SPU self-lubricated polyurethane	XPU hard polyurethane	XHPU hard hydrolysis resistant polyurethane	XSPU hard self-lubricated polyurethane	HNBR hydrogenated acrylonitrile-butadiene	NBR acrylonitrile-butadiene-rubber	FKM/ FPM VITON® / fluoro-rubber	EPDM ethylene propylene rubber	ALFAS tetrafluorethylene propylene rubber	MVQ silicone rubber	POM polyacetal	PTFE 1 virgin polytetrafluorethylene - virgin PTFE	PTFE 2 glass PTFE + 15% Glass Fibre + 5% MoS	PTFE 3 bronze PTFE+ 40% Bronze	PTFE 4 carbon PTFE+ 25% Carbon	PA polyamide	PAEK polyaryletherketone
Colour			green	red	red	blue	gray	dark green	red	gray	black	black	brown	black	black	maroon	white	white	gray	brown	black	white	cream
Hardness	53505	Shore A	95±2	95±2	95±2	95±2	95±2				85±5	85±5	83±5	85±5	83±5	85±5							
	53505	Shore D	48±3	48±3	47±3	48±3	48±3	57±3	60±3	57±3							82	82	60	64	65	77	86
Density	53479	g/cm³	1,20	1,20	1,20	1,17	1,24	1,21	1,22	1,26	1,22	1,31	2,30	1,22	1,60	1,52	1,41	2,17	2,25	2,25	2,10	1,15	1,32
100% Modulus	53504	N/mm	≥12	≥13	≥11	≥12	17	≥18	≥20	24	≥10	≥11	≥5	≥9	8	≥5							
Tensile Strength / Yield Stress	53504/ 53455	N/mm	≥40	≥50	≥45	≥50	50	≥50	≥50	45	≥18	≥16	≥8	≥12	13	≥7	62	27	18	22	15	65	97
Elongation At Break	53504/ 53455	%	≥430	≥330	≥280	≥450	380	≥400	≥350	350	≥180	≥130	≥200	≥110	200	≥130	40	300	200	280	180	120	≥50
Modulus Of Elasticity - Tensile Strength	53457	N/mm															2600					1800	3600
Compression Set 70°c/24h 20% Def		%	≤30	≤27	≤30	≤27	25	24	26	24													
100°c/24h 20% Def		%	≤35	≤33	≤40	≤33	30	29	30	30													
100°c /22h	53517	%									≤22	≤22	≤15										
175°c /24h	53517	%											≤20		29	≥15							
Rebound Resilience	52512	%	42	29	43	50					29	28	7	38		44							
Tear Strength	53515	N/mm	≤100	≤100	≤40	≤80	120	≤140	170	160	20	21	15	21	19								
Abrasion	53516	mm³	18	17	25	15	17	18	20	20	90	90	150	120	110								
Minimum Service Temperature		°C	-30	-20	-30	-50	-20	-30	-20	-20	-25	-30	-20	-50	-10	-60	-50	-200	-200	-200	-200	-40	
Maximum Service Temperature		°C	+110	+110	+110	+110	+110	+110	+110	+110	+150	+100	+200	+150	+200	+200	+100	+260	+260	+260	+260	+100	260

Classification of sealing materials

Primarily two groups of macromolecular (polymer) substances are used in sealing technology - elastomers and thermoplastics.

Macromolecular substances are basically organic compounds comprising several thousands and at times millions of atoms. These molecules are known as macro, giant, string or chain molecules. These molecules are created either by the modification of highly molecular natural materials like, natural rubber or by depositing low-molecular elements (monomers) through various chemical reactions, as in synthetic materials and plastics.

Elastomers are materials which are highly expandable, with the use of minimal power. Elastomers have high retractibility due to their structure, hence their compression set is very limited. Rubber materials and thermoplastic elastomers are the two main groups of elastomers.

The rubber materials used in sealing requirements are polymers which are created by a process which involves chemically cross-linking macromolecules with different vulcanisation additives. These materials do not melt at high temperatures, but decompose due to their chemical bonds. The cross-linking also ensures that the rubber materials do not dissolve or swell or shrink, depending on the medium.

Thermoplastic Elastomers are elastomers which demonstrate the characteric properties of elastomers across a huge range of temperatures and with the processing behaviours of thermoplastics. These elastomers can be melted at high temperatures and it is possible to process them with traditional themoplastic processing techniques. They swell less than chemically cross-linked industry equivalents and are soluble.

Examples of Engineering Thermoplastics include Polyacetal, Polyamid, PTFE and PEEK.

Thermoplastics are polymer materials, harder and more rigid at their application temperatures compared to Elastomers and can be melted. The properties of Thermoplastics vary from being hard, to stiff, ductile and flexible, depending on their chemical structure. Extensive stretching of thermoplastics is non-reversible and the moulded parts remain in deformed state due to their morphological structure.

Thermoplastics are known by the name Plastomers and Engineering Thermoplastics are used in sealing technologies to manufacture backup rings, guide rings, bearing buses and others.

POLYURETHANES

PU (TPU) Green

PU, also known as Thermoplastic Polyurethane Elastomers, are Elastomers with excellent abrasion resistance properties, low compression sets, high physical properties and tear strength.

PU is mostly used in the manufacturing of U-Cup Seals, Lip Seals, Wipers and Chevron Packings. It is also used in dampers and other machined parts. Products manufactured using PU can be used in mineral oil, in water (upto 40°C), in bio-degradable hydraulic oils, like vegetable oils and synthetic esters (upto 60°C).

Note: It is better to use HPU instead of PU Green in these hydraulic fluids.

As per the requirements of a particular seal design and the installation housing, seals made of PU can be used up to a range of 400 bar.

Note: For a higher pressure range, anti extrusion rings are required.

HPU (TPU) red

HPU or hydrolysis-resistant thermoplastic polyurethane elastomer, is created by adding to the engineering properties of a PU, the quality of high resistance to hydrolysis (degradation in water), which is rare in polyurethanes. HPU is stable in water upto +90°C and displays outstanding stability in mineral oil too. This property of resistance to hydrolysis makes HPU ideal in the use of water hydraulics and in applications of mining, tunnelling and the manufacture of presses. HPU is also highly recommended for use in pure and seawater, in HFA and HFB fluids and biologically degradable hydraulic fluids (vegetable oils and synthetic esters) and food articles. HPU conforms to and meets the requirements of various food and beverage regulations and can be used in many food and beverage and healthcare applications.

GPU (CPU) red

A cast hydrolysis - resistant polyurethane elastomer, GPU, is similar in property to HPU, specifically in regards to its chemical composition.

LTPU (TPU) blue

TPU, developed specifically for low temperature applications, is a thermoplastic polyurethane elastomer. Similar in properties to those of PU, the minimum service temperature of TPU is extended upto -50 °C and is thus ideal for use under severe climatic conditions and for applications in freezing plants.

SPU (TPU) gray

SPU (TPU) grey is a new polyurethane optimised in terms of its tribological characteristics (friction and wear). This has been achieved by the addition of a synergetic combination of solid lubricants. It's application is ideal for the most severe applications in water hydraulics and non-lubricated pneumatics.

XPU (TPU) dark green

3D Seals offers this specialised thermoplastic polyurethane elastomer called XPU. The composition of XPU is such that it provides outstanding friction and wear properties along with high pressure resistance. This material is ideal for use as a composite seal, for wipers working in heavy duty applications and for engineered plastic parts that need high elasticity and demand superior resilient behaviour. XPU's exceptional extrusion resistance seals are the perfect solution for applications in high pressure levels and larger clearances, than those made from standard polyurethanes and PTFE compounds.

XHPU (TPU) red

XHP is a material with a significantly higher hardness compared to standard grade HPU. The specialised composition of the XHP comprising special raw materials ensures outstanding friction and wear, as well as pressure resistance properties. Additionally this material also has outstanding chemical and hydrolysis resistance properties, making it ideal for applications in mineral oil, biodegradable hydraulic fluids like HETG and HEES and others, and water-based fluids like HFA and HFB.

XSPU (TPU) gray

With a higher hardness compared to a standard material SPU, XS-PU provides improved sliding properties. Sealing elements made of this material can be used at high pressures as XS-PU provides better extrusion resistance as long as the same profiles are used. The use of XSPU is recommended under poor lubrication working conditions instead of XPU and XHPU. This material can withstand dry-running, depending on overall service conditions.

RUBBER ELASTOMERS

HNBR black

Ideal for applications in aliphatic hydrocarbons like propane or butane and mineral oils and greases (for short durations upto 170 °C) and for sulfonated crude oil, HNBR, a hydrogenated or saturated acrylonitrile-butadiene rubber, is the perfect material. HNBR is also utilised in many diluted acids, bases and salt solutions, at elevated temperatures and also in glycol-water mixtures.

3D Seals HNBR is not compatible with fuels with high content of aromatic hydrocarbons (premium blend petrol), gasolines (petrol/alcohol blends) ketones, esters, ethers and chlorinated hydrocarbons like trichloroethylene and tetrachloroethylene.

NBR black

Utilised for U-cup seals, chevron pickings, special seals and various other components, NBR is an elastomer derived from acrylonitrile-butadiene rubber. NBR is highly resistant to mineral oils, greases and HFA, HFB and HFC pressure fluids, although it is not resistant to glycol-based brake fluids, HFD fluids, aromatic fluids like benzene, esters, ketones and amines or concentrated acids and bases.

FKM/ FPM brown

FKM, an elastomer, comprising fluororubber (VITON®) can be utilised for U-Rings, lip seal, chevron packings, wipers and special seals. FKM's excellent properties include high resistance to heat, weathering, ozone and many other chemicals.

FKM is compatible with mineral oils and greases containing sulphur, HFD pressure fluids (nearly all phosphate esters and chlorinated hydrocarbons), crude oil and sour gas. 3D Seals FKM is not resistant to anhydrous ammonia, amines, ketones, esters, hot water and low molecular weight organic acids.

EPDM

EPDM, an elastomer-based onethylene-propylene rubber, is used for U-cup seals, lip seals and chevron packings.

3D Seals' EPDM has outstanding resistance to hot water, steam, washing agents and polar organic solvents. EPDM is highly resistant to weathering, ozone and ageing. 3D Seals' EPDM is not resistant to mineral oils and other unpolar media. When used in glycol-based brake fluids, national regulations have to be adhered to.

AFLAS black

3D Seals' AFLAS is a unique fluoro-elastomer based upon an alternating copolymer of tetrafluoroethylene and propylene (TFE/P) and is chemically related to fluororubber. 3D Seals' AFLAS has a slightly higher tensile strength compared to fluoro rubber materials, although with similar heat resistance properties.

MVQ maroon

3D Seals' MVQ is a silicone rubber used for O-rings, gaskets and special seals, although it is mostly used in static applications due to its poor mechanical properties. It is highly resistant to weathering, ozone and ageing. MVQ is compatible with mineral oils due to the presence of aromatic hydrocarbons as part of its content.

THERMOPLASTICS

Polyacetal (POM) white

3D Seals' POM is a semi-crystalline poly-acetalcopolymer, utilised in anti-extrusion rings, guide ring bushes, scrapers and for precision-machined parts with tight tolerances.

3D Seals' POM is a high-utility engineering thermoplastic with good physical properties and low water absorption. It delivers good results in mineral oils and water-based fire-resistant hydraulic fluids (HFA, HFB and HFC fluids). It is vulnerable to attack and destruction in concentrated acids and bases.

PTFE 1 – Virgin white

3D Seals' PTFE 1 is a thermoplastic based on Polytetra-fluoro-ethylene, that is utilised for back-up rings, chevron packings, O-rings, rotary seals and gaskets. PTFE 1 is very versatile and has the widest application range of all sealing materials. Our PTFE 1 is outstandingly chemical resistant and is only vulnerable to molten alkali metals and elementary fluorine at high temperatures. While using PTFE seals, the fact that creeping occurs at relative low loads (pressures), should be noted.

3D Seals' PTFE 1 is perfectly suitable for the food industry.

PTFE 2 (PTFE +25% glass fibre + 5% MoS2) grey

3D Seals' PTFE 2 has enhanced compression strength and improved sliding properties compared to our PTFE 1. The chemical resistance is similar to 3D Seals' PTFE 1.

PTFE 3 (PTFE +40%) bronze

3D Seals' PTFE 3 delivers improved compression strength, sliding properties and improved thermal conductivity in comparison to PTFE 1.

PTFE 4 (PTFE +25% carbon) black

3D Seals' PTFE 4 delivers improved mechanical strength, stiffness and hardness, along with enhanced sliding properties in comparison to PTFE 1.

Polyamide (PA) white

3D Seals' PA, a cast polyamide with good sliding properties, is used for back-up rings, guide rings and bearing components, instead of our POM for diameters above 400 mm. 3D Seals' PA can be used in mineral oils and water-based fire-resistant hydraulic fluids. The swelling of the material (PA absorbs water up to eight percent of the weight), must be kept in mind while designing parts out of our PA for an application in water or water-based fluids.

PEEK cream

3D Seals' PEEK is a polymer with a high tensile strength, stiffness, high heat distortion temperature and good sliding and friction behaviour. Our PEEK exceeds most technical plastics vis-à-vis its strength and stiffness, especially at high temperatures.

Special materials

We can provide any thermoplastic with mineralreinforced polyamides and high temperature plastics like Polyphenylsulfide and others. 3D Seals is capable of modifying all standard materials to deliver tailor-made, customised and optimised sealing solutions.

What sets us apart

Use of top-quality sealing materials | Designs for a variety of applications and industries. | Engineered to specifications using CNC technology. | Delivery at short turnarounds. | Customised inventory programmes. | After-sales and maintenance support

SEALS

3D Seals Pvt. Ltd.
124, Shiv Krupa Industrial Estate,
Surya Nagar, LBS Marg, Vikhroli West,
Mumbai, Maharashtra 400083, India.

T +91 74230 00050

E info@3dseals.in

www.3dseals.in