Oil & Gas industry

Seals and engineered plastic parts

ECONOMOS

The Power of Knowledge Engineering

Contents

The SKF brand now stands for more than ever before, and means more to you as a valued customer.

While SKF maintains its leadership as the hallmark of quality bearings throughout the world, new dimensions in technical advances, product support and services have evolved SKF into a truly solutions-oriented supplier, creating greater value for customers.

These solutions encompass ways to bring greater productivity to customers, not only with breakthrough application-specific products, but also through leading-edge design simulation tools and consultancy services, plant asset efficiency maintenance programmes, and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but it now stands for much more.

SKF – the knowledge engineering company

Sealing solutions for the Oil & Gas industry

SKF Economos is a supplier of top quality, highly reliable products to the Oil & Gas industry. In this most challenging industry our customers benefit from our comprehensive field experience and extensive knowledge in the sealing technology.

Our optimized sealing solutions enable our customers to achieve their strategic goals

- enhanced safety at work
- increased productivity and reliability
- increased environmental sustainability
- increased lifetime
- reduced maintenance and downtime costs
- media and energy savings

SKF Economos solutions provide the most flexible options for the Oil & Gas industry: seals and advanced engineered plastic parts for wet, abrasive and contaminating environments in Oil & Gas equipment.

SKF Economos competence

- application engineering
- extensive list of client success stories
- material technology
- standard and custom engineered sealing solutions
- advanced engineered plastic parts (AEPP)

SKF Economos is one of the leading suppliers for standard and custom engineered sealing solutions. Our extensive knowledge in the Oil & Gas industry is based on many years of experience in dealing with the industry specific requirements.

SKF Economos capabilities

- on-site solution analysis
- innovative custom engineered solutions
- immediate availability of machined standard seals and customized sealing solutions
- injection moulded seals for higher volume orders

Our customers benefit from our flexibility and our short delivery times for customized seals. SKF Economos products are always made from high-performance materials and cover the following product groups:

- hydraulic and pneumatic sealing systems
- sealing solutions for rotary equipment
- oil shaft seals, V-rings
- flat seals for flange connections
- static seals and O-rings
- advanced engineered plastic parts (AEPP)

Finding the most suitable sealing solution is a complex and rewarding task. Our experience shows, that there is always potential for optimization.

The right seal for extreme conditions

Whenever enhanced worker safety, reduced needs for maintenance, increased productivity or process reliability matter – SKF Economos is there with improved sealing solutions for the hostile environment in the Oil & Gas industry.

The following points are essential when selecting the right seal for the harsh operating conditions of the Oil & Gas industry.

Sealing purpose

The purpose of sealing is to keep oilfield media or operating media in and/or environmental contamination out of the sealed system.

Environment

Aggressive environmental conditions can be a concern. Abrasive particles or chemically aggressive media may affect the sealed machine part.

Media

Media affect the sealing system in diverse ways. The sealing material has to be compatible with the sealed and environmental media. This could be any oilfield media like drilling and completion fluids, acids, corrosion inhibitors, sour gas, etc..

Operating parameters

Type, speed and duration of the motion at the sealing lip are relevant. In the Oil & Gas industry seals have to withstand temperatures between –45 °C *(–50 °F)* up to 230 °C *(450 °F)* and pressures from zero to more than 172 MPa *(25 000 psi)*. However these figures easily can be extended for special applications. Additionally to these extreme conditions lifetime requirements, especially for subsea applications, can be in the range of years.

Machine design

Shaft alignment must be considered when choosing the sealing lip design for rotating or pivoting applications. Shaft-to-bore misalignments (STBM) and dynamic run-out (DRO) are both relevant, especially in maintenance cases. For large sized reciprocating components the rod misalignment may also be of concern.

The condition of the counter-surface at the point of sealing (at the sealing lip) has a large effect on the sealing performance. Housing design and condition (in case of maintenance) determine the seal design.

Improvement potentials

Finally, the most important indicators for possible improvement potentials are the existing seal performance and the reasons for seal failure and/or necessary seal replacement.

The seal's performance may affect productivity, process reliability, mean time between failure (MTBF) and maintenance schedules. Optimizing a sealing solution can be a complex task. Our experience for sealing solutions and your experience in your special application indicates the high optimization and cost saving potential (in terms of total cost of ownership – TCO) for optimized sealing solutions.

SKF Economos – your flexible partner

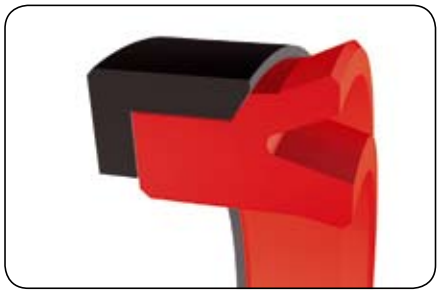
SKF Economos is the leading player in the global custommade machined seals market. Specialising in complete sealing service for Oil & Gas, we serve many countries worldwide using our global sales network.

Standard seals

- seals in standard dimensions
- machined or injection moulded seals
- immediate availability
- extensive range of materials

Customized seals

- standard seals modified to your specific requirements
- various materials and dimensions
- machined seals
- shortest possible delivery time (availability permitting, from 24 hours)



Custom engineered sealing solutions

- application engineering service
- flexible machined sealing solutions
- shortest possible delivery time

Due to our flexible production process, we can supply standard and special seals in customized dimensions and heavy duty sealing materials up to 4 000 mm in diameter as one piece and larger using our welding technique. Our manufacturing concept provides a truly local service, being very close to the end customer. Our customer service encompasses:

Advanced engineered plastic parts

Turned, milled and moulded parts, made of in-house developed high performance plastic materials or materials from qualified suppliers.

Other business and services

Maintenance and repair of hydraulic and pneumatic cylinders; gaskets and products manufactured using water-jet cutting technology.

Applications and solutions for the Oil & Gas industry

SKF Economos provides a large variety of sealing solutions for equipment and tools to meet the extremely challenging requirements in the Oil & Gas industry.

To meet the demands of subsea, ultra deep-water, downhole, on- or offshore applications, SKF Economos co-operates with customers, providing standard or individual solutions to maximize equipment efficiency and dramatically reduce downtime.

We offer advice at any stage of a project regarding material and profile selection, often saving time, money and vital engineering resources. If required we provide Finite Element Analysis information for your application and our global communications network is in place to offer full technical and engineering support for any application.

Just to name a few applications, you can find SKF Economos sealing solutions in the following equipment:

- actuators with wipers, piston seals, guide rings, O-rings
- pumps with rotary seals, multi-lip seals, piston seals, wipers, O-rings
- valves with flange seals, stem seals, seat seals
- downhole tools with O-rings, back-up rings, T-seals, U-cup seals
- cranes with rotary seals, piston seals, wipers, O-rings
- MWD equipment with O-rings, back-up rings, rotary seals
- swivels with lip seals, O-rings, rotary seals

For any application we provide standard seals, customized sealing solutions and special custom engineered solutions including advanced engineered plastic parts (AEPP) in a broad variety of oilfield compatible materials.

Test cost reduction

Before any equipment is allowed to leave the manufacturing or refurbishment facility, it has to undergo several tests. Testing cannot be eliminated, but costs for it can be minimized.

Testing is not only time consuming but also requires the input of material, which increases the overall costs for testing. In order to reduce the associated costs either test procedures need to be shortened, which might have an impact on quality, or the usability of the input material needs to be extended. In that special case for each test two new API ring gaskets were necessary previously.

SKF Economos has designed a special sealing solution, which replaces all standard API ring gaskets (R, RX, BX). This seal system is made of H-ECOPUR, which has outstanding mechanical properties. The seals can be used up to 30 times for testing purposes, which significantly reduces the testing costs. Theses ECO-Flange test seals are available in many standard sizes to meet a great variety of testing equipment.

Downhole tools

Over recent years, significant development of downhole tools has taken place. Downhole tools are not only used to increase drilling performance, but also have to fulfil emergency aspects and measurement while drilling purposes.

One of the most severe conditions, a seal needs to withstand when drilling for hydrocarbons, is found downhole. It is not only the combination of high pressure and high temperature, but also the sometimes unforeseeable mixture of aggressive wellbore fluids and special installation conditions, which must be considered when designing the sealing solution.

The performance of a downhole often depends on the functionality of its hydraulic system, hence it depends on the performance of a sealing solution.

SKF Economos seals can be found in a variety of different downhole tools. Apart from standard seals we are able to provide customized sealing solutions in order to meet the requirements of different applications.

As an example special designed packers made of SKF Ecorubber-1 (NBR) or SKF Ecorubber-H (HNBR) are used to seal the wellbore annulus.

For downhole generators e.g. a custom engineered sealing solution made of SKF Ecoflon 4 (PTFE carbon filled) is used.

Wire logging tools used for remote logging of downhole areas require special designed “T-seals” with an SKF Ecorubber-H (HNBR) sealing element and SKF Ecopaek as backup ring, which are available in very broad diameter range. This leads to outstanding durability and reliability of the sealing solution.

Emergency equipment and valves

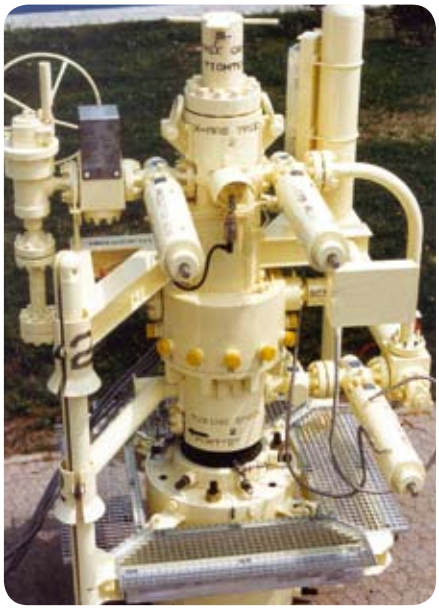
Valving is one of the key issues in all areas of Oil & Gas industry and many regulations have been developed with regard to emergency situations occurring. These also include special equipment that is only installed to safely handle an emergency situation.

For an emergency shutdown valve, highest reliability and total compliance with environmental and safety directives is required.

In these applications seals have to deal with high pressures (up to 550 bar resp. *8 000 psi*) and a wide temperature range (–20 to 65 °C resp. –4 to *150 °F*). By introducing H-ECOPUR and selecting a composite seal profile with an SKF Ecotal backup ring for a hydraulic actuator, the seal suffers no operational damage and the sealing capability is maintained in all operating stages.

In case of pneumatic actuators e.g. in arctic conditions the specially designed T-ECOPUR (low temperature grade) with an SKF Ecosil energizer comes into consideration.

SKF Economos seals can be found in a variety of different valves including emergency shutdown valves, gate valves, swab valves, wing valves, choke valves, BOPs, etc.



Sealing materials for Oil & Gas

For polymeric seals the Oil & Gas industry provides the most hostile environment (mechanically and chemically). It is essential to fulfil the steadily increasing demands in safety, reliability and cost efficiency for all Oil & Gas applications.

SKF Economos is equipped with state-of-the-art R&D resources including computer aided engineering (CAE) tools, advanced seal test rigs and highly qualified polymer-scientists operating a materials characterization centre. This technological expertise results in the innovative development of materials that set new performance standards for the Oil & Gas industry.

A variety of polymers can be used as sealing materials in the Oil & Gas industry. Basically they can be separated into five groups:

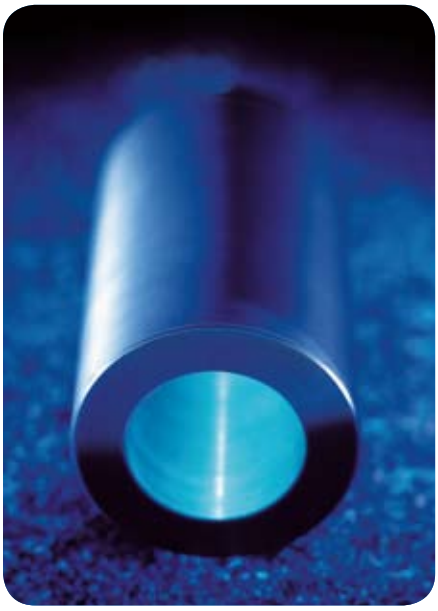
1 Elastomers
2 Thermoplastic elastomers
3 Flouro-elastomers and its compounds
4 Thermoplastics
5 Thermosets

Today, elastomers are the most frequently used materials for oilfield applications. For some applications NBR (nitrile rubber) or HNBR (hydrogenated nitrile rubber) is the material of first choice, because of their chemical resistance. In case of higher requirements concerning chemical and temperature resistance fluorinated elastomers (FKM/FPM, TFE/P, FFKM) come into consideration.

In some applications elastomers alone do not provide sufficient sealing capabilities. In these cases other high quality materials such as PTFE or PEEK need to be selected either in combination with elastomers for anti extrusion purposes, or even as a sealing material itself.

However, SKF Economos has developed a wide range of thermoplastic elastomers and provides oilfield compatible Polyurethanes, which offer superior abrasion and extrusion resistance compatible with oilfield fluids, including sour gas according to NORSOK.

When elastomers are exposed to high gas pressures for a certain period of time and this pressure is released quickly, material deterioration may occur. The effects of explosive decompression (ED) can be influenced by specific additives, which alter the permeability of the material. SKF Economos has a wide range of ED resistant materials in accordance with the international NACE resp. NORSOK test standards available.



Sealing materials

Elastomer

Material		Colour	Properties
SKF Ecorubber-1	(NBR, 85 Shore A)	black	Standard grade, good chemical resistance
SKF Ecorubber-1-85A-b-LT	(NBR, 85 Shore A)	black	Low temperature grade, outstanding cold flexibility
SKF Ecorubber-H	(HNBR, 85 Shore A)	black	Standard grade, good mechanical and chemical properties
SKF Ecorubber-H-85A-b-LT	(HNBR, 85 Shore A)	black	Low temperature grade, good mechanical and chemical properties
SKF Ecorubber-H-85A-b-ED	(HNBR, 85 Shore A)	black	Good mechanical, chemical and explosive decompression properties
SKF Ecorubber-H-85A-b-ED-LT	(HNBR, 85 Shore A)	black	Explosive decompression resistant low temperature grade
SKF Ecorubber-H-93A-b	(HNBR, 94 Shore A)	black	Hard grade, high pressure resistance
SKF Ecorubber-2	(FKM, FPM, 85 Shore A)	brown	Standard grade, good chemical resistance
SKF Ecorubber-2-85A-b-ED	(FKM, FPM, 85 Shore A)	black	Good chemical and explosive decompression resistance
SKF Ecorubber-2-85A-b-ED-TP	(FKM, FPM, 85 Shore A)	black	Good chemical, explosive decompression and sour gas resistance
SKF Ecorubber-2-85A-b-Ex	(FKM, FPM, 85 Shore A)	black	Viton extreme, outstanding chemical resistance
SKF Ecorubber-2-75A-b-C	(FKM, FPM, 75 Shore A)	black	Soft grade, low compression set, good wear characteristics
SKF Ecorubber-2-75A-b-perox	(FKM, FPM, 75 Shore A)	black	Peroxide-cured, good chemical and heat resistance
SKF Ecorubber-2-90A-b	(FKM, FPM, 90 Shore A)	black	Hard grade, high pressure and extrusion resistance
SKF Ecorubber-2-95A-b	(FKM, FPM, 95 Shore A)	black	Very hard grade, for special applications
SKF Ecorubber-3	(EPDM, 85 Shore A)	black	Standard grade, good mechanical properties, for steam injection
SKF Ecorubber-3-93A-b	(EPDM, 93 Shore A)	black	Hard grade, high pressure resistance, for steam injection
SKF Ecoperfluoro	(FFKM, 80 Shore A)	black	Standard grade, outstanding chemical resistance including sour gas and high temperature steam, extreme heat resistance
SKF Ecoflas	(TFE/P, 83 Shore A)	black	Outstanding resistance to hot water, steam, corrosion inhibitors, glycol and sour gas
SKF Ecoflas-85A-b-ED	(TFE/P, 85 Shore A)	black	Explosive decompression resistant grade
SKF Fluorosilicone-83A-rb	(FMVQ, 83 Shore A)	reddish brown	Outstanding chemical resistance

Polyurethanes

Material		Colour	Properties
ECOPUR	(TPU, 95 Shore A)	green	Good chemical resistance, for hydraulic applications
H-ECOPUR	(TPU, 95 Shore A)	red	Outstanding chemical resistance against water based fluids and sour gas
S-ECOPUR	(TPU, 95 Shore A)	charcoal grey	Outstanding sliding performance, similar mechanical and chemical properties to H-ECOPUR
T-ECOPUR	(TPU, 95 Shore A)	blue	Low temperature grade, excellent cold flexibility, limited chemical resistance
G-ECOPUR	(CPU, 95 Shore A)	red	Chemical resistance similar to H-ECOPUR
X-ECOPUR	(TPU, 57 Shore D)	dark-green	Increased pressure and extrusion resistance, for composite seals, chemical resistance similar to ECOPUR
XH-ECOPUR	(TPU, 60 Shore D)	dark-red	Increased pressure and extrusion resistance, for composite seals, chemical resistance similar to H-ECOPUR
XS-ECOPUR	(TPU, 57 Shore D)	charcoal-grey	Increased pressure and extrusion resistance, for composite seals, chemical resistance similar to S-ECOPUR, outstanding sliding performance

PTFE and its compounds

Material		Colour	Properties
SKF Ecoflon 1	(PTFE, virgin)	white	High chemical resistance
SKF Ecoflon 2	(PTFE, 15% glass, 5% MOS2)	grey	Good mechanical characteristics
SKF Ecoflon 3	(PTFE, 40% bronze)	bronze	Good tribological properties, high pressure resistance
SKF Ecoflon 3F	(PTFE, 40% bronze)	green	High pressure resistance, improved wear and abrasion resistance compare to SKF Ecoflon 3
SKF Ecoflon 4	(PTFE, 25% carbon)	black	High wear and pressure resistance
SKF Ecoflon 5	(PTFE, modified)	white	Unfilled, modified, increased pressure and creep resistance

Thermoplastics

Material		Colour	Properties
SKF Ecomid	(PA)	black	Good mechanical properties, glass filled grades for increased pressure available. Not to be used in water or moist environments!
SKF Ecotal	(POM)	black	Good mechanical characteristics; glass filled grades for increased pressure
SKF Ecopaek	(PEEK)	cream/black	Exceptional mechanical, chemical and thermal resistance, glass and carbon filled grades for high pressure applications
SKF Ecopps	(PPS)	beige	Outstanding hardness and modulus, high chemical and thermal resistance

[1] Additionally, SKF Economos offers a wide range of organic and inorganic compounds, such as PTFE + glass, graphite (steam injection), EKONOL, PI, PEEK, etc..
[2] SKF Economos offers a wide range of individual thermoplastic materials specially designed for guide rings, backup rings, etc..

Properties

Elastomers

	DIN	Unit	SKF Ecorubber-1	SKF Ecorubber-1 -85A-b-LT	SKF Ecorubber-H	SKF Ecorubber-H -85A-b-LT	SKF Ecorubber-H -85A-b-ED	SKF Ecorubber-H -85A-b-ED-LT	SKF Ecorubber-H -93A-b
Colour			NBR black	NBR black	HNBR black	HNBR black	HNBR black	HNBR black	HNBR black
Density	53479	g/cm³	1,31	1,29	1,22	1,21	1,27	1,38	1,23
Thermal properties									
Max. service temperature		°C	100	100	150	150	150	150	150
Min. service temperature		°C	-30	-50	-25	-40	-25	-35	-25
Mechanical properties									
Tensile test[1]									
– Tensile strength[2]	53504	MPa	16	16	18	18	21	12	21
– elongation at break[2]	53504	%	130	130	180	180	200	200	94
– 100% modulus[2]	53504	MPa	11	13	10	9	10	8	-
Compression set[3]									
– after 22 h at 100 °C	53517	%	15	14	22	23	18	23	16
– after 22 h at 175 °C	53517	%	-	-	-	-	-	-	-
Tear strengh	53515	N/mm	20	17	30	15	23	20	28
Abrasion	53516	mm³	90	90	90	94	130	150	117
Durometer hardness Shore A[4]	53505		85	85	85	85	88	85	93
Durometer hardness Shore D[4]	53505		36	35	33	30	41	35	48

Polyurethanes

	DIN	Unit	ECOPUR	H-ECOPUR	S-ECOPUR	T-ECOPUR	G-ECOPUR	X-ECOPUR	XH-ECOPUR	XS-ECOPUR
Colour			TPU green	TPU red	TPU grey / black	TPU blue	TPU red	TPU dark green	TPU dark red	TPU grey / black
Density	53479	g/cm³	1,2	1,2	1,24	1,17	1,2	1,21	1,22	1,26
Thermal properties										
Max. service temperature		°C	110	110	110	110	110	110	110	110
Min. service temperature		°C	-30	-20	-20	-50	-30	-30	-20	-20
Mechanical properties										
Tensile test[1]										
– tensile strength[2]	53504	MPa	40	50	50	50	45	50	53	45
– elongation at break[2]	53504	%	430	330	380	450	280	380	350	350
– 100% modulus[2]	53504	MPa	12	13	17	12	11	18	20	24
Compression set[3]										
– after 24 h at 70 °C / 20% deformation	53517	%	30	27	25	-	30	27	26	24
– after 24 h at 100 °C / 20% deformation	53517	%	35	33	30	-	40	33	30	30
– after 70 h at 70 °C / 20% deformation	53517	%	20	20	-	20	20	-	-	-
Tear strengh	53515	N/mm	100	100	120	80	40	120	140	160
Abrasion	53516	mm³	18	17	17	15	25	20	20	20
Durometer hardness Shore A[4]	53505		95	95	95	95	95	97	97	96
Durometer hardness Shore D[4]	53505		48	48	48	48	47	57	60	57

All test performed at 23 °C, except other themperatures are listed.
[1] Test specimens: Type S 2.
[2] Test speed: 200 mm/min.
[3] Tests performed on discs Ø 13 × 6,3 mm. Compression rating 20% (TPUs) as well as 15% (elastomers). Test specimens are stored at elevated temperature in an air circulating oven for defined period. Compression set represents the percentage of deflection, which did not return to its original shape.
[4] 6,3 mm thick test specimens.

SKF Ecorubber-2	SKF Ecorubber-2 -85A-b-ED	SKF Ecorubber-2 -85A-b-ED-TP	SKF Ecorubber-2 -85A-b-Ex	SKF Ecorubber-2 -75A-b-C	SKF Ecorubber-2 -75A-b-perox	SKF Ecorubber-2 -90A-b	SKF Ecorubber-2 -95A-b	SKF Ecorubber-3	SKF Ecorubber-3 -93A-b	SKF Ecoperfluoro	SKF Ecoflas	SKF Ecoflas-85A-b-ED	SKF Fluorosilicone -83A-rb
FKM	FKM	FKM	FKM	FKM	FKM	FKM	FKM	EPDM	EPDM	FFKM	TFE/P	TFE/P	FMVQ
brown	black	black	black	black	black	black	black	black	black	black	black	black	red. brown
2,30	2,30	1,87	1,82	1,86	1,90	1,79	1,82	1,22	1,17	-	1,60	1,60	1,57
200	200	200	200	200	200	200	200	150	150	290	200	200	200
-20	-20	-10	-10	-20	-20	-20	-20	-50	-50	-15	-10	-10	-65
8	8	20	12	11	13	9	13	12	15	15	13	18	7
200	200	230	220	210	230	120	105	110	95	180	220	220	175
5	5	8	6	5,8	4	8	12	9	-	9	8	8	5
-	-	-	-	-	-	-	-	15	16	-	-	-	-
20	20	19	42	7	30	14	15	-	-	-	29	39	23
21	21	21	20	17	18	22	23	15	16	-	19	19	12
150	150	74	170	135	100	210	200	120	105	-	110	110	-
85	85	85	85	75	75	90	95	85	93	80	83	85	83
36	36	37	39	25	27	45	50	34	41	-	31	38	24

The data listed here fall within the normal range of product properties. However, they are not guaranteed and shall not be used to establish material specification limits nor used alone as the basis of design. This is valid for all the tables at pages 14, 15, 16, 18, 19, 20 and 21.

Properties

PTFE and compounds

	ISO / (IEC)	Unit	SKF Ecoflon 1 virgin	SKF Ecoflon 2 15% glass fibre 5% MoS_2	SKF Ecoflon 3	SKF Ecoflon 3F	SKF Ecoflon 4	SKF Ecoflon 5
Colour			PTFE white	PTFE dark grey	PTFE bronze	PTFE green	PTFE black	PTFE white
Density	1183	g/cm³	2,17	2,25	3,0	3,1	2,1	2,16
Thermal properties								
Max. service temperature in air								
– for short periods [1]		°C	300	300	300	300	300	300
– continuously for 5 000 / 20 000 h [2]		°C	– / 260	– / 260	– / 260	– / 260	– / 260	– / 260
Min. service temperature [3]		°C	– 200	– 200	– 200	– 200	– 200	– 200
Mechanical properties								
Tensile test [4]								
– tensile stress at yield / break [5]	527	MPa	– / 27	– / 18	– / 22	– / 22	– / 15	– / 30
– tensile strain at break [5]	527	%	300	200	280	300	180	360
– tensile modulus of elasticity [6]	527	MPa	400 – 700	–	–	–	–	–
Compression test [7]								
– compressive stress at 2% nominal strain	604	MPa	8	14	–	–	–	–
Shore hardness D (3 s)	868		57	60	64	64	65	59

Thermoplastics

	ISO / (IEC)	Unit	SKF Ecomid	SKF Ecotal	SKF Ecopaek	SKF Ecopps
Colour			PA 6 G black	POM - C natural / black	PEEK grey	PPS beige
Density	1183	g/cm³	1,15	1,41	1,32	1,35
Thermal properties						
Max. service temperature in air						
– for short periods [1]		°C	170	140	310	260
– continuously for 5 000 / 20 000 h [2]		°C	105 / 90	115 / 100	– / 250	– / 220
Min. service temperature [3]		°C	- 30	– 50	– 60	–
Mechanical properties						
Tensile test [4]						
– tensile stress at yield [5]	527	MPa	85 / 65 [8]	68	110	95
– tensile strain at break [5]	527	%	25 / >50 [8]	35	20	15
– tensile modulus of elasticity [6]	527	MPa	3 500 / 1 800 [8]	3 100	4 400	3 450
Compression test [7]						
– compressive stress at 1 / 2 / 5% nominal strain	604	MPa	26 / 51 / 92	19 / 35 / 67	29 / 57 / –	–

All test performed at 23 °C, except other themperatures are listed.

[1] Short exposure time (a few hours) in applications where no or only a very low load is applied to the material.

[2] Temperature resistance over a period of min. 20 000 hours. After this period of time, there is a decrease in tensile strength of about 50% compared to the original value. The temperature values given here are based on the thermal oxidative degradation, which causes a reduction in properties. Please note however, that, as far as all thermoplastics are concerned, the maximum service temperature in many cases depends on the duration and the magnitude of the mechanical stresses to which the material is subjected.

[3] Impact strength decreases with decreasing temperature; the minimum service temperature is practically mainly determined by the extent to which the material is subjected to impact. The values given here are based on unvafourable impact conditions and may consequently not be considered as being the absolute practical limits.

[4] Test specimens: Type 1 B.

[5] Test speed: 5 mm / min.

[6] Test speed: 1 mm / min.

[7] Test specimens: cylinders with ∅ 12 x 30 mm.

[8] Left value referring to dry material; right value referring to material in equilibrium with the standard atmosphere 23°C / 50% relative humidity (mostly derived from literature).

Chemical resistance

	Elastomers										
	SKF Ecorubber-1	SKF Ecorubber-1 -85A-b-LT	SKF Ecorubber-H	SKF Ecorubber-H -85A-b-LT	SKF Ecorubber-H -85A-b-ED	SKF Ecorubber-H -85A-b-ED-LT	SKF Ecorubber-H -93A-b	SKF Ecorubber-2	SKF Ecorubber-2 -85A-b-ED	SKF Ecorubber-2 -85A-b-ED-TP	SKF Ecorubber-2 -85A-b-Ex
Acids											
– inorganic diluted	o	o	o	o	o	o	o	+	+	+	+
– inorganic concentrated	–	–	–	–	–	–	–	+	+	+	+
– organic diluted	+	+	+	+	+	+	+	+	+	+	+
– organic concentrated	–	–	–	–	–	–	–	–	–	–	o
Alkalies general	o	o	o	o	o	o	o	o	o	o	+
Alcohols general (except Methanol)	+	+	+	+	+	+	+	+	+	+	+
Biocides											
– diluted	+	+	+	o	o	o	+	+	+	+	+
– concentrated	–	–	–	–	–	–	–	–	–	–	–
Brines general	o	o	o	o	o	o	o	+	+	+	+
Carbon dioxides	+	+	+	+	+	+	+	+	+	+	+
Corrosion inhibitors											
– amine based	–	–	+	o	+	o	+	–	–	–	+
– potassium based	–	–	o	o	o	o	o	–	–	–	o
Crude oil											
– sweet	+	+	+	+	+	+	+	+	+	+	+
– sour; up to 5% H_2S	–	–	+	o	+	o	+	+	+	+	+
– sour; above 5% H_2S	–	–	–	–	o	–	–	–	–	o	o
Drilling mud											
– diesel based	o	o	+	+	+	+	+	o	o	o	+
– ester based	–	–	–	–	–	–	–	o	o	o	+
– mineral oil based	+	+	+	+	+	+	+	+	+	+	+
– silicate based	o	o	+	+	+	+	+	+	+	+	o
Glycols general	+	+	+	+	+	+	+	+	+	+	+
Hydraulic fluids											
– mineral oil based	+	+	+	+	+	+	+	+	+	+	+
– HFA (water – oil emulsion)	+	+	+	+	+	+	+	+	+	+	+
– HFB (oil – water emulsion)	o	o	+	+	+	+	+	+	+	+	+
– HFC (water – glycol)	+	+	+	+	+	+	+	–	–	–	+
– HFD (water free)											
HFD–R	–	–	–	–	–	–	–	o	o	o	+
HFD–S	–	–	–	–	–	–	–	+	+	+	+
HFD–U	o	o	o	o	o	o	o	+	+	+	+
Hydrocarbons											
– aliphatic	+	+	+	+	+	+	+	+	+	+	+
– aromatic	o	o	o	o	o	o	o	+	+	+	+
Hydrogen sulphide	–	–	+	o	+	o	+	o	o	+	+
Methanol											
– diluted	+	+	+	+	+	+	+	+	+	+	+
– concentrated	o	o	+	o	+	o	+	–	–	–	+
Natural gas	+	+	+	+	+	+	+	+	+	+	+
Sea water	+	+	+	+	+	+	+	+	+	+	+
Solvents											
– Toluene	–	–	–	–	–	–	–	+	+	+	+
– Acetone	–	–	–	–	–	–	–	–	–	–	–
– MEK	–	–	–	–	–	–	–	–	–	–	–
Steam	–	–	–	–	–	–	–	–	–	–	o
Water											
– general	+	+	+	+	+	+	+	+	+	+	+
– produced	o	o	+	+	+	+	+	o	o	o	o
– treated	o	o	+	+	+	+	+	–	–	–	o

Rating legend:
+ excellent
o good / fair
– poor

	SKF Ecorubber-2 -75A-b-C	SKF Ecorubber-2 -75A-b-perox	SKF Ecorubber-2 -90A-b	SKF Ecorubber-2 -95A-b	SKF Ecorubber-3	SKF Ecorubber-3 -93A-b	SKF Ecoperfluoro	SKF Ecoflas	SKF Ecoflas-85A-b-ED	SKF Fluorosilicone -83A-rb
Acids										
– inorganic diluted	+	+	+	+	+	+	+	+	+	+
– inorganic concentrated	+	+	+	+	+	+	+	+	+	+
– organic diluted	+	+	+	+	+	+	+	+	+	+
– organic concentrated	–	+	–	–	+	+	+	o	o	o
Alkalies general	o	+	o	o	+	+	+	+	+	+
Alcohols general (except Methanol)	+	+	+	+	+	+	+	+	+	+
Biocides										
– diluted	+	+	+	+	+	+	+	+	+	+
– concentrated	–	+	–	–	–	–	+	o	o	–
Brines general	+	+	+	+	+	+	+	+	+	+
Carbon dioxides	+	+	+	+	o	o	+	o	o	+
Corrosion inhibitors										
– amine based	–	+	–	–	+	+	+	+	+	o
– potassium based	–	o	–	–	+	+	+	+	+	o
Crude oil										
– sweet	+	+	+	+	–	–	+	+	+	+
– sour; up to 5% H_2S	o	+	+	+	–	–	+	+	+	o
– sour; above 5% H_2S	–	o	–	–	–	–	+	o	o	–
Drilling mud										
– diesel based	o	o	o	o	–	–	+	o	o	+
– ester based	o	o	o	o	–	–	+	o	o	o
– mineral oil based	+	+	+	+	–	–	+	+	+	+
– silicate based	+	+	+	+	o	o	+	+	+	+
Glycols general	+	+	+	+	+	+	+	+	+	+
Hydraulic fluids										
– mineral oil based	+	+	+	+	–	–	+	+	+	+
– HFA (water – oil emulsion)	+	+	+	+	–	–	+	+	+	+
– HFB (oil – water emulsion)	+	+	+	+	–	–	+	+	+	o
– HFC (water – glycol)	–	o	–	–	+	+	+	+	+	o
– HFD (water free)										
HFD–R	o	+	o	o	+	+	+	+	+	+
HFD–S	+	+	+	+	–	–	+	o	o	+
HFD–U	+	+	+	+	–	–	+	o	o	–
Hydrocarbons										
– aliphatic	+	+	+	+	–	–	+	+	+	+
– aromatic	+	+	+	+	–	–	+	o	o	+
Hydrogen sulphide	o	+	o	o	+	+	+	+	+	–
Methanol										
– diluted	+	+	+	+	+	+	+	+	+	+
– concentrated	–	o	–	–	o	o	+	+	+	+
Natural gas	+	+	+	+	–	–	+	+	+	o
Sea water	+	+	+	+	+	+	+	+	+	+
Solvents										
– Toluene	+	+	+	+	–	–	+	o	o	o
– Acetone	–	o	–	–	+	+	+	–	–	–
– MEK	–	o	–	–	+	+	+	–	–	–
Steam	–	o	–	–	+	+	+	+	+	–
Water										
– general	+	+	+	+	+	+	+	+	+	+
– produced	o	+	o	o	o	o	+	+	+	o
– treated	–	+	–	–	+	+	+	+	+	o

Chemical resistance

	Polyurethanes							
	ECOPUR	H–ECOPUR	S–ECOPUR	T–ECOPUR	G–ECOPUR	X–ECOPUR	XH–ECOPUR	XS–ECOPUR
Acids								
– inorganic diluted	–	+	o	–	o	–	+	o
– inorganic concentrated	–	–	–	–	–	–	–	–
– organic diluted	o	+	+	o	+	o	+	+
– organic concentrated	–	o	o	–	o	–	o	o
Alkalies general	–	o	o	–	o	–	o	o
Alcohols general (except Methanol)	–	+	o	–	o	–	+	o
Biocides								
– diluted	o	+	+	o	+	o	+	+
– concentrated	–	–	–	–	–	–	–	–
Brines general	o	+	+	o	+	o	+	+
Carbon dioxides	o	+	+	o	+	o	+	+
Corrosion inhibitors								
– amine based	–	o	o	–	o	–	o	o
– potassium based	o	+	+	o	+	o	+	+
Crude oil								
– sweet	+	+	+	+	+	+	+	+
– sour; up to 5% H_2S	o	+	+	o	+	o	+	+
– sour; above 5% H_2S	–	+	o	–	o	–	+	o
Drilling mud								
– diesel based	o	+	+	o	+	o	+	+
– ester based	–	o	o	–	o	–	o	o
– mineral oil based	+	+	+	+	+	+	+	+
– silicate based	o	+	+	o	+	o	+	+
Glycols general	–	o	o	–	o	–	o	o
Hydraulic fluids								
– mineral oil based	+	+	+	+	+	+	+	+
– HFA (water – oil emulsion)	–	+	+	–	+	–	+	+
– HFB (oil – water emulsion)	–	+	+	–	+	–	+	+
– HFC (water – glycol)	–	o	o	–	o	–	o	o
– HFD (water free)								
HFD–R	–	–	–	–	–	–	–	–
HFD–S	–	–	–	–	–	–	–	–
HFD–U	–	+	+	–	+	–	+	+
Hydrocarbons								
– aliphatic	+	+	+	+	+	+	+	+
– aromatic	o	o	o	o	o	o	o	o
Hydrogen sulphide	–	+	+	–	o	–	+	+
Methanol								
– diluted	o	+	+	o	+	o	+	+
– concentrated	–	–	–	–	–	–	–	–
Natural gas	o	+	+	o	+	o	+	+
Sea water	–	+	+	–	+	–	+	+
Solvents								
– Toluene	–	–	–	–	–	–	–	–
– Acetone	–	–	–	–	–	–	–	–
– MEK	–	–	–	–	–	–	–	–
Steam	–	–	–	–	–	–	–	–
Water								
– general	–	+	+	–	+	–	+	+
– produced	–	+	+	–	+	–	+	+
– treated	–	o	o	–	o	–	o	o

Rating legend:
+ excellent
o good / fair
– poor

	PTFE and its compounds						Thermoplastics			
	SKF Ecoflon 1 virgin	**SKF Ecoflon 2** 15% glass fibre 5% MoS_2	**SKF Ecoflon 3**	**SKF Ecoflon 3F**	**SKF Ecoflon 4**	**SKF Ecoflon 5**	**SKF Ecomid**	**SKF Ecotal**	**SKF Ecopaek**	**SKF Ecopps**
Acids										
– inorganic diluted	+	+	+	+	+	+	o	o	+	+
– inorganic concentrated	+	–	o	o	–	+	–	–	–	o
– organic diluted	+	+	+	+	+	+	o	o	+	+
– organic concentrated	+	+	+	+	+	+	o	o	+	+
Alkalies general	+	o	o	o	o	+	o	o	+	+
Alcohols general (except Methanol)	+	+	+	+	+	+	+	+	o	o
Biocides										
– diluted	+	+	+	+	+	+	+	+	+	+
– concentrated	+	+	+	+	+	+	–	o	+	+
Brines general	+	+	+	+	+	+	o	+	+	+
Carbon dioxides	+	+	+	+	+	+	+	+	+	+
Corrosion inhibitors										
– amine based	+	+	+	+	+	+	+	+	+	+
– potassium based	+	+	+	+	+	+	o	+	+	+
Crude oil										
– sweet	+	+	+	+	+	+	+	+	+	+
– sour; up to 5% H_2S	+	+	+	+	+	+	+	+	+	+
– sour; above 5% H_2S	+	o	+	+	o	+	o	+	+	+
Drilling mud										
– diesel based	+	+	+	+	+	+	+	+	+	+
– ester based	+	+	+	+	+	+	+	+	+	+
– mineral oil based	+	+	+	+	+	+	+	+	+	+
– silicate based	+	+	+	+	+	+	+	+	+	+
Glycols general	+	+	+	+	+	+	o	+	+	+
Hydraulic fluids										
– mineral oil based	+	+	+	+	+	+	+	+	+	+
– HFA (water – oil emulsion)	+	+	+	+	+	+	+	+	+	+
– HFB (oil – water emulsion)	+	+	+	+	+	+	+	+	+	+
– HFC (water – glycol)	+	+	+	+	+	+	o	+	+	+
– HFD (water free)										
HFD–R	+	+	+	+	+	+	+	+	+	+
HFD–S	+	+	+	+	+	+	+	+	+	+
HFD–U	+	+	+	+	+	+	+	+	+	+
Hydrocarbons										
– aliphatic	+	+	+	+	+	+	+	+	+	+
– aromatic	+	+	+	+	+	+	+	+	+	+
Hydrogen sulphide	+	o	+	+	+	+	–	+	+	+
Methanol										
– diluted	+	+	+	+	+	+	+	+	+	+
– concentrated	+	+	+	+	+	+	–	+	+	o
Natural gas	+	+	+	+	+	+	+	+	+	+
Sea water	+	+	+	+	+	+	+	+		+
Solvents										
– Toluene	+	o	+	+	+	+	+	+	+	–
– Acetone	+	+	+	+	+	+	+	+	+	+
– MEK	+	+	+	+	+	+	+	o	+	o
Steam	+	+	+	+	+	+	–	–	+	+
Water										
– general	+	+	+	+	+	+	o	+	+	+
– produced	+	+	+	+	+	+	o	+	+	+
– treated	+	+	+	+	+	+	o	o	+	+

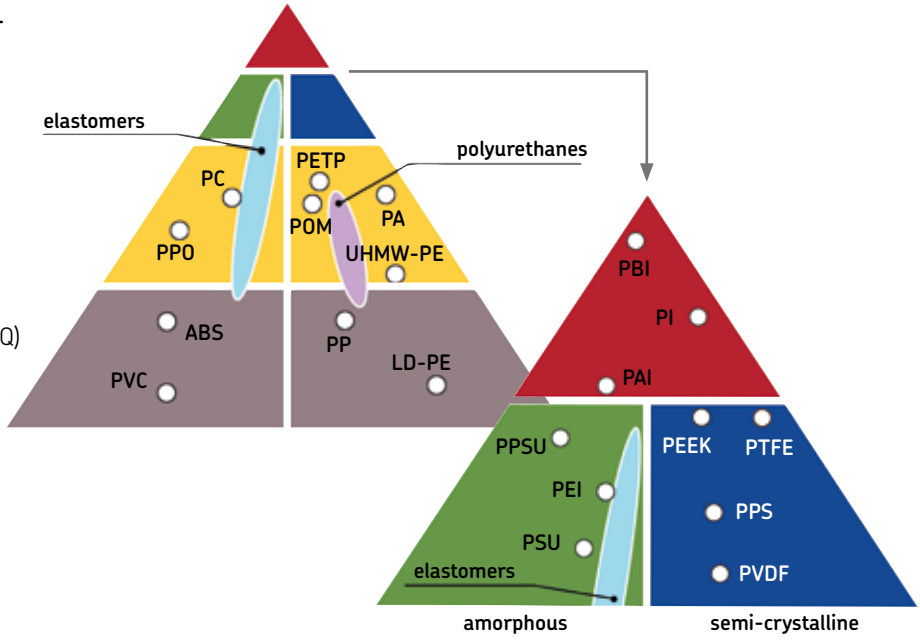
Advanced Engineered Plastic Parts

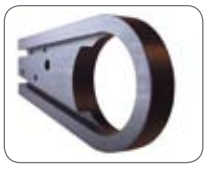
High performance plastic materials are also working at temperatures above +150 °C without any substantial change to their mechanical properties. For the Oil and Gas industry SKF Economos offers machined plastic products made of these high performance polymers as well as standard thermoplastics.

As stated in our capability flyer, SKF Economos produces all seals and advanced engineered plastic parts as a single item, in small quantities, or larger quantities up to a couple of thousand, using machining or milling techniques. So, whether you need prototypes, weight reduction or high performance products, please contact our application engineers, who can advise you on the best possible solution for your application.

Some typical engineered and advanced engineered plastic materials we process:

Polyethylene with high or ultra high molecular weight (HMWPE, UHMWPE)
Polyurethane (TPU, CPU)
Polyoxymethylene (POM)
Polyamide (PA)
Polyethylene terephthalate (PETP)
Polycarbonate (PC)
Elastomers (NBR, H-NBR, FPM, FKM, EPDM, MVQ)
Polyvinylidene fluoride (PVDF)
Polyphenylenesulfide (PPS)
Polytetrafluoroethylene (PTFE)
Polyetheretherketone (PEEK)
Polysulphone (PSU)
Polyetherimide (PEI)
Polyphenylensulphone (PPSU)
Polyamide Imide (PAI)
Polyimide (PI)
Polybenzimidazole (PBI)





Chain guide, SKF Ecomid

Sliding parts, SKF Ecowear

Special parts according to customer's design, SKF Ecopaek

Special parts according to customer's design, SKF Ecopaek

Sliding elements, SKF Ecomid

Tube sealing element, SKF Ecorubber 3 + SKF Ecoflas

The knowledge engineering company

The SKF brand now stands for more than ever before and offers customers a greater choice than ever.

While SKF maintains its leadership in the productions of quality bearings throughout the world, greater customer value has been created through new advances in technology, product support and services, making SKF a truly solutions orientated supplier. Customer productivity has increased through cutting-edge application specific products, design simulation tools, consultancy services, plant asset efficiency maintenance programmes and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but now offers even more.

SKF – the knowledge engineering company. Seals and sealing technology are part of SKF's essential skills and signify excellence and leadership. SKF Sealing Solutions supplies best in class standard seals, customized standards and custom engineered solutions.

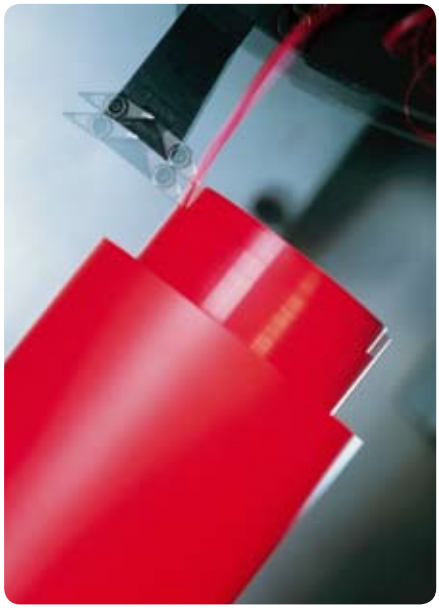
SKF Economos offers a unique and comprehensive seal consultancy service, providing customers with the latest advances in sealing technology. In cooperation with our customers we analyse operational requirements and applications. All our machined seals, whether standard or customized, are manufactured on demand without tooling costs or delays.

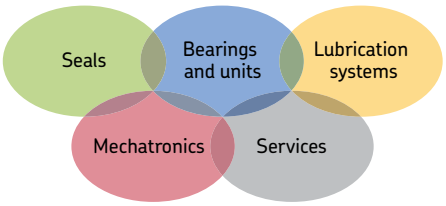
Material availability

All the materials listed in this brochure are available in diameters up to 600 mm and some selected grades can be supplied in diameters up to 1 600 mm (rubber materials) and up to 4 000 mm – one seal, or larger dimensions using our specially developed welding technique (polyurethane materials). Milled parts, plates and sheets are available in a wide range of dimensions.

SKF Economos can produce all seals and plastic parts as a single item, in small quantities, or larger quantities up to a couple of thousand, using machining or milling techniques.

Larger quantities and high volume business are produced using an injection moulding process, as used in the manufacture of polyurethanes and high performance thermoplastics such as polyetheretherketone (PEEK).





The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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