Solutions for the metal industry

Machined seals

The Power of Knowledge Engineering


Sealing solutions customized

for your system performance

SKF is a supplier of top quality, highly reliable products to the metal industry. Customers benefit from SKF's comprehensive field experience and extensive knowledge in the sealing technology.

Optimized sealing solutions

SKF helps customers to achieve their strategic goals:

- Improved safety at work
- Increased productivity
- Reduced effects of contamination
- Increased service life
- Reduced Total Cost of Operation (TCO)
- Reduced operating media and energy consumption
- Increased Mean Time Between Failures (MTBF)

SKF provides the most flexible options for the entire steel making process: logistics and transportation, blast furnace plant, melt shop, casting machine and rolling mill.

Competences

SKF is a leading supplier for standard and custom engineered sealing solutions. Based on many years of experience, SKF is able to support the metal industry with

- on-site solution analysis,
- application engineering,
- material development for high speed solutions, increased wear resistance, reduced friction etc.
- integrated solutions consisting of seals and advanced engineered plastic parts,
- just-in-time availability of standard seals and customized sealing solutions,
- moulded seals for higher volume orders.

Customers benefit from flexibility and short delivery times for customized seals. SKF machined seals are always made from high-performance materials and cover the following product groups:

- Hydraulic and pneumatic sealing systems
- Sealing solutions for rotary distributors and joints
- Radial shaft seals
- V-rings
- Gaskets for flange connections
- Static seals and O-rings
- Advanced engineered plastic parts

Finding the most suitable sealing solution is a complex and rewarding task. SKF's experience shows that a sealing system can always be optimized.



The right sealing solution for extreme conditions

Whenever reduced maintenance costs, increased productivity or process reliability are important – SKF is there with improved machined sealing solutions for the metal industry.

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

Operating environment

The purpose of sealing is to keep operating fluids or lubricants in the system and/or contaminants out.

Aggressive contamination can be a concern. Abrasive scale, cooling water or emulsions may affect the sealed machine part.

Fluids

Fluids affect the sealing system in many ways. The sealing material has to be compatible with internal or external fluids. Those could be lubricants, coolants, operating media in a hydraulic system, but also auxiliary cleaning or assembly media.

Operating parameters

Impact of type, speed and duration of the motion on the sealing lip is critical. Motion can be linear, rotating or pivoting, continuous or discontinuous. Operating pressures as well as possible system and application related pressure peaks are also to be considered.

Elevated temperatures may also affect the seal and its performance. In most cases, media temperature and motion speed determine the actual temperature at the sealing lip, but an elevated ambient temperature can also affect the performance of the seal.

Machine design

The operating fluid determines the seal selection in rotating as well as in reciprocating equipment.

In rotating equipment, the machine can be lubricated with grease, oil, or oil-air. In a reciprocating application, the operating fluid can be hydraulic oil, water-based fluid or compressed air.

Shaft misalignment must be considered when choosing the sealing lip design for rotating applications. Shaft-To-Bore Misalignment (STBM) and Dynamic Run-Out (DRO) are also relevant. For large sized reciprocating machines, the rod misalignment may also be of concern. The structural condition of the seal's counterface strongly affects the sealing performance.

Housing design and its structural condition determine the seal design. Open housings require a self-retaining sealing solution. Closed housings provide a perfect fit for elastomeric seals. SKF supplies customized seals for standard and non-standard housing dimensions.

Improvement potentials

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

The seal's performance can affect productivity, process reliability, MTBF and maintenance schedules. Optimizing a sealing solution can be a complex task. SKF applies its experience to customers' specific operating environment to jointly identify system optimization and cost saving potentials (in terms of TCO) generated by an optimized sealing solution.

Machined seals concept

SKF is a leading player in the global custom-made machined seals market, specializing in complete sealing services for the metal industry. SKF serves many countries worldwide with its global sales network.

Standard seals

- Seals in standard dimensions
- Extensive range of materials
- On-time availability

Customized seals

- Standard seal profiles modified to specific requirements
- Virtually unlimited dimensions
- Extensive range of materials
- On-time availability (approx. 24 hours)

Custom engineered seals

- Application engineering service
- Customer related designed sealing solutions
- Virtually unlimited dimensions and profiles
- Extensive range of materials
- Short delivery time

Due to the flexible production process, SKF can supply standard and special seals in customized dimensions and high performance sealing materials up to 4 000 mm in diameter as one piece. Large seals with diameters up to 10 000 mm and above are assembled using a special welding technique.

SKF's machined seals centers provide global availability with truly local service, being very close to the end customer. In some selected locations you can also find:

Advanced engineered plastic parts

Turned, milled and moulded parts, made of high performance plastic materials.

Other business and services

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

Upstream

❶ Seals for tap hole cylinders

One of the hottest environments a seal may be exposed to, is in blast furnace taping equipment.

The equipment used for tapping a blast furnace is exposed to extremely high temperatures. Heat protection for installed seals can be rather difficult.

SKF's high performance materials (SKF Ecorubber-2, SKF Ecoflon 2 and SKF Ecopaek), in combination with appropriate seal profiles, increase the lifespan from one week to a few months.

❷ Large diameter seals for converters

Dismantling large scale machinery to replace seals is time consuming and related downtime costs can be enourmous.

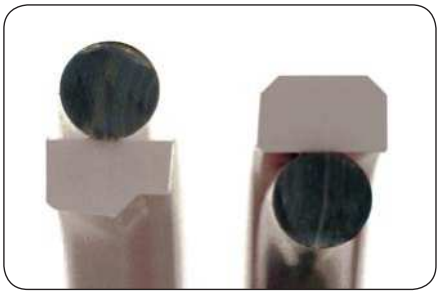
To replace a standard rubber fabric seal at the trunnion gear mechanism of a converter, SKF has developed a procedure that allows the welding of large diameter polyurethane seals on site maintaining the full sealing capacity. For SKF, installing replacement seals is a common process that allows customers to keep production downtime to a minimum.

❸ Seals for continuous casting plants

To maintain a continuous operating process without unplanned downtime, each machine component, even a simple seal, has to meet highest performance expectations.

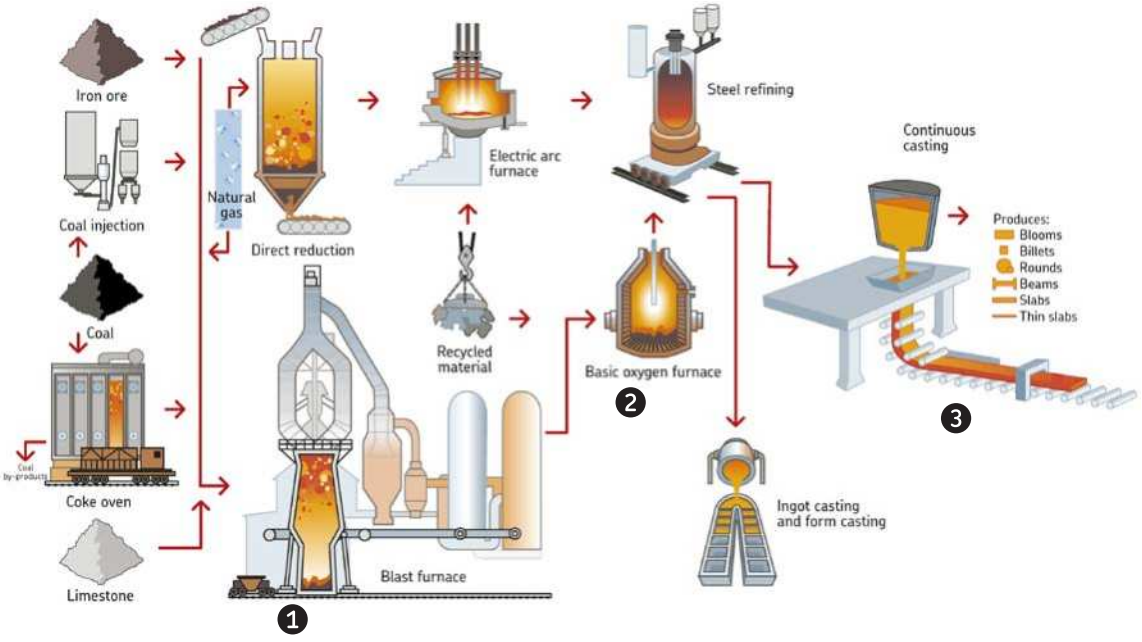
In this particular case, SKF's S09 profile is installed in hydraulic cylinders of the straightening section to increase wear resistance and reliability of the plant.

SKF provides state-of-the-art sealing technology that is widely used in continuous casting plants. In cooperation with maintenance specialists from steel plants, SKF helps to optimize the actual operations. With OEMs, SKF develops innovative solutions.

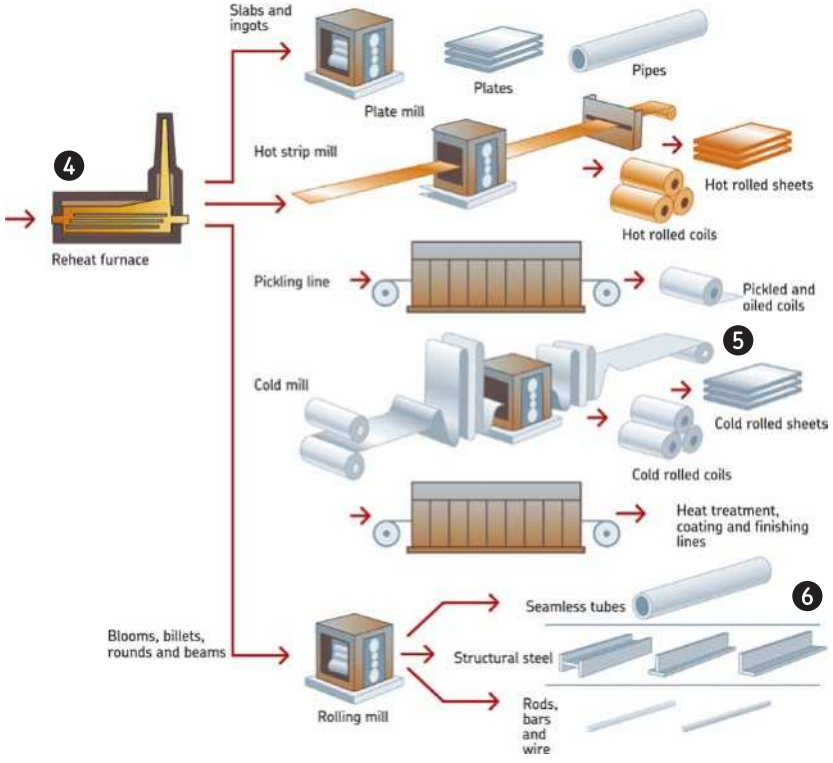


Steel making process

Upstream



Downstream



Downstream

❹ Seals for heavy duty applications

Hydraulic cylinders in extreme conditions require specific sealing solutions. Contamination and elevated temperature affect the sealing systems.

In the tough environmental conditions of the metal industry, heavy duty hydraulic cylinders tilt melting furnaces, move billets and open and shut reheating furnace doors. The SKF competence in developing new sealing materials is key to provide optimized solutions to replace technologies like rubber-fabric-packings, especially in applications where high wear resistance is required. Composite seals made of SKF Ecopeak, SKF Ecoflon 4 and SKF Ecorubber-2 combine the relevant features of these high performance materials. These materials, with appropriate seal design, are the base for high performance hydraulic sealing solutions with long service life.

❺ Seals for rolling mills

Rolling systems are quite often rotating at high speeds and need to operate 24 hours, 7 days a week.

Surface speed of rotating shafts in rolling mills can reach 30 m/s. However, even at lower revolutions, sealing can be a challenge such as when dealing with high pressure.

For this application, SKF was requested to replace an unsatisfactory seal and to design a sealing solution for the clamping mechanism of the coiler, which has to seal 100 bar pressure whilst rotating.

By introducing the K-35 profile and the use of high performance materials (SKF Ecorubber-1 and SKF Ecopaek), SKF was able to increase the lifetime of the seal by a factor of 10.

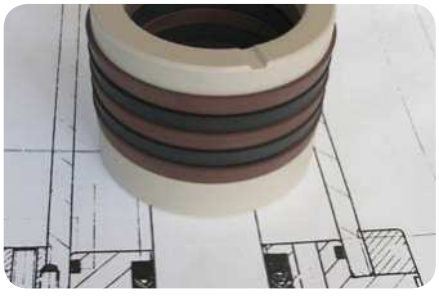
❻ Seals for online hydro tester

In a seamless tube production, every tube must be pressure tested to detect possible leakage.

The positioning procedure of tubes in the testing unit can cause mechanical damage to a seal. During the hydrostatic testing process, seals have to withstand pressure of up to 700 bar and are sometimes exposed to rather large extrusion gaps.

With the water compatible and highly wear resistant polyurethane H-ECOPUR and the right seal profile, SKF provides a reliable sealing solution that significantly extends the service life of the seal.

Tube diameters vary from small (a few inches) to several feet.



Optimized for your system performance

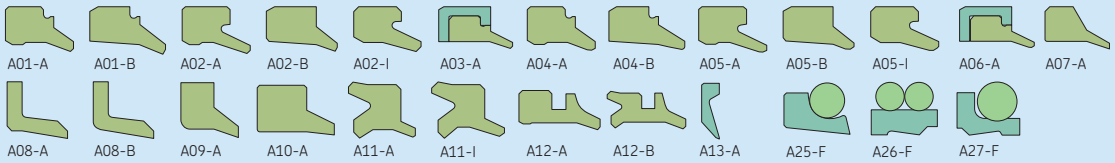
With more than 100 years of experience, SKF provides advanced sealing solutions and meets the requirements of applications and processes for the metal industry. This focus has led to the development of new, reliable products and materials specifically engineered, designed and optimized for your system performance.

After a detailed study of the customer's operation and needs, SKF will check its comprehensive list of standard products to find a suitable solution; alternatively, SKF can engineer customized solutions.

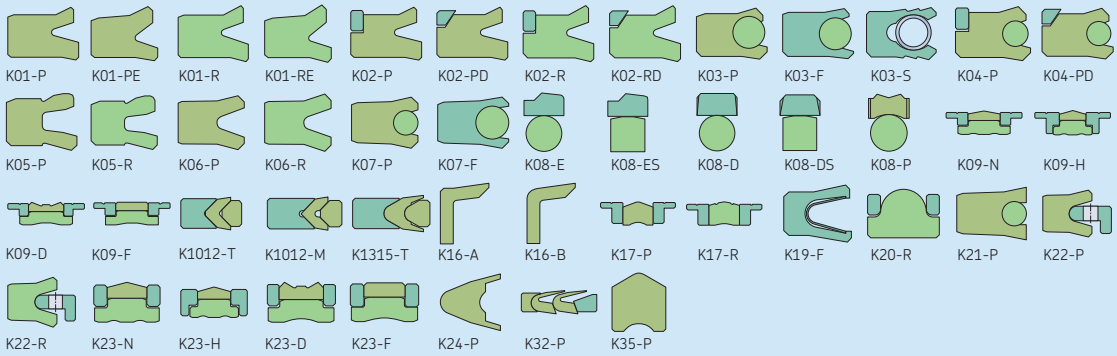
The unique SKF total service approach provides a solution with considerable advantages over conventional arrangements. With the SKF SEAL JET system, SKF supplies seals in a wide range of different sizes and offers cost-effective sealing solutions on demand – without any tooling costs or delays.

Standard machined seal profiles

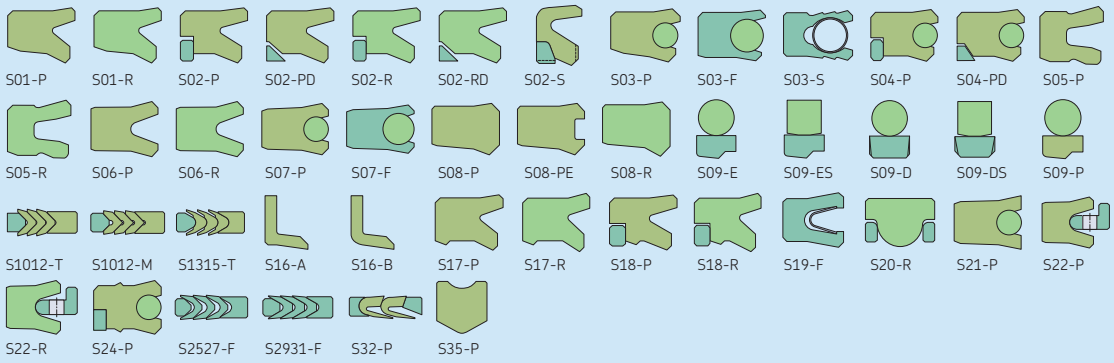
Wipers



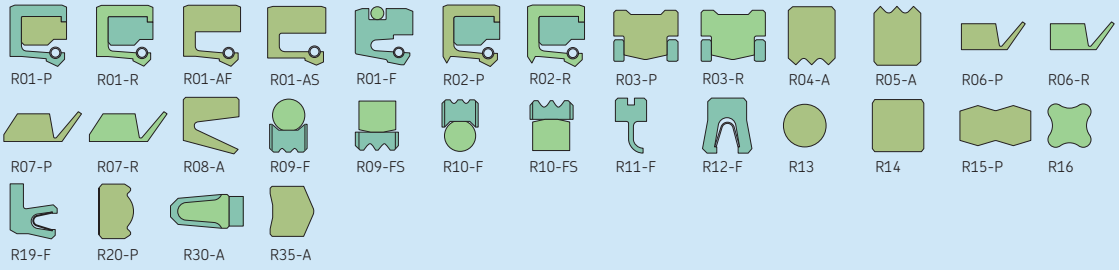
Piston seals



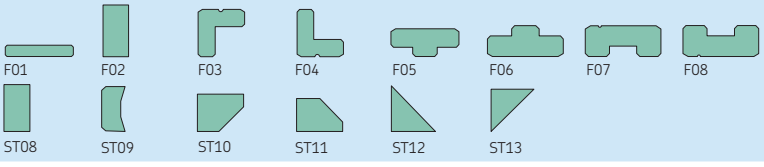
Rod seals



Rotary seals



Guide and backup rings



O-rings and static seals



Sealing materials

Polyurethanes

SKF has developed many high performance sealing materials. In particular, the polyurethanes have outstanding mechanical properties which outperform many other elastomeric sealing materials (like rubbers). Possible application limits are chemical resistance and in some cases, very high temperatures. For further information, please contact SKF competence centres for machined seals.

Material		Colour	Properties
ECOPUR	(TPU/TPE–U, 95 Shore A)	Green	Recommended for hydraulic applications, good chemical resistance
ECOPUR LD	(CPU, 95 Shore A)	Green	Cast polyurethane elastomer (CPU) for large diameter seals with similar properties to ECOPUR
G-ECOPUR	(CPU, 95 Shore A)	Red	Hydrolysis-resistant cast polyurethane elastomer (CPU) with similar properties to H-ECOPUR.
H-ECOPUR	(TPU/TPE–U, 95 Shore A)	Red	Outstanding chemical resistance against water-based fluids
S-ECOPUR	(TPU/TPE–U, 95 Shore A)	Grey/black	Outstanding sliding performance, similar mechanical and chemical properties to H-ECOPUR
T-ECOPUR	(TPU/TPE–U, 95 Shore A)	Blue	Low temperature grade, excellent cold flexibility, limited chemical resistance
X-ECOPUR	(TPU, 57 Shore D)	Dark green	Increased pressure and extrusion resistance, recommended for composite seals, chemical resistance similar to ECOPUR
X-ECOPUR H	(TPU, 60 Shore D)	Dark red	Increased pressure and extrusion resistance, recommended for composite seals, chemical resistance similar to H-ECOPUR
X-ECOPUR S	(TPU, 57 Shore D)	Dark grey	Increased pressure and extrusion resistance, recommended for composite seals, chemical resistance similar to H-ECOPUR, outstanding sliding performance

Elastomers

High quality rubber standard grades with the commonly known features of elastomeric materials, good chemical resistance, but limitations in mechanical properties. For further information, please contact SKF competence centres for machined seals.

Material		Colour	Properties
SKF Ecoflas	(TFE/P, 83 Shore A)	Black	Fluoro-elastomer with outstanding resistance to hot water and steam
SKF Ecorubber-H	(HNBR, 85 Shore A)	Black	Standard grade with good mechanical and chemical properties
SKF Ecorubber-1	(NBR, 85 Shore A)	Black	Standard grade, good chemical resistance
SKF Ecorubber-2	(FKM, FPM, 85 Shore A)	Brown	Standard grade with good chemical resistance
SKF Ecorubber-3	(EPDM, 85 Shore A)	Black	Standard grade with good mechanical properties, recommended for steam injection
SKF Ecosil	(MVQ, 85 Shore A)	Reddish brown	Silicone rubber with high resistance against weathering, ozone and ageing

Thermoplastics and special materials [1)]

Thermoplastics and special glassfibre reinforced materials with outstanding mechanical properties.
For further information, please contact SKF competence centres for machined seals.

Material		Colour	Properties
SKF Ecomid	(PA)	Black	Standard grade with good mechanical properties (glass filled grades for increased pressure resistance are also available) NOTE: Not to be used in water or moist environments.
SKF Ecopaek	(PEEK)	Cream/black	Exceptional mechanical, chemical and thermal resistance
SKF Ecotal	(POM)	Black	Standard grade with good mechanical properties (glass filled grades for increased pressure resistance are also available)
SKF Ecotex	(fabric reinforced material on polyester resin base)	Light orange	High wear and pressure resistance

PTFE and its compounds [2)]

Top performance PTFE compound materials with highest chemical and temperature resistance, optimized for sealing applications.
For further information, please contact SKF competence centres for machined seals.

Material		Colour	Properties
SKF Ecoflon 1	(PTFE, virgin)	White	High chemical resistance
SKF Ecoflon 2	(PTFE, 15% glass, 5% MOS2)	Grey	Good mechanical properties
SKF Ecoflon 3	(PTFE, 40% bronze)	Bronze	Good tribological properties, high pressure resistance
SKF Ecoflon 4	(PTFE, 25% carbon)	Black	High wear and pressure resistance
SKF Ecoflon 5	(PTFE, modified)	White	Unfilled modified grade to increased pressure and creep resistance

[1)] SKF also offers a wide range of individual thermoplastic materials specially designed for guide rings, backup rings, etc..

[2)] SKF also offers a wide range of organic and inorganic compounds, such as PTFE + glass, PTFE + graphite (steam injection), PTFE + EKONOL, PTFE + PI, PTFE + PEEK, etc..

Material properties

			Polyurethanes								
Properties	**Standard**	**Unit**	**ECOPUR**	**ECOPUR LD**	**G-ECOPUR** cast – hydrolysis resistant	**H-ECOPUR** hydrolysis resistant	**S-ECOPUR** solid lubricants	**T-ECOPUR** low temperature grade	**X-ECOPUR** hard grade	**X-ECOPUR H** hard grade hydrolysis resistant	**X-ECOPUR S** hard grade solid lubricants
			TPU	CPU	CPU	TPU	TPU	TPU	TPU	TPU	TPU
Standard colour			Green	Green	Red	Red	Grey/ black	Blue	Dark green	Dark red	Dark grey
Hardness	DIN ISO 7619	Shore A	95 ±2[1)]	95 ±2[1)]	95 ±2[1)]	95 ±2[1)]	95 ±2[1)]	95 ±2[1)]	97 ±2[1)]	97 ±2[1)]	97 ±2[1)]
Hardness	DIN ISO 7619	Shore D	48 ±3[1)]	48 ±3[1)]	47 ±3[1)]	48 ±3[1)]	48 ±3[1)]	48 ±3[1)]	57 ±3[1)]	60 ±3[1)]	58 ±3[1)]
Density	DIN EN ISO 1183	g/cm³	1,2	1,19	1,17	1,2	1,23	1,17	1,21	1,22	1,23
100% modulus	DIN 53504	MPa	12	≥ 10	≥ 11	≥ 13	≥ 17	≥ 12	≥ 16	≥ 22	≥ 22
Tensile strength/yield stress	DIN 53504	MPa	≥ 50	≥ 45	≥ 45	≥ 50	≥ 45	≥ 50	≥ 45	≥ 45	≥ 38
Elongation at break	DIN 53504	%	≥ 430	≥ 380	≥ 330	≥ 330	≥ 380	≥ 450	≥ 400	≥ 350	≥ 300
Modulus of elasticity – tensile test	ISO 527-1/2	MPa	–	–	–	–	–	–	–	–	–
Compression set											
70 °C/24 h 20% compression	DIN ISO 815	%	≤ 27	≤ 30	≤ 30	≤ 27	≤ 30	≤ 27	≤ 30	≤ 30	≤ 33
100 °C/24 h 20% compression	DIN ISO 815	%	≤ 33	≤ 40	≤ 40	≤ 33	≤ 35	45[3)]	≤ 35	≤ 35	≤ 39
100 °C/24 h	DIN ISO 815	%	–	–	–	–	–	–	–	–	–
175 °C/24 h	DIN ISO 815	%	–	–	–	–	–	–	–	–	–
Tear strength	DIN ISO 34-1	N/mm	100	–	–	100	120	80	130	160	160
Abrasion	DIN ISO 4649	mm³	18	22	18	17	21	15	18	20	29
Minimum service temperature[7)]		°C	–30	–35	–30	–20	–20	–50	–30	–20	–20
Maximum service temperature[7)]		°C	+110	+110	+110	+110	+110	+110	+110	+110	+110

[1)] Testing time 3 s only valid for polyurethanes
[2)] DIN EN ISO 868
[3)] DIN ISO 815 at –40 °C/24 h 20% compression
[4)] ASTM D4894
[5)] ASTM 4745
[6)] ISO 527-1/2
[7)] Minimum and maximum service temperatures are material properties only. Deviations due to varying application parameters are mentioned/stated at each seal profile at the following pages.
Data concerning special materials based on the here mentioned standard grades are available on request.



Elastomers						Thermoplastics									Thermoset
SKF Ecoflas	**SKF Ecorubber-H**	**SKF Ecorubber-1**	**SKF Ecorubber-2**	**SKF Ecorubber-3**	**SKF Ecosil**	**SKF Ecoflon 1**	**SKF Ecoflon 2** +15% GF + 5% MoS2	**SKF Ecoflon 3** +40% bronze	**SKF Ecoflon 4** +25% Carbon	**SKF Ecoflon 5** modified	**SKF Ecomid**	**SKF Ecopaek**	**SKF Ecotal**	**SKF Ecowear 1000**	**SKF Ecotex**
TFE/P	HNBR	NBR	FPM, FKM	EPDM	MVQ	PTFE virgin	PTFE	PTFE	PTFE	PTFE	PA	PEEK	POM	UHMWPE	–
Black	Black	Black	Brown	Black	Reddish brown	White	Grey	Bronze	Black	White	Black	Cream	Black	White	Light orange
83 ±5	85 ±5	85 ±5	85 ±5	85 ±5	85 ±5	–	–	–	–	–	–	–	–	–	–
						57[2]	62[2]	65[2]	65[2]	65[2]	77[2]	87[2]	82[2]	61[2]	67–77
1,73	1,23	1,31	2,33	1,22	1,52	2,16	2,25	3,05	2,1	2,16	1,15	1,30	1,41	0,93	1,21
8	≥ 10	≥ 11	≥ 5	≥ 8	≥ 5	–	–	–	–	–	–	–	–	–	–
13	≥ 18	≥ 16	≥ 7	≥ 12	≥ 7	27[4]	20[5]	23[5]	15[5]	30[4]	55[6]	100[6]	65[6]	20[6]	55
220	≥ 180	≥ 130	≥ 200	≥ 110	≥ 130	300[4]	220[5]	240[5]	150[5]	360[4]	100[6]	≥ 45[6]	25[6]	≥ 350[6]	–
–	–	–	–	–	–	–	–	–	–	–	1 800[6]	3 700[6]	2 900[6]	600[6]	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	≤ 22	≤ 15	–	≤ 15	–	–	–	–	–	–	–	–	–	–	–
29	–	–	≤ 20	–	≤ 15	–	–	–	–	–	–	–	–	–	–
19	24	20	21	15	8	–	–	–	–	–	–	–	–	–	–
110	90	90	150	120	–	–	–	–	–	–	–	–	–	–	–
–10	–25	–30	–20	–50	–60	–200	–200	–200	–200	–200	–40	–100	–50	–200	–40
+200	+150	+100	+200	+150	+200	+260	+260	+260	+260	+260	+110	+260	+100	+90	+120

Working fluids and sealing materials

Metal working plants with a wide range of different working fluids may require chemical resistant sealing solutions. Due to increased safety and contamination regulations and standards, more and more combustible fluids, such as mineral oils, are replaced by fire-resistant fluids.

These fire-resistant fluids can be divided into two main groups:

- Water-based fluids and
- Synthetic fluids

The water-based fluids can be divided into fluids with high (HWB-fluids) and low (LWB-fluids) water content. The main chemical composition is summarised in **table 1.** Due to the water content of these fluids, the working temperature is limited up to 60 °C to avoid equipment damage. For higher temperatures, fire-resistant fluids with a synthetic composition are available (HFD).

Generally, all fire-resistant working fluids strongly affect sealing materials and therefore, the selection of the seal material must be more accurate compared to seals used in mineral oils.

SKF has many years of experience in sealing systems for these kinds of critical applications and has extensively investigated the compatibility of seals with these types of fluids. The results of these investigations and general recommendations for suitable sealing materials are summarized in **table 2.**

Table 1

Composition of water-based fluids

Category	Characterisation	Water content (%)	Non-water ingredients
HFA–E	Oil-in-water-emulsion	90–98	Mineral oil, emulsifiers, stabilizers corrosion inhibitors, etc.,
HFA–S	Synthetic solutions	90–98	Synthetic fluids, fluids in water antioxidants, corrosion inhibitors, detergents/dispergents
HFB	Water-in-oil emulsion	0–40	Mineral oil, emulsifiers, stabilizers, corrosion inhibitors, etc.
HFC	Water-glycol solutions	35–50	Polyalkylene glycols, corrosion inhibitors, various additives

Table 2

Fluid compatibility of sealing materials

Category	Service temp. (°C)	Compatible sealing materials Market standards	SKF recommendations
HFA–E	+5 to 60	NBR, HNBR and specially formulated FPM	Specially formulated polyurethanes (e.g. H-ECOPUR)
HFA–S	+5 to 60	Individual tests necessary	Specially formulated polyurethanes (e.g. H-ECOPUR), SKF Ecorubber-1/H/2/3
HFB	+5 to 60	NBR, HNBR and specially formulated FPM	Specially formulated polyurethanes (e.g. H-ECOPUR)
HFC	–20 to 60	NBR, HNBR, EPDM and MVQ	Depending on the temperature range, specially formulated polyurethanes (e.g. H-ECOPUR)

Chemical resistance

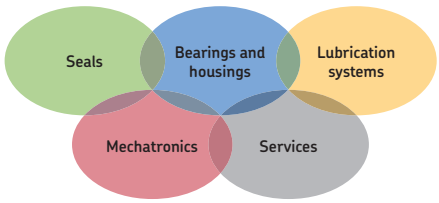
Chemical and environmental resistance[1]	Temperature	Polyurethanes							Elastomers					
		ECOPUR	ECOPUR LD	G-ECOPUR	H-ECOPUR	S-ECOPUR	T-ECOPUR	X-ECOPUR	X-ECOPUR H	X-ECOPUR S	SKF Ecorubber-H	SKF Ecorubber-1	SKF Ecorubber-2	SKF Ecorubber-3
Acids														
– inorganic, diluted	RT	–	–	o	+	+	–	–	+	+	o	o	+	+
– inorganic, concentrated	RT	–	–	–	–	–	–	–	–	–	–	–	+	+
– organic, diluted	RT	o	o	o	+	+	o	o	+	+	+	+	+	+
– organic, concentrated	RT	–	–	o	o	o	–	–	o	o	–	–	_	+
Alkalies														
– general	RT	–	–	o	o	o	–	–	o	o	o	o	o	+
Hydraulic fluids														
– mineral oil based	RT	+	+	+	+	+	+	+	+	+	+	+	+	–
	60 °C	+	+	+	+	+	+	+	+	+	+	+	+	–
– synthetic oils														
HETG (triglyceride)	RT	+	+	+	+	+	+	+	+	+	o	o	+	–
	60 °C	o	o	o	+	+	o	o	+	+	o	o	+	–
HEES (synthetic ester)	RT	+	+	+	+	+	+	+	+	+	o	o	+	–
	60 °C	o	o	o	+	+	o	o	+	+	o	o	+	–
HEPG (polyglycols)	RT	o	o	+	+	+	o	o	+	+	+	+	+	+
	60 °C	–	–	o	o	o	–	–	o	o	+	+	+	+
HEPR (polyalphaolefines)	RT	+	+	+	+	+	+	+	+	+	+	+	+	–
	60 °C	o	o	+	+	+	o	o	+	+	o	o	+	–
Fire resistant fluids														
– HFA (water – oil emulsion)														
HFA-E	RT	o	o	o	+	+	o	o	+	+	+	+	+	–
	60 °C	–	–	o	+	+	–	–	+	+	+	+	o	–
HFA-S	RT	o	o	o	+	+	o	o	+	+	+	+	+	+
	60 °C	–	–	o	+	+	–	–	+	+	o	o	o	o
– HFB (oil – water emulsion)	RT	o	o	o	+	+	o	o	+	+	+	+	+	–
	60 °C	–	–	o	+	+	–	–	+	+	+	+	+	–
– HFC (water – glycol)	RT	–	–	o	+	+	–	–	+	+	+	+	o	+
	60 °C	–	–	o	o	o	–	–	o	o	+	+	–	+
Solvents														
– Toluene	RT	–	–	–	–	–	–	–	–	–	–	–	+	–
– Acetone	RT	–	–	–	–	–	–	–	–	–	–	–	–	+
– MEK	RT	–	–	–	–	–	–	–	–	–	–	–	–	+
Steam		–	–	–	–	–	–	–	–	–	–	–	–	+
Water	RT	+	+	+	+	+	+	+	+	+	+	+	+	+
	60 °C	–	–	o	+	+	–	–	+	+	+	+	+	+

[1] Rating legend:
+ Excellent
o Good / fair
– Poor

IMPORTANT: The tables on this page and the next page provide valuable assistance in the choice of materials. The data listed here are within the normal range of product properties. However, they are not guaranteed, should not be used to establish material specification limits and should be used in combination with other design guidelines.
Please contact SKF for additional information.



Chemical and environmental resistance	Thermoplastics								
	SKF Ecoflon 1	SKF Ecoflon 2	SKF Ecoflon 3	SKF Ecoflon 4	SKF Ecoflon 5	SKF Ecomid	SKF Ecopaek	SKF Ecotal	SKF Ecotex
Acids									
– inorganic, diluted	+	+	+	+	+	0	+	0	0
– inorganic, concentrated	+	0	0	0	+	–	–	–	–
– organic, diluted	+	+	+	+	+	0	+	0	0
– organic, concentrated	+	+	+	+	+	0	+	0	–
Alkalies									
– general	+	0	0	0	+	0	+	0	0
Hydraulic fluids									
– mineral oil based	+	+	+	+	+	+	+	+	+
– synthetic oils	+	+	+	+	+	+	+	+	+
HETG	+	+	+	+	+	+	+	+	+
HEES	+	+	+	+	+	+	+	+	+
HEPG	+	+	+	+	+	+	+	+	+
HEPR	+	+	+	+	+	+	+	+	+
Fire resistant fluids									
– HFA (water – oil emulsion)	+	+	+	+	+	+	+	+	+
HFA–E	+	+	+	+	+	+	+	+	+
HFA–S	+	+	+	+	+	+	+	+	+
– HFB (oil – water emulsion)	+	+	+	+	+	+	+	+	+
– HFC (water – glycol)	+	+	+	+	+	0	+	+	+
– HFD (water free)	+	+	+	+	+	+	+	+	+
Solvents									
– Toluene	+	0	+	+	+	+	+	+	+
– Acetone	+	+	+	+	+	+	+	+	–
– MEK	+	+	+	+	+	+	+	0	–
Steam	+	+	+	+	+	0	+	+	+
Water	+	+	+	+	+	0	+	+	+



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Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

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