Iron and steel industry

Customised machined seals

ECONOMOS

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 iron and steel industry

As a supplier of high-quality, highly reliable products to the metal industry, we can provide our comprehensive field experience and specific knowledge in sealing technology to support our customers' operations.

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

- Improved safety at work
- Increased productivity
- Reduced effects of contamination
- Increased durability
- Reduced maintenance and downtime
- Media and energy savings

SKF Economos solutions support the entire steel making process: logistics and transportation, blast furnace plant, melt shop, casting machine and rolling mill.

SKF Economos competences

- Application engineering
- Extensive list of success stories
- Material technology
- Standard and custom engineered sealing solutions
- Advanced engineered plastic parts (AEPP)

SKF Economos performance

- On-site solution analysis
- Innovative custom engineered solutions
- Immediate availability of machined standard seals and customised sealing solutions
- Injection moulded seals for higher volume orders

SKF Economos' leading supplier position in standard and custom engineered sealing solutions is based on detailed knowledge of the metal industry's requirements.

One of our competitive advantages is our ability to offer fast and flexible customised seals. They are always made from high-performance materials.

- Hydraulic and pneumatic sealing systems
- Oil shaft seals, V-rings
- Rotary distributor seals (rotary joint)
- Flat seals for flange connections
- Static seals and O-rings

Finding the correct sealing solution is a complex and rewarding task. Our experience shows this is where always potential for optimization can be found.

Selecting the right seal for harsh conditions

Whenever reduced maintenance costs, increased productivity or process reliability matters – SKF Economos is there with improved sealing solutions.

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

Sealing Purpose

The purpose of sealing is to keep operating media or lubricants in, or environmental contamination out of the sealed system.

Environment

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

Media

Media affect the sealing system. The sealing material has to be **compatible** with the sealed media. This could be lubricant, the operating media in a hydraulic system, but also auxiliary cleaning or assembly media.

Operating Parameters

Type, speed and duration of the motion at the sealing lip are relevant. Motion can be continuous, interrupted or pivoting. All pressures are relevant, not just operating **pressure**, but also possible system and application related pressure peaks.

Elevated **temperature** may affect the seal. In most cases, lubricant or hydraulic media temperature determine the actual temperature at the seal, but an elevated ambient temperature can also affect wipers.

Machine design

The **type of lubrication** affects the seal selection for rotating equipment. The machine can be lubricated with grease, oil, or oil-air. In a reciprocating application, the **operating fluid** determines the seal selection. It can be hydraulic-oil, water-based fluid or pneumatic.

Shaft **misalignment** must be considered when choosing the sealing lip design for rotation. Shaft-to-bore misalignment (STBM) and dynamic run-out (DRO) are both relevant. For large sized reciprocating machines 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 sealing performance.

Housing design and condition determine the seal design. Open housing requires a self-retaining seal.

Closed housings ensure a perfect fit for elastic seals. SKF Economos also supplies customised seals for non-standard housing dimensions.

Improvement potentials

Finally, the existing seal performance and reason for seal change or failure are the most important indicators of possible improvement potential.

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, however, indicates the high optimization and cost saving potential of optimised sealing solutions.

SKF Economos – your flexible partner

SKF Economos is the leading player in the global custom-made machined seals market. Specialised in providing a complete sealing service to steel and other heavy industries, its subsidiaries and partners serve many countries around the world.

Standard seals

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

Customised seals

- standard seals modified to your specific requirements
- flexible material 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 are able to supply standard and special seals in customised dimensions and heavy duty sealing materials. Our manufacturing concept provides truly local service being very close to the end customer. Our customer service is completed by additional services:

Advanced engineered plastic parts

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

Other business and services

Customers maintenance and repair of cylinders, gaskets and products made by water-jet cutting technology.

Upstream solutions

❶ High temperature

Blast furnace tapping equipment is one of the hottest places a seal can be exposed.

Solution for tap hole cylinder

The equipment used for tapping a blast furnace is exposed to extremely high temperatures. Heat protection of the seals used can be rather difficult. Therefore, seals need to be able to operate at unusually high temperatures.

By introducing the appropriate sealing profile in combination with high performance materials (SKF Ecorubber-2, SKF Ecoflon 2 and SKF Ecopaek), SKF Economos increased the lifespan from one week to a few months.

❷ Seal installation and welding – reducing downtime

Dismantling large scale machinery for the replacement of seals is time consuming and related downtime costs are enourmous.

Welding of large diameter polyurethane seals

In this particular case, we had to replace a standard rubber fabric seal at the trunnion gear mechanism of a converter.

SKF Economos has developed a procedure that allows welding of large diameter polyurethane seals on site ensuring no loss of sealing capability. For us, this is a common process for installing replacement seals. Production downtime is kept to an absolute minimum.

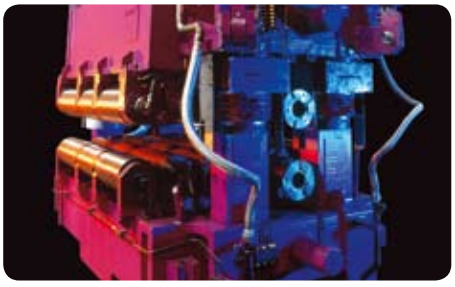
❸ Wear and reliability

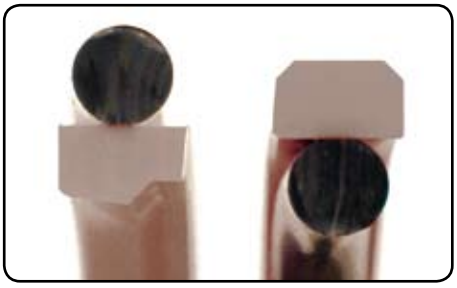
To ensure a real continuous process without unplanned downtime, each machine component - even a simple seal - has to meet highest performance expectations.

Seals for a continuous casting plant

One example that represents many applications where SKF Economos seals are used is our S09 profile installed in hydraulic cylinder of the straightening section.

SKF Economos provides state-of-the-art sealing technology that is widely used in continuous casting plants. In cooperation with maintenance specialists of steel plants we optimise their actual operations.
With OEMs we are developing new innovative solutions.

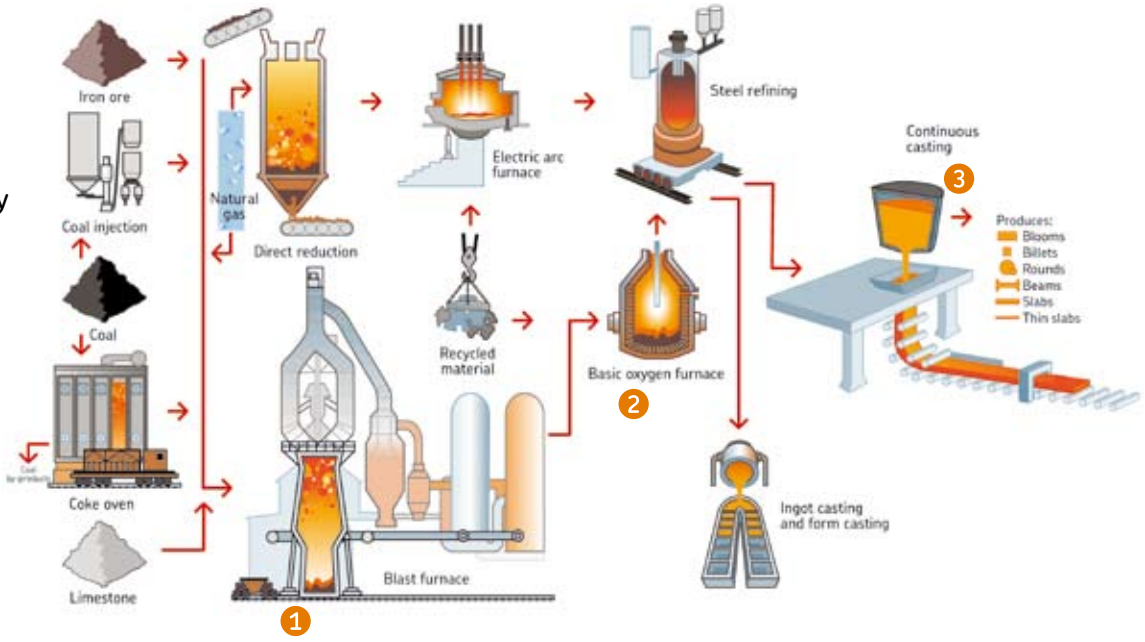


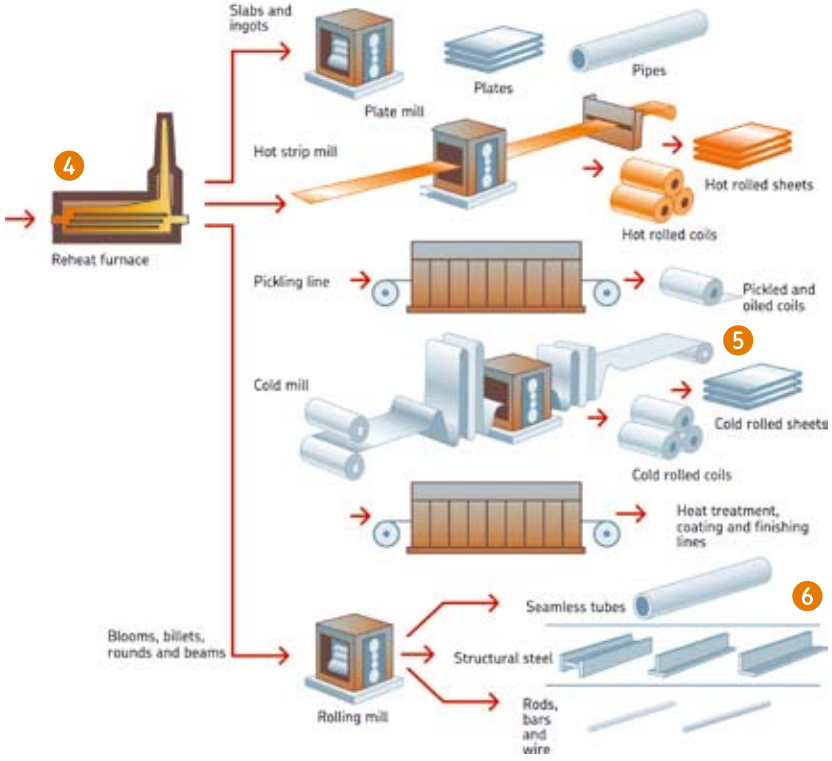


Steel making process

Upstream

1 High temperature
2 Seal installation
3 Wear and reliability





Downstream

4 Heavy duty
5 Sliding speed
6 Pressure

Downstream solutions

❹ Heavy duty

Hydraulic cylinders in harsh conditions require specifc sealing solutions. Contamination and elevated temperature are affecting the sealing systems.

Seals for heavy duty applications

Heavy duty hydraulic cylinders are tilting melting furnaces, moving billets, opening reheating furnace doors in the tough environment of steel production.

SKF Economos material competence is the key to new sealing solutions substituting old technologies like rubber-fabric-packings. The seal made of SKF Ecopeak, SKF Ecoflon 4 and SKF Ecorubber-2 combines the relevant features of these high performance materials. The result is a convincing solution with unique sealing performance and unequalled life time in harsh conditions.

❺ Sliding speed – pressure rotary seals

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

Seals for the rolling mill

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

At this application we were requested to replace an unsatisfactory seal and design a sealing solution for the clamping mechanism of the coiler, which has to seal under pressure of 100 bar or above whilst rotating.

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

❻ Pressure

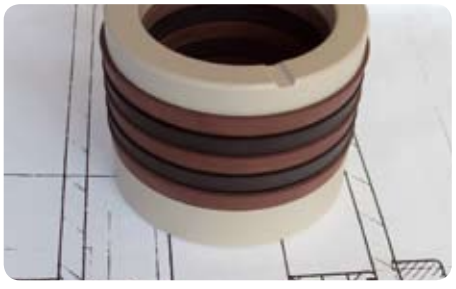
In seamless tube production every tube has to be pressure tested to detect possible leakage.

Seals for in line hydro tester

The positioning of tubes in the testing unit may cause mechanical damage of the seal. More difficulty when hydrostatic testing steel tubes is that sometimes rather large extrusion gaps need to be sealed off whereby high pressures (e.g. 700 bar) have to be applied.

By utilising SKF Economos water compatible and highly wear resistant polyurethane H-ECOPUR and selecting an adequate sealing profile we provide a reliable sealing solution that significantly extends the service life of the seal.

Tube diameters vary from small (few inches) to rather big (several feet). The machined seal concept is the ideal solution when cost effective individual sealing solutions are required in a wide range of different sizes.



Proven to optimise system performance

For many years SKF Economos has been providing technically advanced solutions to meet the needs of applications and processes in the steel industry. This focus has led to the development of products and materials specifically engineered, designed, and proven to meet the demands of your operation.

After a detailed study of your operation and your needs, we will review our comprehensive list of standard products and, if the application demands non-standard products, we can tailor a customised solution.

The unique SKF Economos total service capability can manufacture (on demand – without tooling costs or delays) a solution which will provide considerable advantages over conventional arrangements.

Sealing materials

Polyurethanes and elastomers

SKF Economos has developed many high performance sealing materials, in particular our polyurethane has outstanding mechanical properties which outperform all other elastomeric sealing materials (like rubbers). Possible application limits are chemical resistance and in some cases, very high temperatures. For further information, please contact your SKF Economos representative.

Polyurethanes

Material		Colour	Properties
ECOPUR	(TPU/TPE–U, 95 Shore A)	Green	Good chemical resistance, recommended for hydraulic applications
H-ECOPUR	(TPU/TPE–U, 95 Shore A)	Red	Outstanding chemical resistance against water based fluids
S-ECOPUR	(TPU/TPE–U, 95 Shore A)	Charcoal grey	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
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, recommended for composite seals, chemical resistance similar to ECOPUR
XH-ECOPUR	(TPU, 60 Shore D)	Dark-red	Increased pressure and extrusion resistance, recommended for composite seals, chemical resistance similar to H-ECOPUR
XS-ECOPUR	(TPU, 57 Shore D)	Charcoal-grey	Increased pressure and extrusion resistance, recommended for composite seals, chemical resistance similar to H-ECOPUR, outstanding sliding performance

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 your SKF Economos representative.

Elastomers

Material		Colour	Properties
SKF Ecorubber-1	(NBR, 85 Shore A)	Black	Standard grade, good chemical resistance
SKF Ecorubber-H	(HNBR, 85 Shore A)	Black	Standard grade with good mechanical and chemical properties
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

Thermoplastics, special materials and PTFE

Thermoplastics and special glassfibre reinforced materials with outstanding mechanical properties.
For further information, please contact your SKF Economos representative.

Thermoplastics and special materials [1)]

Material		Colour	Properties
SKF Ecomid	(PA)	Black	Good mechanical properties, glass filled grades for increased pressures are available. Not to be used in water or moist environments!
SKF Ecotal	(POM)	Black	Good mechanical characteristics; glass filled grades
SKF Ecopaek	(PEEK)	Cream/black	Exceptional mechanical, chemical and thermal resistance
SKF Ecotex	(fabric reinforced material on polyester resin base)	Orange	High wear and pressure resistance

Top performance PTFE compound materials with highest chemical and temperature resistance,
optimised for sealing applications. For further information, please contact your SKF Economos representative.

PTFE and its compounds [2)]

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	Outstanding extrusion resistance, other properties compatible with 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

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

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

Properties

			Polyurethanes							
Properties	**DIN**	**Unit**	**ECOPUR**	**H-ECOPUR** hydrolysis resistant	**S-ECOPUR** + solid lubricants	**T-ECOPUR** low temperature	**G-ECOPUR** casted	**X-ECOPUR**	**XH-ECOPUR** hydrolysis resistant	**XS-ECOPUR** + solid lubricants
			TPU	TPU	TPU	TPU	TPU	TPU	TPU	TPU
Colour	–	–	green	red	charcoal grey	blue	red	dark green	dark red	charcoal grey
Density	53479	g/cm^3	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	20
Compression set[3)]										
– after 22 h at 100 °C	53517	%	–	–	–	–	–	–	–	–
– after 22 h at 175 °C	53517	%	–	–	–	–	–	–	–	–
– after 24 h at 70 °C/20% deformation	–	%	30	27	25	–	30	27	26	24
– after 24 h at 100 °C/20% deformation	–	%	35	33	30	–	40	33	30	30
– after 70 h at 70 °C/20% deformation	–	%	20	20	–	20	20	–	–	–
Tear strengh	53515	N/mm	100	100	120	80	40	140	140	160
Rebound resilience	53512	%	42	29	–	50	43	–	–	–
Abrasion	53516	mm^3	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

Elastomers

SKF Ecorubber-1	SKF Ecorubber-H	SKF Ecorubber-2	SKF Ecorubber-3
NBR	H–NBR	FKM, FPM	EPDM
black	black	brown	black
1,31	1,22	2,3	1,22
100	150	200	150
–30	–25	–20	–50
16	18	8	12
130	180	200	110
11	10	5	9
15	22	–	15
–	–	20	–
–	–	–	–
–	–	–	–
–	–	–	–
20	30	21	15
28	29	7	38
90	90	150	120
85	85	83	85
36	33	36	34

[1] Test specimens: Type S 2.
[2] Test speed: 200 mm/min.
[3] Tests were performed on discs Dia 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 periods.
Compression set represents the percentage of deflection, which did not return to its original shape.
[4] 6,3 mm thick test specimens.

Properties

			Thermoplastics			
Properties	**DIN**	**Unit**	**SKF Ecomid**	**SKF Ecotal**	**SKF Ecopps**	**SKF Ecopaek**
			PA 6 G	POM–C	PPS	PEEK
Colour	–	–	black	natural/black	beige	cream
Density	1183	g/cm^3	1,15	1,4	1,35	1,32
Water absorption						
– after 24/96 h immersion in water at 23 °C[1)]	62	mg	44/83	20/37	–	5/10
	62	%	0,65/1,22	0,24/0,45	–	0,06/0,12
– at saturation in air at 23°C/50% RH	–	%	2,2	0,2	–	0,2
Thermal properties[2)]						
Coefficient of linear thermal expansion:						
– average value between 23 and 60 °C	–	m/(m K)	80×10^{-6}	110×10^{-6}	–	–
– average value between 23 and 100 °C	–	m/(m K)	90×10^{-6}	60×10^{-6}	126×10^{-6}	–
– average value above 150 °C	–	m/(m K)	–	–	80×10^{-6}	65×10^{-6}
Max. allowable service temperature in air:						
– for short periods[3)]	–	°C	170	140	260	310
– continuously: for 5 000/20 000 h[4)]	–	°C	105/90	115/100	–/230	–/250
Min. service temperature[5)]	–	°C	–40	–50	–20	–60
Flammabilty[6)]						
– oxygen indes	4589	%	25	15	–	35
– according to UL 94 (thickness 1,5/3/6 mm)	–	–	–/HB/HB	–/HB/HB	V–0/–	V–0/V–0
Mechanical properties at 23°C						
Tensile test[7)]						
– tensile stress at yield / tensile stress at break[8)]	527	MPa	85/–	68/–	95/–	110/–
	527	MPa	65/–	68/–	95/–	110/–
– tensile strain at break[8)]	527	%	25	35	15	20
	527	%	>50	35	15	20
– tensile modulus of elasticity[9)]	527	MPa	3 500	3 100	3 450	4 400
	527	MPa	1 800	3 100	3 450	4 400
Compression test						
– compressive stress a 1/2/5% nominal strain[10)]	604	MPa	26/51/92	19/35/67	–	29/57/–
Charpy impact strength – unnotched[11)]	179/1eU	kJ/m^2	no break	≥ 150	–	no break
Charpy impact strength – notched[12)]	179/1eU	kJ/m^2	3,5	7	–	3,5
Izod impact strength – notched	180/2A	kJ/m^2	3,5	7	–	6
Ball indentation hardness[13)]	2039-1	N/mm^2	165	140	–	230
Rockwell hardness[13)]	2039-2	–	M 88	M 84	M 95	M 105
Hardness shore D (3 s)	868	–	77	82	–	86

PTFE and special materials

SKF Ecoflon 1	**SKF Ecoflon 2**	**SKF Ecoflon 3F**	**SKF Ecoflon 4**	**SKF Ecoflon 5**	**SKF Ecotex** fabric reinforced
PTFE	PTFE	PTFE	PTFE	PTFE	
white	grey	green	black	white	orange
2,17	2,25	3,13	2,1	2,16	1,25
–	–	–	–	–	–
–	–	–	–	–	–
<0,01	0,02	–	–	–	–
<0,02	<0,15	–	–	–	<0,1
–	–	–	–	–	–
–	–	–	–	–	–
160×10^{-6}	110×10^{-6}	60×10^{-6}	90×10^{-6}	120×10^{-6}	–
300	300	300	300	300	130
–/260	–/260	–/260	–/260	–/260	–/120
–200	–200	–200	–200	–200	–40
95	95	–	–	–	–
V–0/–	V–0/–	–	–	–	–
–/27	–/18	–/22	–/15	–/30	55/–
–/27	–/18	–/22	–/15	–/30	55/–
300	200	300	180	360	–
300	200	300	180	360	–
400–700	–	–	–	–	3 200
400–700	–	–	–	–	3 200
–/8/–	–/14/–	–	–	–	–
no break	–	–	–	no break	–
–	–	–	–	–	–
16	12	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	M100
57	60	64	65	59	–

1) Tests were performed on discs ∅ 50 × 3 mm.
2) The figures given for these properties are for the most part derived from raw material supplier data and other publications.
3) Short exposure time (a few hours) in applications where no or only a very low load is applied to the material.
4) 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 allowable service temperature depends in many cases essentially on the duration and the magnitude of the mechanical stresses to which the material is subjected.
5) Impact strength decreases with decreasing temperature; the minimum allowable service temperature is practically always determined by the extent to which the material is subjected to impact. The values given here are based on unfavourable impact conditions and may consequently not be considered as being the absolute practical limits.
6) These estimated ratings, derived from raw material supplier data, are not intended to reflect hazards presented by the materials under actual fire conditions. There are no UL-yellow cards available for these stock shapes.
7) Test specimens: Type 1 B.
8) Test speed: 5 mm/min
9) Test speed: 1 mm/min.
10) Test specimens: cylinders with Ø 12 × 30 mm.
11) Pendulum used: 4 J.
12) Pendulum used: 5 J.
13) 10 mm thick test specimens.

Working fluids and sealing materials

In steel plants a wide range of working fluids may require chemical resistant seals. Generally, more and more combustible fluids such as mineral oils are substituted by fire-resistant fluids due to safety concerns.

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 summarized in **table 1.** Due to the water content of these fluids the working temperature is limited up to 60 °C max. to avoid damaging of the equipment.

For higher temperatures fire-resistant fluids of synthetic composition are available (HFD).

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

SKF Economos has a long experience in sealing these kind of critical applications as well as having done extensive investigations of the compatibility of seals with these types of fluids. The results of these investigations and general recommendations for adequate sealing materials are summarized in **table 2.**

Table 1

Composition of water-based fluids

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

Table 2

Fluid compatibility of sealing materials

Fluid-category	Service temp. (°C)	Compatible sealing materials Common opinion	SKF Economos results
HFA–E	+5 to 55 (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, SKF Ecorubber-H, SKF Ecorubber-2 and SKF Ecorubber-3
HFB	+5 to 60	NBR, HNBR and specially formulated FPM	Specially formulated polyurethanes
HFC	–20 to 60	NBR, HNBR, EPDM and MVQ	Specially formulated polyurethanes and FPM have limited stability

Chemical resistance

		Polyurethanes						Elastomers					
Chemical and environmental resistance[1]	**Tempera-ture**	**ECOPUR**	**H-ECOPUR** hydrolysis resistant	**S-ECOPUR** + solid lubricants	**T-ECOPUR** low temperature	**G-ECOPUR** casted	**X-ECOPUR**	**XH-ECOPUR** hydrolysis resistant	**XS-ECOPUR** + solid lubricants	**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	+	+	+	+	+	+
– 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	+	–
HEES (synthetic ester)	RT	+	+	+	+	+	+	+	+	o	o	+	–
	60 °C	o	+	+	o	o	o	+	+	o	o	+	–
HEPG (polyglycols)	RT	o	+	+	o	+	o	+	+	+	+	+	+
	60 °C	–	o	o	–	o	–	o	o	+	+	+	+
HEPR (polyalphaolefines)	RT	+	+	+	+	+	+	+	+	+	+	+	–
	60 °C	o	+	+	o	+	o	+	+	o	o	+	–
Fire resistant fluids													
– HFA (water – oil emulsion)													
HFA-E	RT	o	+	+	o	o	o	+	+	+	+	+	–
	60 °C	–	+	+	–	o	–	+	+	+	+	o	–
HFA-S	RT	o	+	+	o	o	o	+	+	+	+	+	+
	60 °C	–	+	+	–	o	–	+	+	o	o	o	o
– HFB (oil – water emulsion)	RT	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

This table is a valuable help in the choice of materials. The data listed here falls within the normal range of product properties. However, they are not guaranteed, they should not be used to establish material specification limits and should be used in combination with other design basis information.

Chemical resistance

	Thermoplastics			
Chemical and environmental resistance	**SKF Ecomid**	**SKF Ecotal**	**SKF Ecopps**	**SKF Ecopaek**
Acids				
– inorganic diluted	o	o	+	+
– inorganic concentrated	–	–	o	–
– organic diluted	o	o	+	+
– organic concentrated	o	o	+	+
Alkalies				
– general	o	o	+	+
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)	o	+	+	+
– HFD (water free)	+	+	+	+
Solvents				
– Toluene	+	+	o	+
– Acetone	+	+	+	+
– MEK	+	o	+	+
Steam	o	+	+	+
Water	o	+	+	+

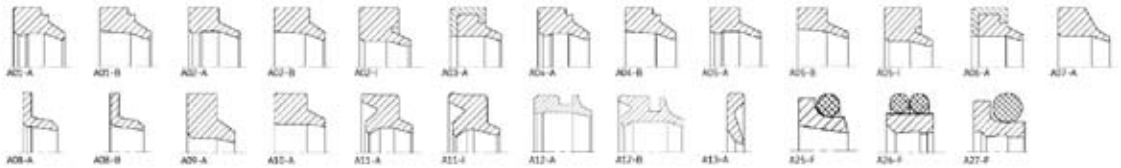
SKF Ecoflon 1	SKF Ecoflon 2	SKF Ecoflon 3	SKF Ecoflon 4	SKF Ecoflon 5	SKF Ecotex
+	+	+	+	+	0
+	0	0	0	+	–
+	+	+	+	+	0
+	+	+	+	+	–
+	0	0	0	+	0
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	+	+	+	+	+
+	0	+	+	+	+
+	+	+	+	+	–
+	+	+	+	+	–
+	+	+	+	+	+
+	+	+	+	+	+

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

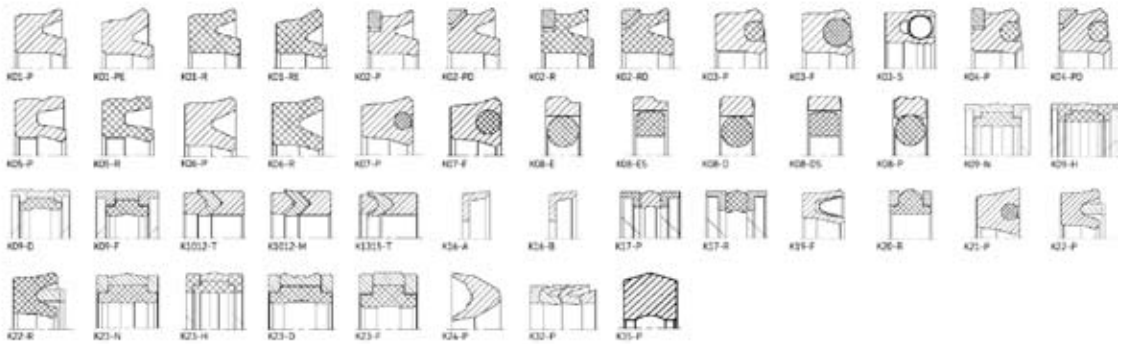
This table is a valuable help in the choice of materials. The data listed here falls within the normal range of product properties for dry materials. However, they are not guaranteed, they should not be used to establish material specification limits and should be used in combination with other design basis information.

Standard profiles for the iron and steel industry

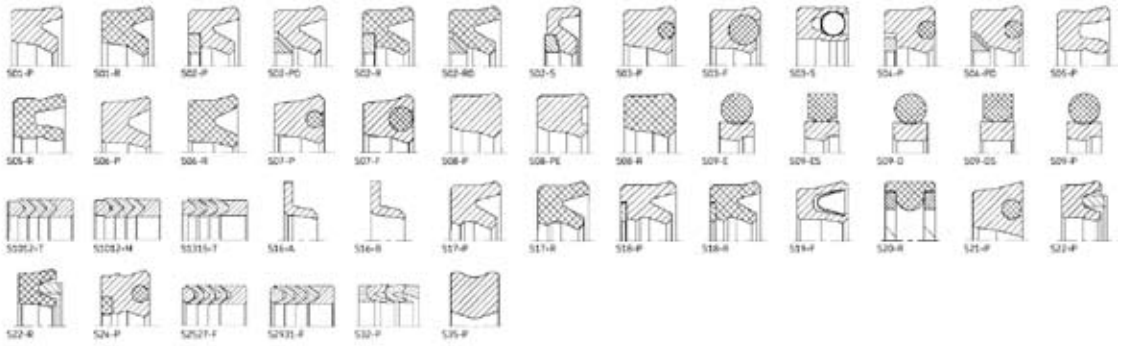
Wipers



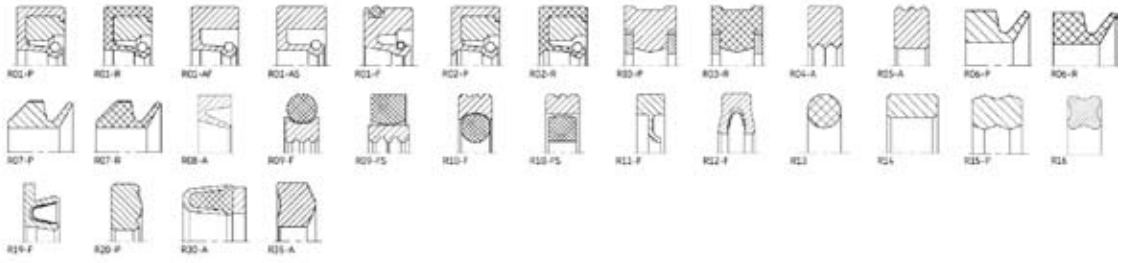
Piston seals



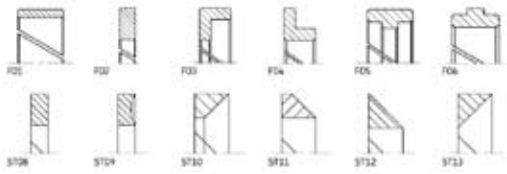
Rod seals



Rotary seals



Guide and Backup rings



O-Rings and static seals

The knowledge engineering company

The SKF brand now means more than ever to the customer. While maintaining its position as world leader in quality bearings, greater customer value has been created through new advances in technology, product support and services, making SKF a truly solutions-oriented supplier. Customer productivity has increased through leading edge application-specific products, design simulation tools, consultancy services, plant asset efficiency maintenance programs 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, customised standards and customer engineered solutions.

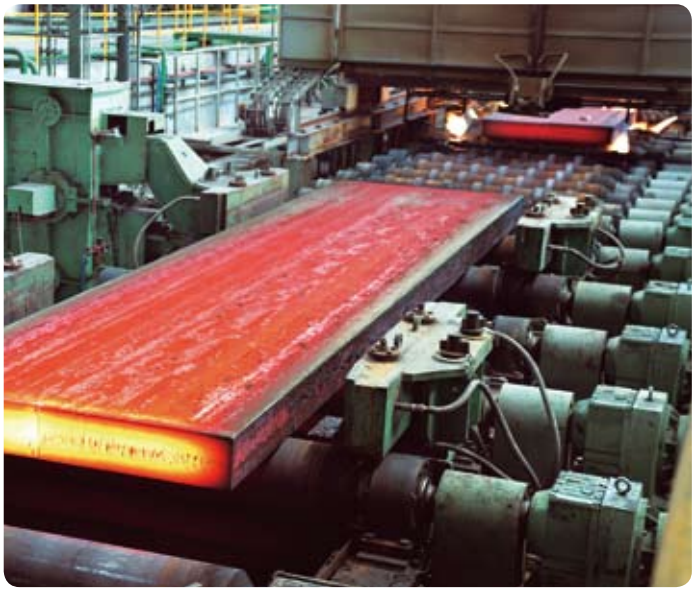
SKF Economos offers a unique and comprehensive seal consultancy service, providing customers with the latest advances in sealing technology. In cooperation with our customers, we analyse operational requirements and applications. All our seals, whether standard or customised, are manufactured on demand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

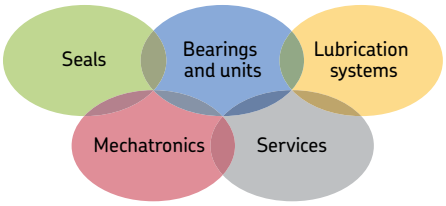
Material availability

All the materials listed in this brochure are available in diameters of up to 600 mm and some selected grades can be supplied in diameters of up to 1 600 mm for rubber materials and up to 8 500 mm in polyurethane materials. Milled parts, plates and sheets are available in a wide range of dimensions.

The SKF Economos production philosophy allows us to produce all seals and plastic parts as a single item, in small quantities, or larger quantities up to a couple of thousands, using machining or milling techniques.

Larger quantities and high volume business will be 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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