quality sealing and engineering plastics solutions

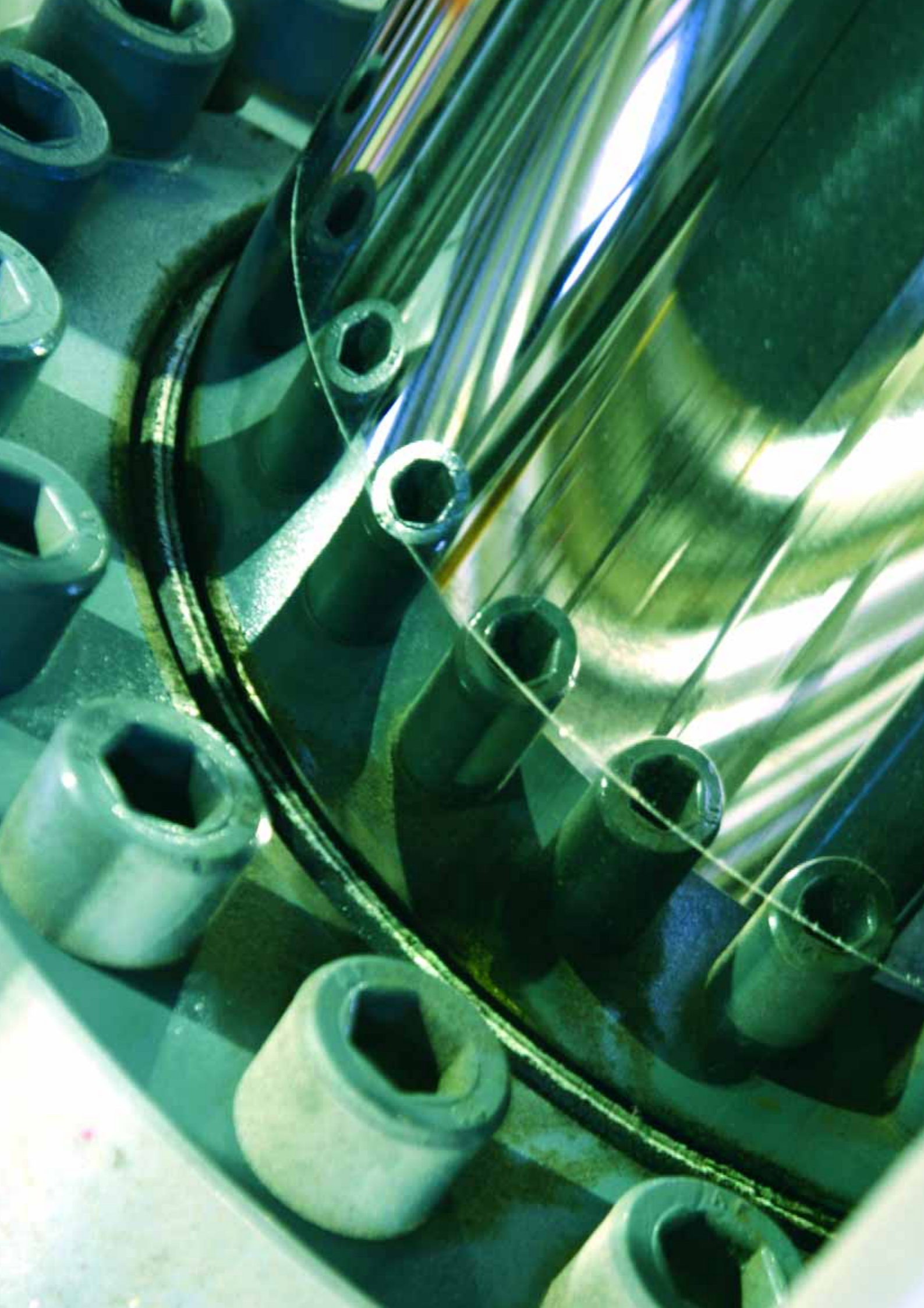
ECONOMOS®

Press forming industry survey

Table of content

Press forming industry

Due to our production process we are able to produce any special seal profile in any diameter. Therefore - in combination with our R&D department - we can offer tailormade sealing solutions to our customers. Furthermore we produce a wide range of gasket types, engineering plastic parts (EPP) and advanced engineering plastic products (AEPP).



Introduction

The history of press forming

ECONOMOS® is a global leader in providing customised sealing solutions and engineered plastics products. Due to our competence in material development and our sealing know-how, we are a respected and reliable partner for any type of industry.

Over the last few decades, forming technology, by means of mechanical and hydraulic presses, has been expanded to cover various applications.

Starting from its original main application in the automotive and automotive supplier industry, press forming has been gaining increasing importance in the electric and household appliances industry, in equipment engineering and in the production/processing of timber boards (furniture industry, laminate floors).

As the demand from all fields of industry for volume-produced mounting parts has increased, forming technology has developed accordingly.

Highly complex systems for forming, separating and joining are being developed with a view to economic efficiency, the highest quality and process reliability.

High stroke rates and forces are called for in these systems that pose an extreme challenge to the individual components and sealing systems. ECONOMOS® meets this challenge with its customized sealing solutions and its outstanding expertise in material engineering.

In case of an emergency seals are required to be on site on notice even if diameters are in excess of 1000 mm.

We understand these requirements and, as a supplier of high quality, high reliability products to the press forming industry, we can provide our wealth of field experience and fundamental knowledge in sealing technology to support our customers' operations.

ECONOMOS® is able to provide industry standard sealing and engineering plastic solutions to our customers and have the capability of shipping single pieces as well as small and large quantities - all on a just-in-time basis.

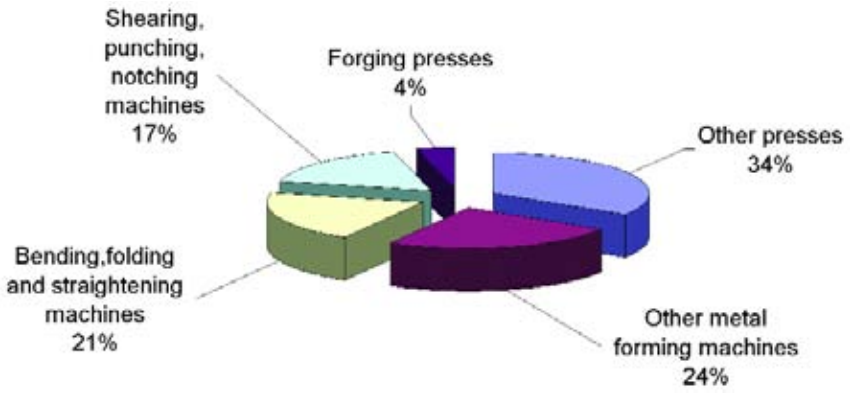
Our engineers also have the competence and experience to create custom-made products. We can engineer solutions to overcome the most complex of problems utilising in-house material technology, Finite Element Analysis and rig testing along with our many years of expertise in this industry.

Industry overview

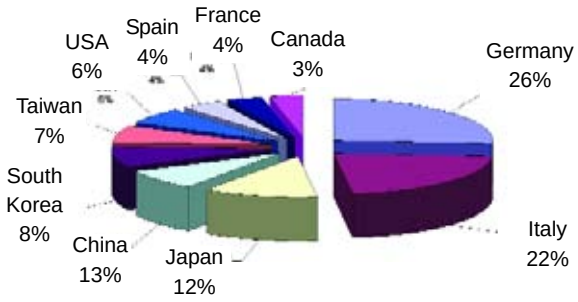
Market overview

Overview about the press forming industry - a listing of the overall manufactured presses worldwide and differetn types produced in Germany as leading manufacturing country.

Types of presses built in Germany



Major forming equipment manufacturers (top 10 countries)



countries of press forming industry

1 . . . .Germany
2 . . . .Italy
3 . . . .Japan
4 . . . .China
5 . . . .South Korea
6 . . . .Taiwan
7 . . . .USA
8 . . . .Spain
9 . . . .France
10 . . .Canada

Typical ECONOMOS® sealing solution involvements in the press forming industry

Typical ECONOMOS® sealing solutions involvements in the press forming industry

Hydraulic and mechanical presses are used for the manufacture of ready-to-install, high-volume parts in the automobile and the supplier industry, for the electrical industry and for household appliances as well as for industrial equipment and other branches of industry.

ECONOMOS® offers time saving retro-fit split element sealing solutions for

- Single hydraulic and mechanical presses
- Cold-flow and hot flow forming presses
- Deep drawing presses
- Forming presses
- Trimming presses
- Bending and straightening presses
- High speed presses
- Automatic blanking and forming press
- High pressure presses
- multiple press
- vulcanising presses

Hydraulic press at one of our clients

Hydraulic press in dismanteled condition

Branches of industry for press forming

- Automobile industry,
- Automobile supplier industry
- Forest industry
- Furniture industry
- Steel industry
- Electrical industry
- Elastics industry
- Household appliances

Hydraulik presses in a production area

ECONOMOS® - your partner in the press formin technology

Since many years, ECONOMOS® is supplying seals and sealing solutions to the press forming industry. However, it is not only seals what we are offering - knowledge and experience based on long term relationships to our customers are also important factors that enable us to understand and solve your sealing problem and are the basis of a high quality product.

The press forming technology in particular has a high demand for special sealing solutions and large diameter seals produced in small quantities. For these seals ECONOMOS® uses its unique manufacturing system - CNC lathe production of seals with a diameter range from 4 mm to 4,000 mm in one piece. It allows for manufacturing single pieces or small quantities of tailor made solutions without the costs of tooling or moulds that - if required - can be delivered within the same day.

The combination of this fast and flexible manufacturing process with our in-house experience and competence of a variety of industry proven materials qualifies ECONOMOS® to be your number one partner even for the most critical applications regardless whether retrofitting existing housings or developing new equipment.

Above all one of the enormous advantages of our commonly used material G-ECOPUR® is its capability of being able to be welded (even on site) without the loss of physical material properties. This provides the possibility of reducing installation time for large diameter seals for heavy duty machinery (e.g. forging presses) what drives costs for stand still down tremendously.

Next to our outstanding sealing solutions ECONOMOS® offers the complete range of engineered plastics parts (EEP/AEPP) that are widely used in the press forming such as roller bearings, wear plates, etc.

Our service is not limited to developing the proper sealing solution for your specific application, fast and cost effective production of custom-built seals but also includes - if required - on site installation through our well trained and experienced service engineers.

H-ECOPUR®

H-ECOPUR®, a world class polyurethane elastomer developed by ECONOMOS® especially for critical sealing purposes, offers a new scope of applications to our customers. Compared to standard polyurethane elastomers, H-ECOPUR® shows outstanding material characteristics such as:

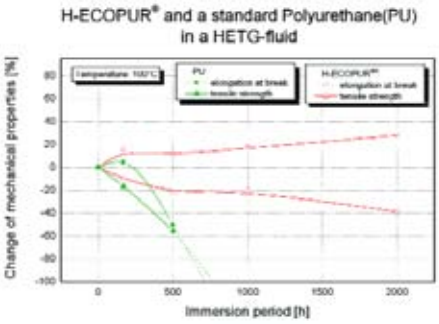
H-ECOPUR® semifinished products

Characteristics

- Superior tensile strength and pressure resistance
- Low compression set and high creep resistance
- Outstanding wear resistance and superior friction properties
- High chemical and hydrolysis resistance
- Extraordinary resistance against high-energy radiation
- Low gas permeability

Chemical resistance

One of the most important benefits H-ECOPUR® is offering to our customers is the superior chemical resistance compared to common polyurethane elastomers. H-ECOPUR® is not only highly resistant against mineral oils but also against a wide range of polar fluids like



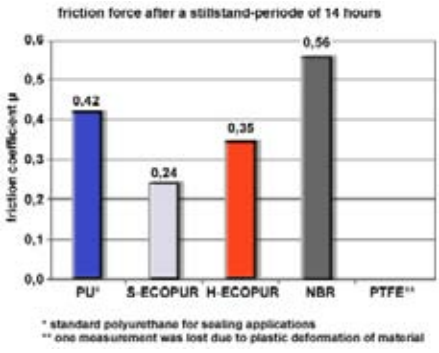
Friction force of various materials after a stillstand periode of 14 hours

- Water and Sea Water
- Many alcohols like ethanol, etc.
- Silicone oils and greases
- Biologically degradable hydraulic fluids

Further benefits

Therefore H-ECOPUR® is not only used in mineral oil based hydraulic fluids like common polyurethanes but also in water-based fluids like

- HFA and HFB (in mining & steel industry, etc.)
- Clear water hydraulics (hydro power stations, etc.)
- Fire-resistant pressure fluids based on synthetic esters (HFD-U)
- Environmentally friendly hydraulic fluids based on a natural and synthetic esters (HETG and HEES), etc.



Friction coefficient µ of various materials after a stillstand periode of 14 hours

H-ECOPUR® is available in a wide range of tube dimensions as well as selected plates for the machining of seals and engineered plastic parts and can also be directly injection-moulded in the shape of the finished part for high quantity demand. The standard grade is in red colour, special grades in different colours and hardnesses are available.

Main use as:

- Rod seals
- Piston seals
- Wipers
- O-rings for water hydraulic and in biologically degradable oils

H-ECOPUR® can also be machined into engineered plastic parts for applications requiring toughness, flexibility, wear resistance and resistance to common media.

Sealing material X-ECOPUR® (3 types)

X-ECOPUR®

(X-ECOPUR®, XH-ECOPUR®, XS-ECOPUR®

see also page 13

ECONOMOS® "X-SLIDE seal range" is the new family of elastomerically energized sealing elements in the special newly developed hard grade polyurethane materials X-ECOPUR®-57D, XH-ECOPUR®-60D and XS-ECOPUR®-57D. Comparable elastomeric energized PTFE sealing elements (with many trade names and brands but mainly known as sliding seals, step seals or composite seals) have been standard sealing elements in hydraulic cylinders for many years. These PTFE sealing systems fulfil the demands of low friction and stick-slip free operation very well, but often they cannot stand up against increasing technological requirements, especially with regard to wear resistance, leakage behaviour and ease of installation and assembly.

The newly developed X-SLIDE seal range meets all the necessary requirements:

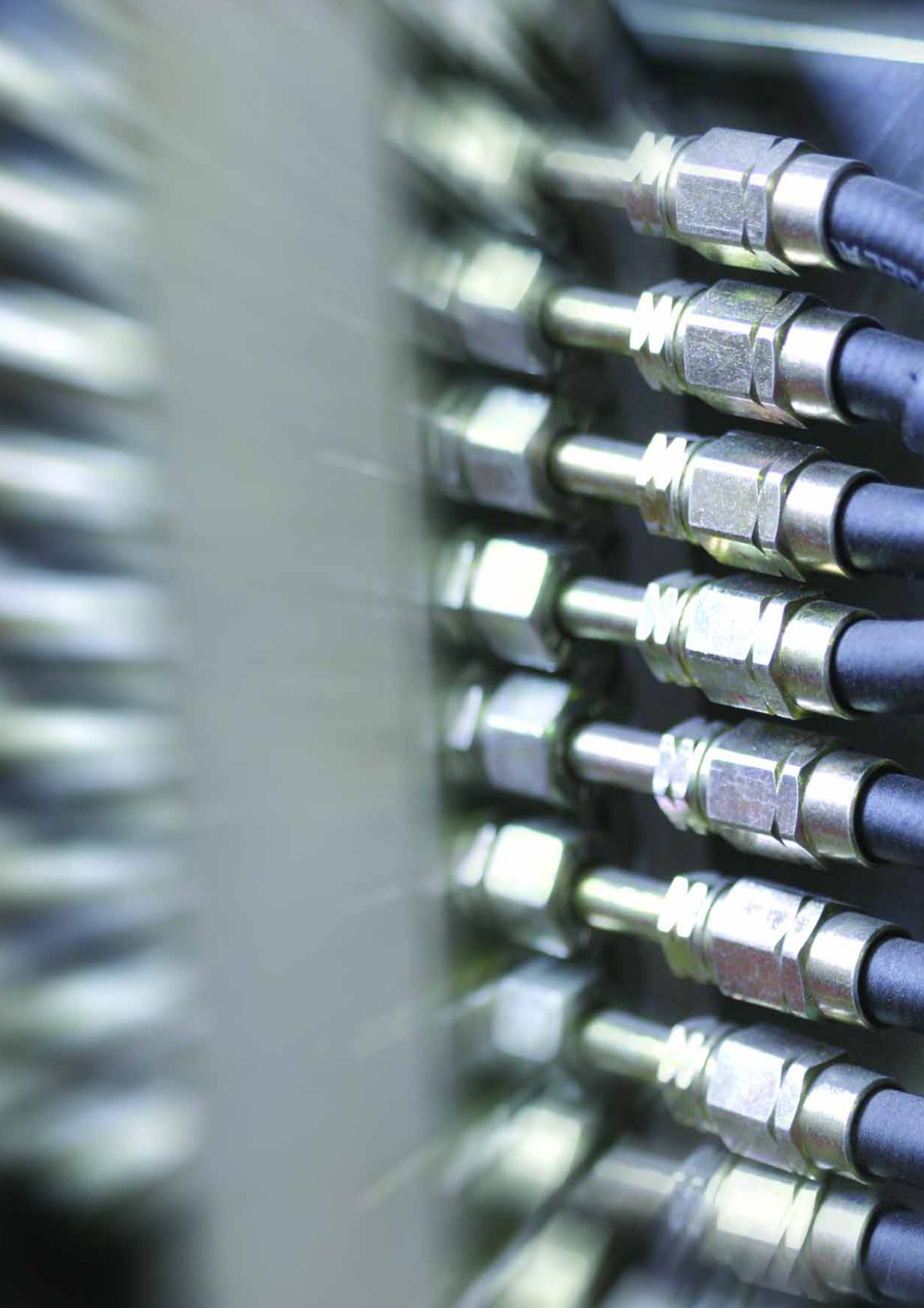
- Low friction and no stick-slip behaviour
- Outstanding leakage performance
- Superior extrusion and wear characteristics
- Excellent installation and assembly properties

Due to these criteria, seals based on these special polyurethanes are an ideal replacement for conventional PTFE based composite seals, provided that the temperature range or pressure fluid are within the recommended operating envelope.

Summary

Seals and sealing elements manufactured from X-ECOPUR® materials are suitable for higher pressures or larger extrusion gaps than PTFE seals and have an outstanding wear resistance leading to longer lifetimes. These benefits along with the installation, assembly, low speed operation and sealability advantages ensure that fluid power sealing has truly entered the 21st century.

Special X-Slide solutions



Sealing materials for press forming technology

Polyurethanes

ECOPUR® (TPU/TPE-U, 95 shore A)
colour: green
properties: Good chemical resistance, recommended for hydraulic applications (e.g.actuators)

H-ECOPUR® (TPU/TPE-U, 95 shore A)
colour: red
properties: Outstanding chemical resistance against water based fluids

Wiper A12-B (H-ECOPUR®)

S-ECOPUR® (TPU/TPE-U, 95 shore A)
colour: charcoal grey
properties: Outstanding sliding behaviour, similar mechanical & chemical properties as H-ECOPUR®

T-ECOPUR® (TPU/TPE-U, 95 shore A)
colour: blue
properties: Low temperature grade, excellent cold flexibility, limited chemical resistance

G-ECOPUR® (CPU, 95 shore A)
colour: red
properties: Outstanding chemical resistance, similar to H-ECOPUR®

X-SLIDE seals (X-ECOPUR® / NBR 70)

X-ECOPUR (TPU, 57 shore-D)
colour: dark-green
properties: Increased pressure & extrusion resistance, recommended for composite seals, chemical resistance similar to ECOPUR®

XH-ECOPUR (TPU, 60 shore-D)
colour: dark-red
properties: Increased pressure & extrusion resistance, recommended for composite seals, chemical resistance similar to H-ECOPUR®

XS-ECOPUR (TPU, 60 shore-D)
colour: charcoal-grey
properties: Increased pressure & extrusion resistance, recommended for composite seals, chemical resistance similar to S-ECOPUR®

compliant se

Elastomers

ECORUBBER 1 (NBR, 85 shore A)
colour black
properties Standard grade, good chemical resistance

H-ECORUBBER (HNBR, 85 Shore A)
colour black
properties Standard grade with good mechanical & chemical properties

ECORUBBER 2 (FKM/FPM, 85 Shore A)
colour brown
properties Standard grade, good wear and chem. characteristics

Rotor seal (ECORUBBER 2)

ECORUBBER 3 (EPDM, 85 Shore A)
colour black
properties Standard grade with good mechanical properties, recommended for steam injection

ECOFLAS (TFE/P, 80 Shore A)
colour black
properties Outstanding resistance to corrosion inhibitors, glycols

ECORUBBER 2 85Ab EX (FKM/FPM, 88 Shore A, “Viton Extreme”)
colour black
properties Outstanding chemical properties

ECOPERFLUORO (FFKM, 73 Shore A)
colour black
properties Best chemical and temperature resistance

Thermoplastics

ECOMID (PA)
colour black
properties Good mechanical properties, glass filled grades for increased pressures available, not to be used in water or moist environments

ECOTAL (POM)
colour black
properties Good mechanical characteristics; glass filled grades for increased pressures available

ECOPPS (PPS)
colour beige
properties Outstanding hardness and modulus, high chemical and thermal resistance

Sealing materials for press forming technology

Thermoplastics

ECOTEX material (orange coloured)

ECOPAEK (PEEK)
colour cream/black
properties Exceptional mechanical, chemical & thermal resistance

ECOTEX (fabric reinforced material on polyester resin base)
colour: orange
properties High wear & pressure resistance

PTFE and its compounds

F-SLIDE seal S09-E (ECOFLON 4 / NBR70)

ECOFLON 1 (PTFE, virgin)
colour white
properties High chemical resistance

ECOFLON 2 (PTFE, 15 % glass, 5 % MoS2)
colour charcoal-grey
Properties Good mechanical characteristics

ECOFLON 3 (PTFE, 40 % bronze)
colour bronze
properties Good tribological properties, high pressure resistance

ECOFLON 4 (PTFE, 25 % carbon)
colour black
properties High wear & pressure resistance

ECOFLON 5 (PTFE, modified)
colour white
properties Unfilled, modified, increased pressure & creep resistance

In addition, ECONOMOS is offering a wide range of organic and inorganic compounds such as PTFE + glass, PTFE + graphite (steam injection), PTFE + EKONOL, PTFE + PI, PTFE + PEEK, etc.

For further assistance please contact your ECONOMOS representative.

Properties	Test Method	Unit	ECOPUR TPU	H-ECOPUR TPU hydrolysis resistant	S-ECOPUR TPU +solid lubricants	T-ECOPUR TPU low temperature	G-ECOPUR TPU casted	X-ECOPUR 57 ShoreD TPU
	DIN							
Colour	-	-	green	red	anthracite	blue	red	dark green
Density	53479	g/cm³	1,2	1,2	1,24	1,17	1,2	1,21
Thermal Properties								
Glass transition temperature (1)	-	°C	-	-	-	-	-	-
Max. service temperature	-	°C	110	110	110	110	110	110
Min. service temperature	-	°C	-30	-20	-50	-50	-30	-30
Mechanical Properties								
Tensile test (2)								
- tensile strength (3)	53504	MPa	40	50	50	50	45	50
- elongation at break (3)	53504	%	430	330	380	450	280	380
- 100% modulus (3)	53504	MPa	12	13	17	12	11	18
Compression set (4)								
- after 22h at 100°C	53517	%	-	-	-	-	-	-
- after 22h at 175°C	53517	%	-	-	-	-	-	-
- after 24h at 70°C / 20% deformation	-	%	30	27	25	-	30	27
- after 24h at 100°C / 20% deformation	-	%	35	33	30	-	40	33
- after 70h at 70°C / 20% deformation	-	%	20	20	-	20	20	-
Tear strength	53515	N/mm	100	100	120	80	40	140
Rebound resilience	53512	%	42	29	-	50	43	-
Abrasion	53516	mm³	18	17	17	15	25	20
Durometer hardness Shore A (5)	53505	-	95	95	95	95	95	97
Durometer hardness Shore D (5)	53505	-	48	48	48	48	47	57
Chemical & Environmental Resistance (6)	**Temperature**							
Acids								
- inorganic diluted	RT		-	+	+	-	0	-
- inorganic concentrated	RT		-	-	-	-	-	-
- organic diluted	RT		0	+	+	0	0	0
- organic concentrated	RT		-	0	0	-	0	-
Alkalies - general	RT		-	0	0	-	0	-
Alcohols - general (except Methanol)	RT		-	+	+	-	0	-
Carbon dioxide	RT		0	+	+	0	+	0
Glycols - general	RT		-	0	0	-	0	-
Hydraulic fluids								
- mineral oil based	RT		+	+	+	+	+	+
	60°C		+	+	+	+	+	+
- synthetic oils								
HETG (triglyceride)	RT		+	+	+	+	+	+
	60°C		0	+	+	0	0	0
HEES (synthetic ester)	RT		+	+	+	+	+	+
	60°C		0	+	+	0	0	0
HEPG (polyglycols)	RT		0	+	+	0	+	0
	60°C		-	0	0	-	0	-
HEPR (polyalphaolefines)	RT		+	+	+	+	+	0
	60°C		0	+	+	0	+	0
Fire resistant fluids								
- HFA (water - oil emulsion)								
HFA-E	RT		0	+	+	0	0	0
	60°C		-	+	+	-	0	-
HFA-S	RT		0	+	+	0	0	0
	60°C		-	+	+	-	0	-
- HFB (oil - water emulsion)	RT		0	+	+	0	+	0
	60°C		-	+	+	-	0	-
- HFC (water - glycol)	RT		-	+	+	-	0	-
	60°C		-	0	0	-	0	-
- HFD (water free)								
HFD-R	RT		-	-	-	-	-	-
	60°C		-	-	-	-	-	-
HFD-S	RT		-	-	-	-	-	-
	60°C		-	-	-	-	-	-
HFD-T	RT		-	-	-	-	-	-
	60°C		-	-	-	-	-	-
HFD-U	RT		+	+	+	+	+	+
	60°C		0	+	+	0	0	0
Hydrocarbons						+		
- aliphatic	RT		+	+	+	-	+	+
- aromatic	RT		-	-	-		-	-
Methanol						-		
- diluted	RT		-	+	+	-	0	-
- concentrated	RT		-	-	-		-	-
Solvents						-		
-Toluene	RT		-	-	-	-	-	-
- Acetone	RT		-	-	-	-	-	-
- MEK	RT		-	-	-	-	-	-
Steam			-	-	-	+	-	-
Water	RT		+	+	+	-	+	+
	60°C		-	+	+		0	-

XH-ECOPUR	XS-ECOPUR	ECORUBBER 1	H-ECORUBBER	ECORUBBER 2	ECORUBBER 3	ECORUBBER 2 85Ab EX	ECOPERFLUORO	ECOFLAS 80A-b
60 ShoreD TPU hydrolysis resistant	57 ShoreD TPU +solid lubricants	NBR	H-NBR	FKM, FPM	EPDM	FKM, FPM (Viton Extreme)	FFKM	TFE/P
dark red	dark grey	black	black	brown	black	black	black	black
1,22	1,26	1,31	1,22	2,3	1,22	1,84	-	1,6
-	-	-23	-27	-12	-47	-7	-	4
110	110	100	150	200	150	200	290	200
-20	-20	-30	-25	-20	-50	-15	-15	0
53	45	16	18	8	12	14	15	15
350	350	130	180	200	110	175	180	200
20	20	11	10	5	9	10	9	8
-	-	15	22	-	15	-	-	-
-	-	-	-	20	-	65	-	30
26	24	-	-	-	-	-	-	-
30	30	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
140	160	20	30	21	15	15	-	22
-	-	28	29	7	38	-	-	-
20	20	90	90	150	120	170	-	110
97	96	85	85	83	85	88	73	80
60	57	36	33	36	34	39	-	31
+	+	0	0	+	+	+	+	+
-	-	-	-	+	+	+	+	+
+	+	+	+	+	+	+	+	+
0	0	-	-	-	+	+	+	0
0	0	0	0	0	+	0	+	+
+	+	+	+	+	+	+	+	+
+	+	+	+	+	0	+	+	+
0	0	+	+	+	+	+	+	+
+	+	+	+	+	-	+	+	+
+	+	+	+	+	-	+	+	+
+	+	0	0	+	-	+	+	+
+	+	0	0	+	-	+	+	+
+	+	0	0	+	-	+	+	+
+	+	0	0	+	-	+	+	+
+	+	+	+	+	+	+	+	+
0	0	+	+	+	+	+	+	+
+	+	+	+	+	-	+	+	+
+	+	0	0	+	-	+	+	+
+	+	+	+	+	-	+	+	+
+	+	+	+	0	-	+	+	0
+	+	+	+	+	+	+	+	+
+	+	0	0	0	0	+	+	0
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+	+	+	+	+	-	+	+	+
-	-	0	0	+	-	+	+	0
+	+	+	+	0	+	0	+	+
-	-	0	+	-	+	-	+	+
-	-	-	-	+	-	+	+	-
-	-	-	-	-	+	-	+	-
-	-	-	-	-	+	-	+	-
-	-	-	-	-	+	0	+	+
+	+	+	+	+	+	+	+	+
+	+	+	+	+	+	+	+	+

Legend:

(1) Values for this property are derived from DMA-analysis and are defined as the maximum of the loss modulus curves.

(2) Test specimens: Type S 2.

(3) Test speed: 200 mm/min.

(4) Tests were done on discs Dia 13 x 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 percent of deflection that did not return.

(5) 6,3 mm thick test specimens.

(6) Symbolic of the rating:

+	Excellent
o	Good / fair
-	Poor

This table is a valuable help in the choice of a material. The data listed here fall within the normal range of product properties.
However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design.

ECONOMOS Thermoplastics

Properties		Test Method	Unit	ECOMID PA 6 G	ECOTAL POM-C	ECOPPS PPS	ECOPAEK PEEK
		ISO (IEC)					
"Colour"		-	-	black	natural/black	beige	cream
Density		1183	g/cm³	1,15	1,4	1,35	1,32
Water absorption:							
- after 24 / 96 h immersion in water of 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 of 23°C / 50% RH		-	%	2,2	0,2	-	0,2
- at saturation in water of 23°C		-	%	8,5	0,85	0,01	0,45
Thermal Properties (2)							
Melting temperature		-	°C	220	165	280	340
Glass transition temperature (3)		-	°C	-	-	-	-
Thermal conductivity at 23°C		-	W/(K·m)	0,29	0,31	0,30	0,25
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 (4)		-	°C	170	140	260	310
- continuously: for 5.000 / 20.000 h (5)		-	°C	105 / 90	115 / 100	- / 230	- / 250
Min. service temperature (6)		-	°C	-40	-50	-20	-20
Flammabilty (7)							
- "Qxygen Index"		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 (8)							
- tensile stress at yield / tensile stress at break (9)	+	527	MPa	85 / -	68 / -	95 / -	110 / -
	++	527	MPa	65 / -	68 / -	95 / -	110 / -
- tensile strain at break (9)	+	527	%	25	35	15	20
	++	527	%	> 50	35	15	20
- tensile modulus of elasticity (10)	+	527	MPa	3 500	3 100	3 450	4 400
	++	527	MPa	1 800	3 100	3 450	4 400
Compression test (11)							
- compressive stress at 1 / 2 / 5 % nominal strain (10)	+	604	MPa	26 / 51 / 92	19 / 35 / 67	-	29 / 57 / -
Charpy impact strength - Unnotched (12)	+	179 / 1eU	kJ/m²	no break	³ 150	-	no break
Charpy impact strength - Notched (13)	+	179 / 1eU	kJ/m²	3,5	7	-	3,5
Izod impact strength - Notched	+	180 / 2A	kJ/m²	3,5	7	-	6
Ball indentation hardness (14)	+	2039 - 1	N/mm²	165	140	-	230
Rockwell hardness (14)	+	2039 - 2	-	M 88	M 84	M 95	M 105
Hardness Shore D (3 sec.)	+	868	-	77	82	-	86
Chemical & Environmental Resistance (16)							
Acids							
- inorganic diluted				0	0	+	+
- inorganic concentrated				-	-	0	-
- organic diluted				0	0	+	+
- organic concentrated				0	0	+	+
Alkalies - general				0	0	+	+
Alcohols - general (except Methanol)				+	+	0	0
Carbon dioxide				+	+	+	+
Glycols - general				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)							
HFD-R				+	+	+	+
HFD-S				+	+	+	+
HFD-T				+	+	+	+
HFD-U				+	+	+	+
Hydrocarbons							
- aliphatic				+	+	+	+
- aromatic				+	+	+	+
Methanol							
- diluted				+	+	+	+
- concentrated				-	+	0	+
Solvents							
-Toluene				+	+	0	+
- Acetone				+	+	+	+
- MEK				+	0	+	+
Steam				0	+	+	+
Water				0	+	+	+

ECONOMOS Thermoplastics

ECOFLON 1 PTFE	ECOFLON 2 PTFE +25% glass fiber +5% MoS2	ECOFLON 3 PTFE +40% Bronze	ECOFLON 4 PTFE +25% Carbon	ECOFLON 5 PTFE modified	ECOTEX
white	grey	bronze	black	white	grey
2,17	2,25	3,0	2,1	2,16	1,25
-	-	-	-	-	-
-	-	-	-	-	-
< 0,01	0,02	-	-	-	< 0,1
< 0,02	< 0,15	-	-	-	-
327	327	327	327	327	-
-	-	-	-	-	-
0,23	0,48	-	0,60	0,35	-
-	-	-	-	-	-
-	-	-	-	-	-
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	280	180	360	-
300	200	280	180	360	-
400 - 700	-	-	-	-	3 200
400 - 700	-	-	-	-	3 200
- / 8 / -	- / 14 / -	-	-	-	-
no break	-	-	-	no break	-
-	-	-	-	-	-
16	12	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	M 100
57	60	64	65	59	-
+	+	+	+	+	0
+	0	0	0	+	-
+	+	+	+	+	0
+	+	+	+	+	-
+	0	0	0	+	0
+	+	+	+	+	+
+	+	+	+	+	+
0	0	0	0	0	+
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+	+	+	+	+	-
+	+	+	+	+	-
+	+	+	+	+	+
+	+	+	+	+	+

Legend

(1) Tests were done on discs Ø50 x 3 mm.

(2) The figures given for these properties are for the most part derived from raw material supplier data and other publications.

(3) Only for short time exposure (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% as compared with the original value. The temperature values given here are thus based on the thermal-oxidative degradation which takes place and causes a reduction in properties. Note, however, that, as far all thermoplastics, 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 decreasing with decreasing temperature, the minimum allowable service temperature is practically mainly 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 Ø12 x 30 mm.

(11) Pendulum used: 4 J.

(12) Pendulum used: 5 J.

(13) 10 mm thick test specimens.

(14) Symbolic of the rating:

+	Excellent
0	Good / fair
-	Poor

Chemical resistance of materials can vary widely, and is affected by factors such as temperature. Material chemical compatibility is considered to be for materials between room temperature and 70°C.

This table is a valuable help in the choice of a material. The data listed here fall within the normal range of product properties of dry material. However, they are not guaranteed and they should not be used to establish material specification limits nor used alone as the basis of design.
It has to be noted that plenty of the products listed in this table fibre reinforced and/or filled, and consequently they are anisotropic materials (properties differ when measured parallel and perpendicular to the extrusion direction).

S09-ES special (XH-ECOPUR®)

K02-P (ECOPUR®)

S32-P (H-ECOPUR®)

Large diameter packing (G-ECOPUR®)

Wiper A12-B (H-ECOPUR®)

ECOTEX for piston guiding (Special textile reinforced material)

applications

Optimized ECONOMOS® solutions

Special applications for this industry

ECONOMOS® produces a large variety of seals and seal-kits for machines in the press technology. The requirements are not only standardized but also for special applications and, of course, all produced in high performance materials.

Press assembly

Filter press

Forging press

Typical applications:

Clutch and Brake	Single acting pneumatic piston or rod seal for low pressure.
Balancing Cylinders	Single acting piston seal or simple cup seal used for replacement in hydraulic and pneumatic cylinders.
Hydraulic safety system	Hydraulic, single acting asymmetric piston seal for standard application.
Press cylinder	Hydraulic, single acting Chevron sealing set, design with extremely flexible sealing lips for difficult operating conditions.
Tool-fix-system	Hydraulic, single action rod seal with active back-up rings suitable for large extrusion gaps or higher pressure range.
Hydraulic drawing cushion	Hydraulic, double acting O-ring activated X-ECOPUR® or PTFE rod seal for extreme low or high speed, suitable for positioning function.
Hydraulic valve block	Static seals conventional O-rings and square-rings and robust profiles mainly used as flange seals Inside or outside pressurization possible.

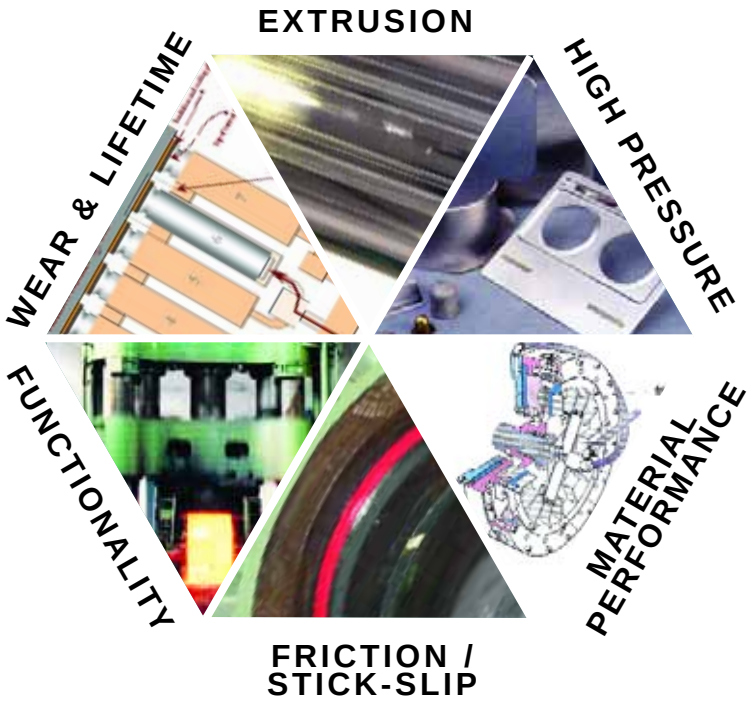
Optimized ECONOMOS® solutions

optimized processes

Proven to optimize system performance

For many years the ECONOMOS® Group has been providing technically advanced system solutions to meet the needs of applications and processes in the press forming technology. 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 system and your needs, we will review our comprehensive list of standard products and, if the application demands non-standard products, we can tailor a customized solution.
The unique ECONOMOS® total service concept can manufacture - on demand - without tooling costs or delays - a solution which will provide considerable advantages over conventional arrangements.

The following pages will give you a flavour of our capabilities in providing customized solutions for your machinery or process.



Applications in the press forming industry

ECONOMOS® seals are present at all different stages of the press production and applications in the press forming industry:

Wear & Lifetime:
Wear and lifetime is surly one of the most important properties of a seal. Especially for press operators, the lifetime is a topic as the replacement of seals is very costly. Therefore the right selection of seal profile and material has to be done very careful.... (see page 24).

High pressure:
The working pressure of hydraulic presses is definitely one of the main characteristics. Normally the pressure is in the range of a few hundred bar but there are also units which use a pressure up to a few thousand bar - an extreme demand on construction and materials ..... (see page 25).

Material performance:
Every mechanical press is equipped with clutch and brake. The clutch is used for torque transmission from motor and flywheel to the driving shaft ..... (see page 26).

Friction / Stick-slip:
Friction of moving parts is always a topic. At high moving speeds a lot of energy is transformed to unwanted heat. But sometimes the question of friction is much more critical at low speeds - especially then when Stick-Slip affects the function of the machine ..... (see page 27).

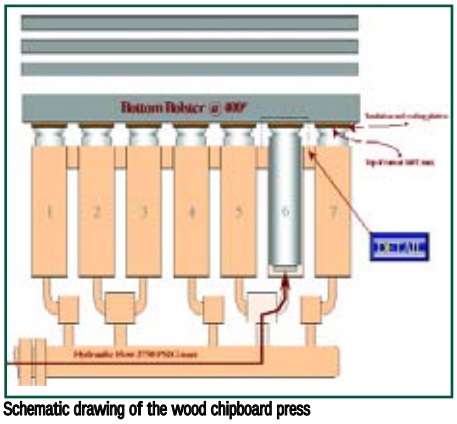
Functionality:
In order to produce steel products that are as close as possible to the final dimensions of the finished product and where casting is not an option, forging presses have to be used ..... (see page 28).

Extrusion
Especially forming presses are more or less machines of large dimensions. As the production of heavy machine parts is following it's own rules - the size of the tolerance fields is growing with the dimension ..... (see page 29).

Wear & lifetime

Wear and lifetime is surly one of the most important properties of a seal. Especially for press operators, the lifetime is a topic as the replacement of seals is very costly. Therefore the right selection of seal profile and material has to be done very careful.

Seals for a wood chipboard press

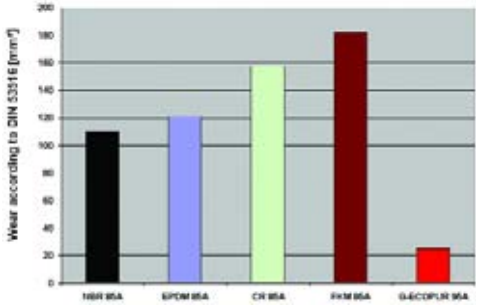


Schematic drawing of the wood chipboard press

This particular press has a series of 14 cylinders in a vertical position with a rod diameter of 580mm. These cylinders raise a heated plate which compresses wood chips and glue into a particleboard. The hydraulic system is operated with SOLENIC 2B which is classified as a HFAE fluid. The composition of the fluid in the system is 97% water and 3% SOLENIC 2B.

The press has been in operation for 12 years and operated quite well until five years ago. Since that time the have had erratic seal life time with seals lasting from 2 to 200 days with an average being 90 days.
The original rod seals were made of EPDM and worked well for the first number of years. After a slightly intensification of the operation parameters the EPDM seals started to fail - the failure mode was random chipping of the rubber on the ID.

S01-special made of G-ECOPUR



Wear of various sealing materials

The reason for the reduced lifetime was a too high friction force / wear at the sealing surfaces caused by a lack of lubrication in combination with a very large cross-section which exerts heavy loads on the sealing surfaces. The system fluid being primarily water does not have sufficient lubrication to support these seal designs.

The problem could be solved by changing the material from EPDM to G-ECOPUR®, a high wear resistance polyurethane and a modification of the seal profile.

High pressure

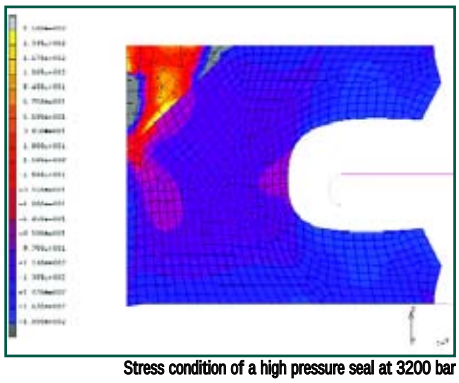
The working pressure of hydraulic presses is definitely one of the main characteristics. Normally the pressure is in the range of a few hundred bar but there are also units which use a pressure up to a few thousand bar - an extreme demand on construction and materials.

Seals for High Pressure Presses

typical products of a high pressure hydraulic press

In the wide field of press technology there are presses which use a pressure up to 3000 bar and more in order to reach necessary forming forces with compact unit dimensions - hot and cold iso static presses as well as presses for sheet metal forming for prototypes and short runs are common examples.

The load of several thousand bar is not just causing a very high stress- it also deforms the components. In this special case the deflection of the cylinder combined with the changing properties of the sealing material at ultra high pressure was initiating fractures of the seal.



Stress condition of a high pressure seal at 3200 bar

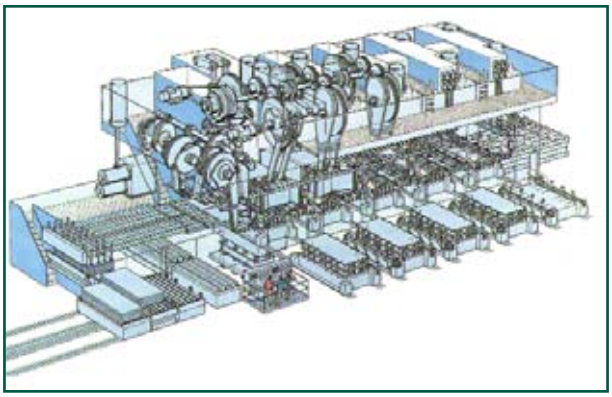
Standard seal is a K02-P (original with a diameter of 580 mm)

Our knowledge about material behaviour under a very high pressure and the use of FEA for the design and optimisation of the seal geometry is the basis for a product which works under this challenging condition and this for many thousand cycles.

Material performance

Every mechanical press is equipped with clutch and brake. The clutch is used for torque transmission from motor and flywheel to the driving shaft.

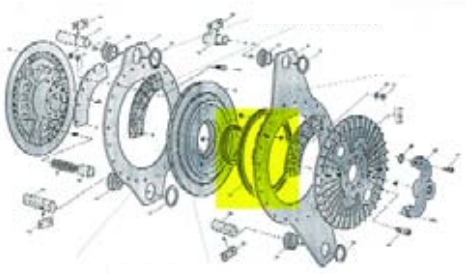
Clutch and brake of mechanical presses



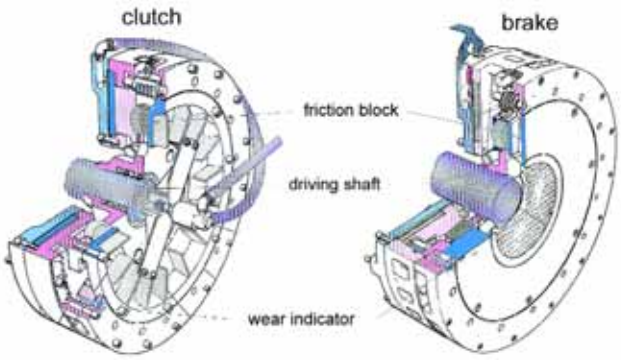
Schematic drawing of a mechanical press

After releasing the clutch, the brake brakes the ram, upper-die and transmission.

Sealing elements made from rubber materials are used because of the pneumatic triggering of clutch and brake and the resulting low pressure.



Exploded drawing of clutch and brake of a mechanical press



Clutch and brake with indicators of wear

ECONOMOS® uses the ECOPUR® material that excels with considerably reduced wear and has thus a positive impact on the service life.

Friction - Stick-slip

Friction of moving parts is always a topic. At high moving speeds a lot of energy is transformed to unwanted heat. But sometimes the question of friction is much more critical at low speeds - especially then when Stick-Slip affects the function of the machine.

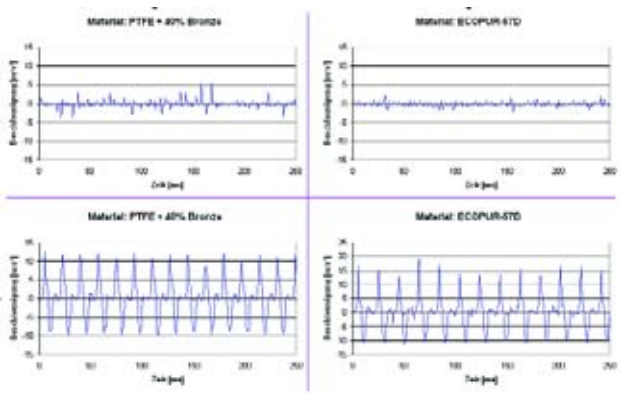
Stick-Slip free Sealing solution for a press reconstruction

Installation of the plunger of a hydraulic press

Chevron packings have been and are still very often used in presses but one big disadvantage of this seal type is the relatively high friction force. This characteristic can lead very fast to Stick-Slip when the press is moving very slow at the end of the stroke or an exact position has to be reached. Therefore a different sealing system is required - even when the housing already exists.

Normally the sealing system of a new press designs is selected according to the specific requirements of the press operation but the situation is totally different if old presses are refurbished and used for a totally different process. The hydraulic control unit can be changed relatively easy but the sealing system has also to be adapted - a not always easy venture.

housing with installed H-ECOPUR® seal



Measured Stick-slip behaviour with the original sealing system

One of the main facts during the refurbishment of an old press was the replacement of a rubber fabric chevron pakking by an especially adapted sealing system with a reduced friction and improved Stick-Slip performance. Additional the design had to be done under the aspect that the metal parts should be modified just very slightly in order to keep the costs at a minimum.

applicatio

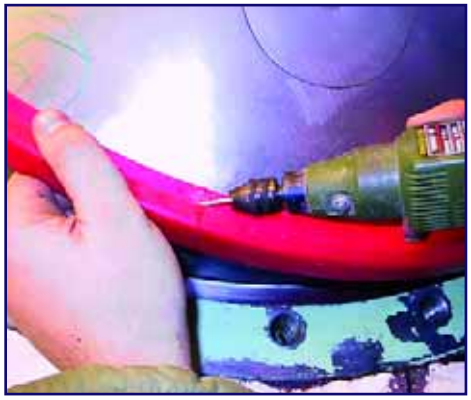
Functionality

In order to produce steel products that are as close as possible to the final dimensions of the finished product and where casting is not an option, forging presses have to be used.

Seals for forging presses

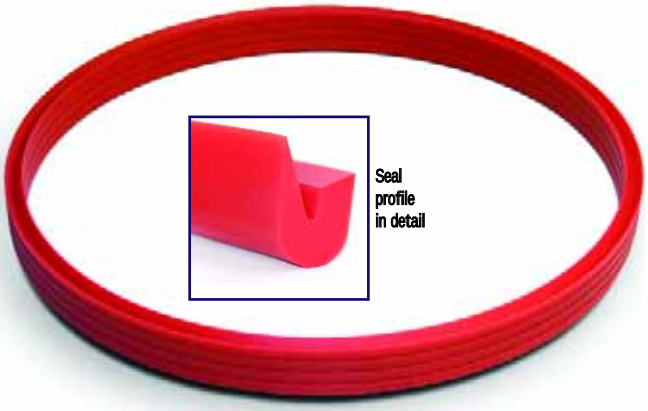
Forging press

In order to shape steel, high forces need to be applied. These high forces are achieved by a fast movement of operating cylinders combined with relatively high hydraulic pressures and diameters of above 1000 mm are no rarity.



Installation of giant seal kit (welded and adapted)

Many high quality sealing solutions for forging presses have been delivered to the steel industry by ECONOMOS® such as our S32-P made of G-ECOPUR®.



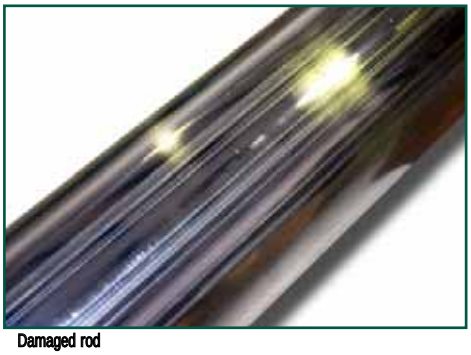
Special seal type S32-P (packing, made of G-ECOPUR®)

Optimal engineered seals (in respect to sealing materials and the selection of the correct profile) in combination with the ability of welding seals on site make ECONOMOS® your number one choice.

Extrusion

Especially forming presses are more or less machines of large dimensions. As the production of heavy machine parts is following it's own rules - the size of the tolerance fields is growing with the dimension.
The mechanical engineering for heavy machines is done under this aspect and therefore it is a must to supply also seals designed under the same aspect.

Seals for a increased extrusion gap

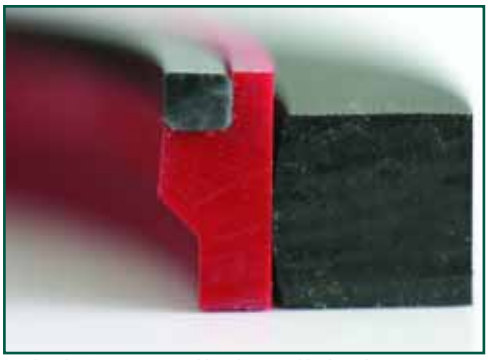


Damaged rod

The extrusion gap is always a topic for the design of new machines. On the one hand, the mechanical construction demand a very high clearance in order to prevent metal to metal contact of rod and seal housing under all circumstances, on the other hand the seal requires a very small gap in order to prevent a premature seal failure caused by extrusion.

extruded PTFE-seal (most common used)

Very frequently used sealing systems are PTFE seals with a rubber energizer - so called composite seals. One of the disadvantage of PTFE is it's inclination to cold flow, a material property which supports extrusion. Therefore the use of PTFE seals in combination with large extrusion gaps and high pressure is always a problem.



Seal made of XH-ECOPUR® with an integrated back-up ring

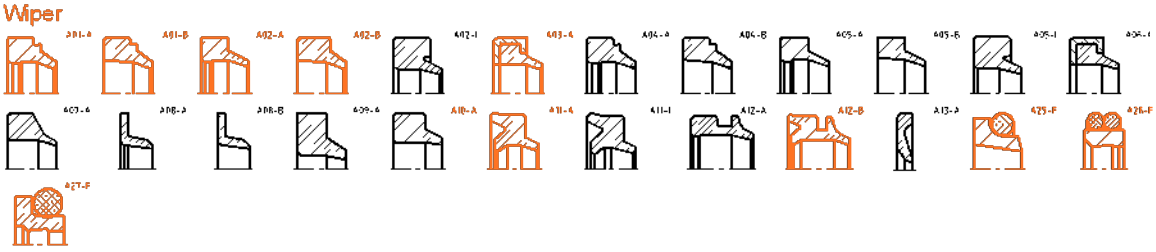
A seal made of our special material XH-ECOPUR, a polyurethane grad with an exceptional extrusion resistance in combination with an integrated back-up ring made of a thermoplastic material was used to replace the PTFE seals in an existing press design. The good experience which was made with this sealing system was furthermore the reason that the extrusion gap could be increased for additional 30% for all new designs.

Preferred profiles in the press forming industry:

preferred profi

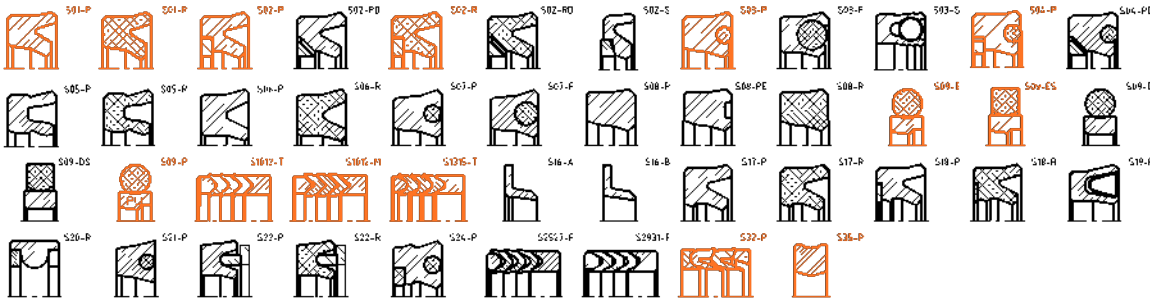
Wipers

Wiper



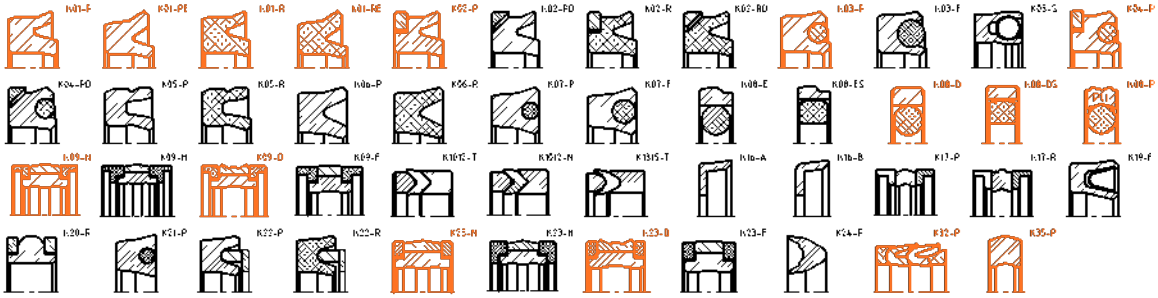
Rod seals

Rod seals



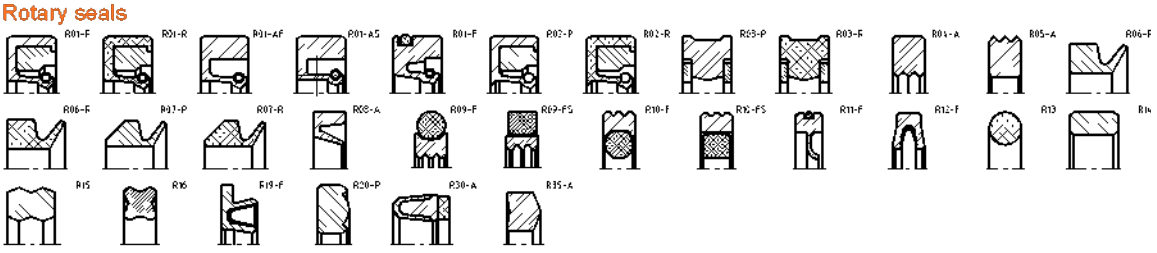
Piston seals

Piston seals



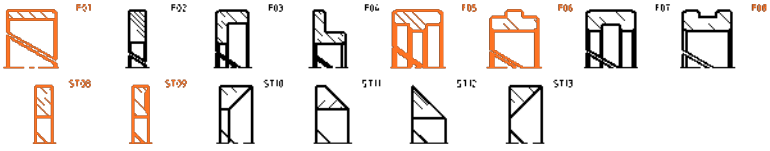
Rotary seals

Rotary seals



Guide- and Back-up rings

Guide and Back-up rings



O-Rings (static seals)

O-Rings and static seals

For all non-standard profiles and our free seal design and advisory services, please contact your local ECONOMOS® office.

Material availability, trade marks ™, liability exclusion

Material Availability

All the materials listed in this brochure are available in diameters of up to 600 mm, and some grades can be supplied in diameters of up to 1,600 mm. Selected materials for large diameter seals up to 4000 mm are available ex stock ECONOMOS® Austria.
For milled parts, plates and sheets (EPP, AEPP) are available in a wide range of dimensions.

According to our production philosophy and our manufacturing equipment, ECONOMOS® is able to produce all the seals and plastic parts as a single piece and small series up to a couple of thousands by machining or milling techniques.
Due to our experience in manufacturing "difficult" materials like polyurethanes and high performance thermoplastics like polyetherether ketone (PEEK), larger series and high volume business will be produced by injection moulding.

Trade Marks [™]

ECONOMOS®´ branding integrates our own products under a unified set of trade names all over the world. This provides a clear and consistent identification of all our materials and makes them available through all partners worldwide.
All other trade names referred to this brochure are the property of their respective owners.

Liability exclusion

All information supplied by or on behalf of ECONOMOS® plastic products and seals in relation to its products, whether in the nature of data, recommendations or otherwise, is supported by research and believed reliable.
ECONOMOS® seals and plastic products assume no liability whatsoever in respect of application, processing or use made of the aforementioned information or products, or any consequence thereof. The buyer undertakes all liability in respect of the application, processing or use of the aforementioned information or product, whose quality and other properties he shall verify, or any consequence thereof.
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Occupational health and safety and the environment

We are committed to providing a safe and healthy workplace, being the steward of the environment and natural resources within our scope of responsibility and to being a respected member of the community.

www.economos.com

quality sealing and engineering plastics solutions

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