seal-mart

semi-finished materials for seal production

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introduce of materials

in the technology of sealing, mainly representatives of two groups of macromolecular (polymer) substances are used, i.e. substances of the group of elastomers and thermoplastics (plastomers).

macromolecular substances are organic compounds whose molecules exist of several thousands, often even of millions, of atoms which are known as macro, giant, string or chain molecules. they can either be created by modification of highly molecular natural materials (e.g. natural rubber) or by depositing low-molecular elements (so- called monomers) through various chemical reactions (synthetic materials, "plastics").

elastomers

elastomers are materials that can be highly expanded by exerting relatively little power. because of their structure, elastomers have a high retractility, which means that the remaining deformation is very small. basically there are two main groups of elastomers: chemically crosslinked and thermoplastic ones.

chemically crosslinked (vulcanized) elastomers or rubber materials are polymers which are formed by crosslinking the macromolecules with various vulcanisation additives. due to this chemical bonds they **do not melt** and they **begin to decompose at high temperatures**. in addition elastomers **swell more or less intensively**, depending on different media, and **do not dissolve.**

thermoplastic elastomers have the significant properties of elastomers over a wide temperature range, but they are physically and not chemically crosslinked. therefore they can be melted at high temperatures and can be processed with the traditional thermoplastic processing techniques. thermoplastic elastomers **are soluble**; generally they **swell less** than their chemically crosslinked equivalents.

elastomers are normally classified as "polar" and "nonpolar" and further as "saturated" and "unsaturated" types. to a certain extent, polarity allows statements about swelling and chemical resistance, and saturation about ozone and ageing resistance of the respective material.

saturation

saturation of elastomers indicates whether there are free double bonds in the macromolecules of the material. saturated elastomers do not have double bonds in their macromolecules and are therefore significantly better resistant to ozone and ageing than unsaturated elastomers.

polarity

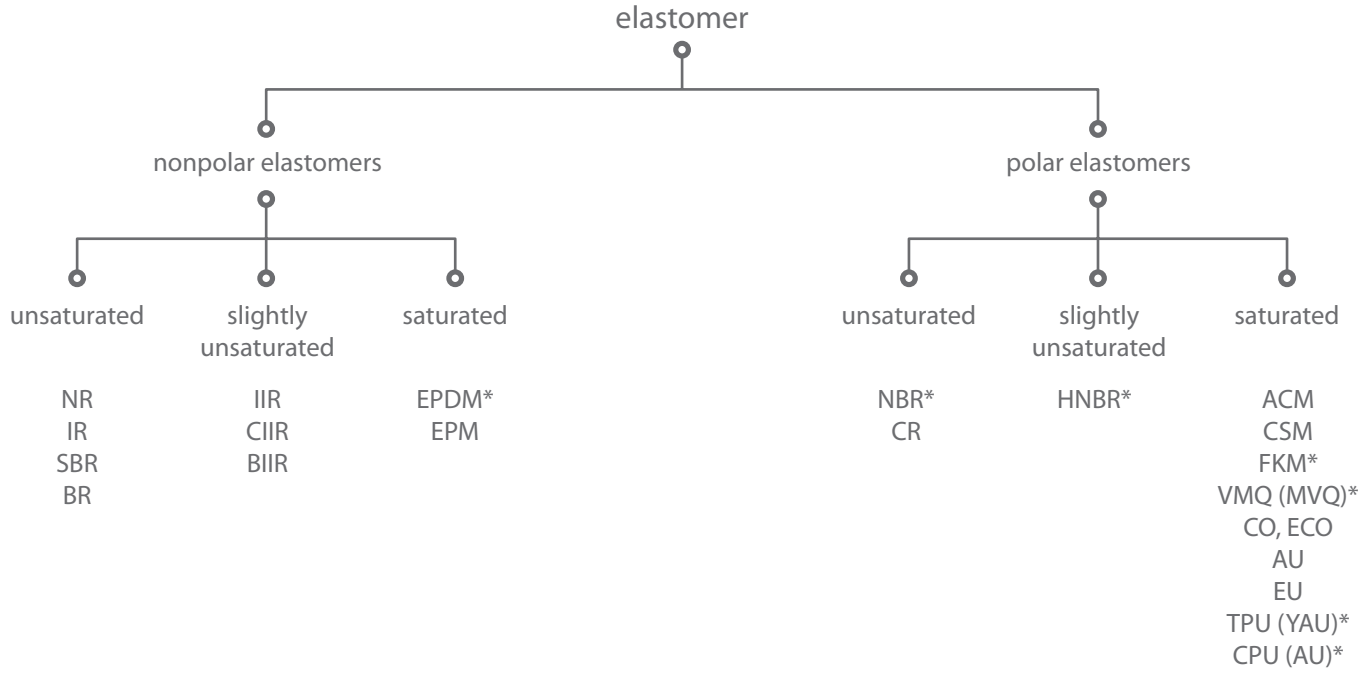
as mentioned above, the polarity of a synthetic material provides information on its swelling behaviour and chemical resistance in different media. s rule of thumb says that polar elastomers are incompatible with polar media and nonpolar elastomers with nonpolar media. In this context it must, however, be said that the chemical resistance of an elastomer cannot or only insufficiently be assessed by an amateur.

polar media are for instance: water, detergents, alcohols, acids and bases, ketones, esters, etc.

nonpolar media are for instance : mineral oil, petrols, vegetable and animal oils and fats, silicone oils and grease and hydrocarbons.

the following graphics shows the most important chemically and physically crosslinked elastomers used in sealing applications.

the most important elastomers for sealing applications



*) elastomers part of the seal-mart program

TPU (YAU) thermoplastic polyurethane elastomer basing on polyester
CPU (AU) cast polyurethane elastomer basing on polyester

overview of other codes, please see table in next pages

overview of codes for materials

elastomers	code according to	
chemical name for the base polymers	ASTM 1418	ISO 1629
acrylonitrile butadiene rubber	NBR	NBR
hydrogenated acrylonitrile-butadiene rubber	HNBR	HNBR
chlorine butadiene rubber	CR	CR
carboxylated nitrile rubber	XNBR	XNBR
acrylate rubber	ACM	ACM
ethylene-acrylate rubber	AEM	AEM
silicone rubber		
methyl polysiloxane	MQ	MQ
vinyl-methyl polysiloxane	VMQ	VMQ
phenyl-vinyl-methyl polysiloxane	PVMQ	PVMQ
phenyl-methyl polysiloxane	PMQ	PMQ
fluorosilicone rubber		
fluoromethyl polysiloxane	FVMQ	FVMQ
fluoro elastomer	FKM	FKM
perfluoro elastomer	FFKM	FFKM
polyurethane rubber		
polyester-urethane rubber	AU	AU
polyether-urethane rubber	EU	EU
ethyleneoxide-epichlorhydrin rubber	ECO	ECO
epichlorhydrin polymer	CO	CO
chlorosulfonated polyethylene	CSM	CSM
natural rubber	NR	NR
isoprene rubber	IR	IR
polybutadiene rubber	BR	BR
styrene-butadiene rubber	SBR	SBR
ethylene propylene diene rubber	EPDM	EPDM
ethylene propylene copolymer	EPM	EPM
butyl rubber	IIR	IIR
chlorobutyl rubber	CIIR	CIIR
bromobutyl rubber	BIIR	BIIR

red highlighted elastomers part of the seal-mart program
ASTM = american society for testing and materials, ISO = international organization for standardization, DIN = Deutsches Institut für Normung e.V.

overview of codes for materials

thermoplastics	code according to	
chemical name for the base materials	DIN 7728, part1, ISO 1043.1	ASTM D 1600
polytetrafluoroethylene	PTFE	PTFE
ethylene tetrafluoroethylene copolymer	E/TFE	E/TFE
perfluoroalkoxy copolymer	PFA	PFA
polyvinyl chloride	PVC	PVC
acrylonitrile-butadiene styrene	ABS	ABS
styrene acrylonitrile	SAN	SAN
polypropylene	PP	PP
polyamide	PA	PA
polyoxymethylene (polyacetal)	POM	POM
polyphenylene oxide	PPO	PPO
polysulphone	PSU	PSU
polyetherblockamide	PEBA	PEBA
polyether ketone	PEEK	PEEK
polyetherimide	PEI	PEI

thermoplastics rubbers	code according to
chemical name for the base polymers	ASTM D 1418
block polymer of styrene and butadiene	YSBR
polyetherester	YBPO
thermoplastic polyolefin	TPO

duroplastics	code according to	
chemical name for the materials	DIN ISO 1043.1	ASTM D 1600
unsaturated polyester	UP	UP
phenol formaldehyde	PF	PF
urea formaldehyde	UF	UF
glass fibre reinforced, unsaturated polyester resin	UP-GF	-

red highlighted elastomers part of the seal-mart program
ASTM = american society for testing and materials, ISO = international organization for standardization, DIN = Deutsches Institut für Normung e.V.

summary of some trade names for elastomers and plastics

elastomers chemical name	trade names
acrylonitrile-butadiene rubber (NBR)	perbunan, hycar, chemigum, breon, butakon, europrene N, butacril, krynac, paracril, nipol, nitriflex
chlorine butadiene rubber (CR)	neoprene, baypren, butaclor, denka chloroprene
acrylate rubber (ACM)	cyanacryl, europrene AR, noxtite PA, nipol AR
ethylene acrylate (AEM)	vamac
silicone rubber (VMQ, FVMQ and PVMQ)	silopren, silastic, silicone, rhodorsil
fluoro elastomer (FKM)	viton, fluorel, tecnoflon, dai el, noxtite
perfluoro elastomer (FFKM)	kalrez, simriz, chemraz
polyurethane (AU and EU)	vulkollan, urepan, desmopan, adipren, estane, elastothane, pellethane, simputhan
ethyleneoxide-epichlorhydrin rubber (ECO)	epichlomer, hydrin, gechron
styrene-butadiene rubber (SBR)	buna hüls, buna SB, europrene, cariflex S, solprene, carom
ethylene propylene diene rubber (EPDM)	dutral, keltan, vistalon, nordel, epsyn, buna AP, royalene, polysar EPDM
butyl rubber (IIR)	enjay butyl, esso butyl, polysar butyl
chlorosulfonated polyethylene (CSM)	hypalon

plastics for seal applications chemical name	trade names
acrylonitrile-butadiene styrene (ABS)	cycolac, novodur, terluran
acetal resin polyoxymethylene (POM)	delrin, hostaform C, ultraform
polyamide (PA)	durethan, dymetrol, nylon, rilsan, ultramid, vestamid
polybutyleneterephthalate (PBTP)	crastin, pocan, ultradur, vestodur
polyethylene (PE)	alathon, baylon, hostalen, lupolen
polycarbonate (PC)	lexan, makrolon
polyphenylene oxide (PPO)	noryl
polypropylene (PP)	hostalen PP, novolen
polystyrene (PS)	hostyren, lustrex, vestyron
polytetrafluoroethylene (PTFE)	algoflon, fluon, halon, hostaflon, teflon
ethylene tetrafluoroethylene copolymer (ETFE)	tefzel
polyvinyl chloride (PVC)	breon, hostalit, plaskon
perfluoroalkoxy copolymer (PFA)	teflon-PFA
phenolic resin hard fabric	ferrozell, pertinax

red highlighted elastomers part of the seal-mart program

shelf life of elastomers and plastics

during storage, the characteristics of elastomeric products can on the one hand be damaged by chemical reactions wich are basically caused by the influence of heat, light, oxygen, ozone and various chemicals on the material, and on the other hand by physical processes. these physical processes, which are called physical ageing, are either due to the influence of external tensions leading to cracks and permanent deformation of the machined parts, or to the migration of plasticizers from the semi-finished products which makes the material more brittle and leads to deformation of the parts.

therefore, rubber products will only maintain their characteristics without major changes for several years, if proper storage is ensured. In this context, it must be said that ageing and storage properties of rubber products depend considerably on their chemical structure. unsaturated elastomers, such as nitrite rubber (s-mart NBR) age much quicker under improper storage conditions than saturated elastomers, such as fluororubbers (s-mart FKM). the ideal characteristics of these products can only be maintained for longer periods of time, if the products are stored in accordance with the following recommendations of DIN 7716.

recommended storage conditions for elastomers and plastics

- rubber and plastic products should be stored in a cool and dry environment. storage temperature should be around 15°C and not exceed 25°C; relative humidity should be less than 65%.
- rubber and plastic products should not be exposed to light above all direct sunlight and artificial light with a high UV content (bulbs to be preferred to neon lamps).
- the storage rooms must not contain any ozone-producing devices, such as electrics motors and high-voltage divices.
- rubber products should not be exposed to draft. this can be ensured by using airtight packaging wich must not, however, contain plasticizers, Polyethylene is most suitable for such purposes.
- contact between rubber products of different compositions is to be avoided.
- contact between rubber and plastic products and chemicals and / or dangerous metals (e.g. copper, manganese) is to be avoided.
- rubber and plastic products should be stored as tension-free as possible, i.e. the parts should not be subject to tensile, pressure or bending deformation. rubber products, must not be hung on nails or tightly folded or rolled.

shelf life of semi-finished products:

at above mentioned storage conditions, semi-finished products can be stored for the periods of time indicated below without loosing their typical properties:

polyurethanes	shelf life (year)
	approx.
s-mart PU	8
s-mart HPU	12
s-mart GPU	12
s-mart LTPU	8
s-mart HTPU	8
s-mart SPU	12
s-mart XPU	12
s-mart XHPU	12
s-mart XSPU	12

rubbers	shelf life (year)
	approx.
s-mart NBR	5
s-mart HNBR	8
s-mart FKM	10
s-mart EPDM	8
s-mart MVQ	10
s-mart TFE/P	10

thermoplastics	shelf life (year)
	approx.
s-mart PTFE virgin	12
s-mart PTFE glass	12
s-mart PTFE bronze	12
s-mart PTFE carbon	12
s-mart PTFE graphite	12
s-mart PTFE ekonol	12
s-mart POM	10
s-mart PA	10
s-mart PAEK	12
s-mart UHMPWE	10
s-mart TEX	12

shelf life of seals:

normally the shelf life of seals is shorter compared to semi-finished materials. the following recommendations are valid for seals, which are produced out of a semi-finished material at the end of the shelf life of the semi-finished material.

polyurethanes	shelf life (year)
	approx.
s-mart PU	4
s-mart HPU	8
s-mart GPU	8
s-mart LTPU	4
s-mart HTPU	4
s-mart SPU	8
s-mart XPU	8
s-mart XHPU	8
s-mart XSPU	8

rubbers	shelf life (year)
	approx.
s-mart NBR	2
s-mart HNBR	4
s-mart FKM	6
s-mart EPDM	4
s-mart MVQ	6
s-mart TFE/P	6

thermoplastics	shelf life (year)
	approx.
s-mart PTFE virgin	8
s-mart PTFE glass	8
s-mart PTFE bronze	8
s-mart PTFE carbon	8
s-mart PTFE graphite	8
s-mart PTFE ekonol	8
s-mart POM	6
s-mart PA	6
s-mart PAEK	8
s-mart UHMPWE	6
s-mart TEX	8

the aforementioned instructions, recommendations and guidelines are according to our best knowledge. we can, however, not accept any liability in this respect.

standard materials

polyurethanes

s-smart PU

(standard polyurethane)

s-mart PU is a thermoplastic polyurethane-elastomer on the basis of polyester. it belongs to the group of the polar and saturated elastomers. the use of special raw materials makes this material especially suitable for sealing purposes. s-mart PU has a green color.

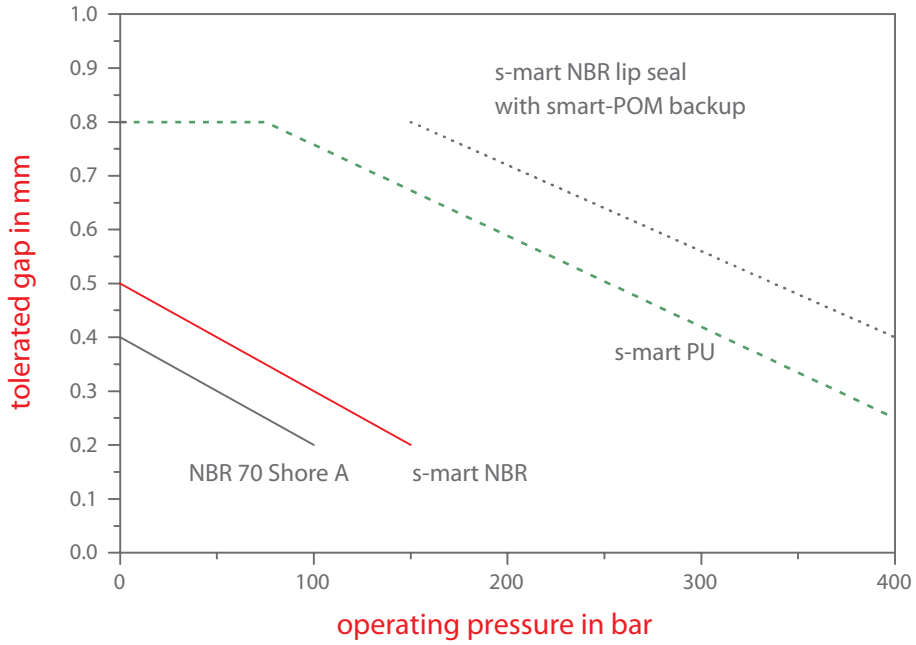
characteristics:

as compared to chemically crosslinked elastomers (s-mart NBR, s-mart FKM, s-mart EPDM) s-mart PU has superior mechanical qualities (see table).

typical properties of s-mart PU and s-mart NBR:

	tensile strenght	elongation at break	tear strenght	abrasion
	DIN 53504	DIN 53504	DIN 53515	DIN 53516
s-mart PU	50 N/mm^2	480 %	120 N/mm	18 mm^3
s-mart NBR	17 N/mm^2	150 %	20 N/mm	90 mm^3

s-mart PU has a much higher extrusion-resistance than rubber elastomers. the diagram below shows the tolerated gaps in dependence on pressure for various materials and/or material combinations.



this comparison underlines the special suitability of s-mart PU for sealing purposes. In addition, s-mart PU excels with an extreme low compression set (20% at 70°C/70h). service temperatures range from -30°C to +110°C.

due to its saturated structure s-mart PU has good ozone, weather and temperature resistance. swelling in mineral oils is relatively low in comparison to many chemically crosslinked elastomers. gas permeability of s-mart PU is very low (inclination to explosive decompression is not relevant). just like most polyurethane elastomers, s-mart PU is more radiation-resistant than chemically cross-linked elastomers.

resistance:

good resistance	medium resistance	little to no resistance
hydraulic fluids basing on mineral oil	non-alcoholic fuels	aromatic hydrocarbons chlorinated hydrocarbons
mineral oils and grease (certain additives may be destructive)	biologically degradable hydraulic oils (HEES, HETG)	ketones, alcohols, glycols
water up to 40°C	fire resistant pressure fluids HFA and HFB up to max. +30°C	fire resistant pressure fluids of the HFC and HFD groups
aliphatic hydrocarbons (propane, butane)	silicone oils and grease	hot water, steam, alkalis, amines, acids, bases
compressed air up to 110°C		brake fluid basing on glycol

application:

s-mart PU is mainly used where best mechanical properties and wear-resistance in addition with good resistance to mineral oil is required.

e.g.:
s-mart PU is best suited for applications, which require low friction, limited wear, high extrusion resistance, simple fitting (snap in and/or slip-on installation), small size design and long service life.

main use:
rod seals, piston seals, wipers, rotor seals and o-rings

material specification

s-mart PU

(standard polyurethane) on the basis of polyester

property	unit	value	standard
color		green	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 3	DIN 53505
density	g/cm³	1,20 ± 0,01	DIN 53479
tensile strength	N/mm²	≥ 40	DIN 53504
elongation at break	%	≥ 430	DIN 53504
100 % modulus	N/mm²	≥ 12	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	≤ 30	----
compression set: 100°C / 24h, 20 % compression	%	≤ 35	----
compression set: 70°C/70h, 10 % compression	%	20	DIN ISO 815
tear strength	N/mm	≥ 100	DIN 53515
rebound resilience	%	42	DIN 53512
abrasion	mm³	18	DIN 53516
minimum service temperature	°C	-30	----
maximum service temperature	°C	+110	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

s-smart HPU

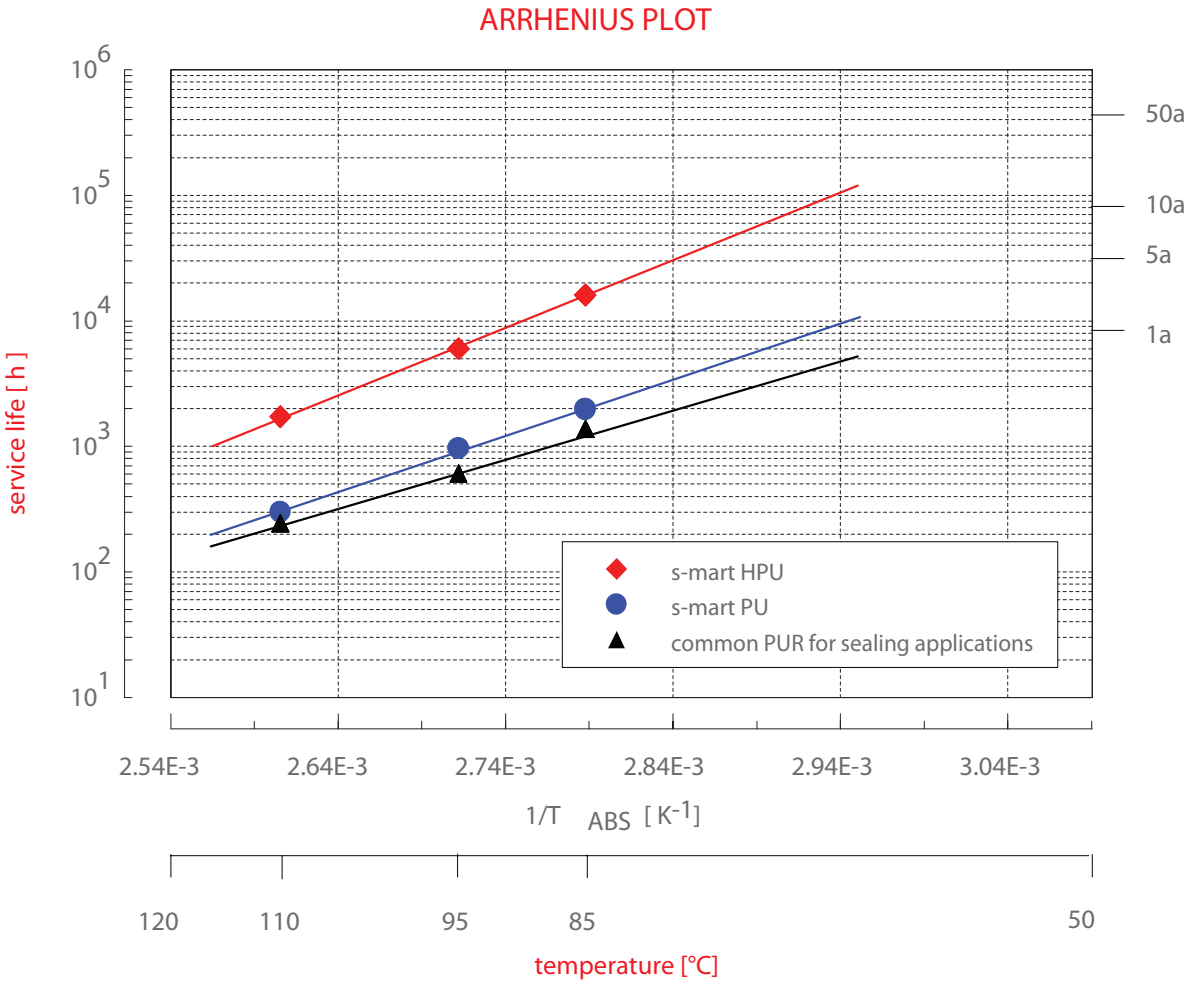
(hydrolysis resistant polyurethane)

s-mart HPU is a thermoplastic polyurethane elastomer. It is hydrolysis resistant and belongs to the group of polar and saturated elastomers. the use of special raw materials makes this material especially suitable for use in water, biologically degradable fluids, re-resistant liquids (HFA, HFB) and mineral oils with additives. s-mart HPU is red.

characteristics:

as compared to s-mart PU, s-mart HPU has about the same mechanical properties. the compression set is extremely low (20% at 70°C/70h). application temperatures range from -20°C to +110°C.

the main difference is the -in the case of polyurethane elastomers -unusually high hydrolysis stability and the high chemical resistance. therefore it can be recommended for use in hot water and biologically degradable fluids. the high chemical resistance of s-mart HPU can be seen in the following diagrams:



failure criteria: decrease elongation at break to 40% of original value
media: dist. water

fig. 1 arrhenius plot for ageing of various polyurethane elastomers in distilled water

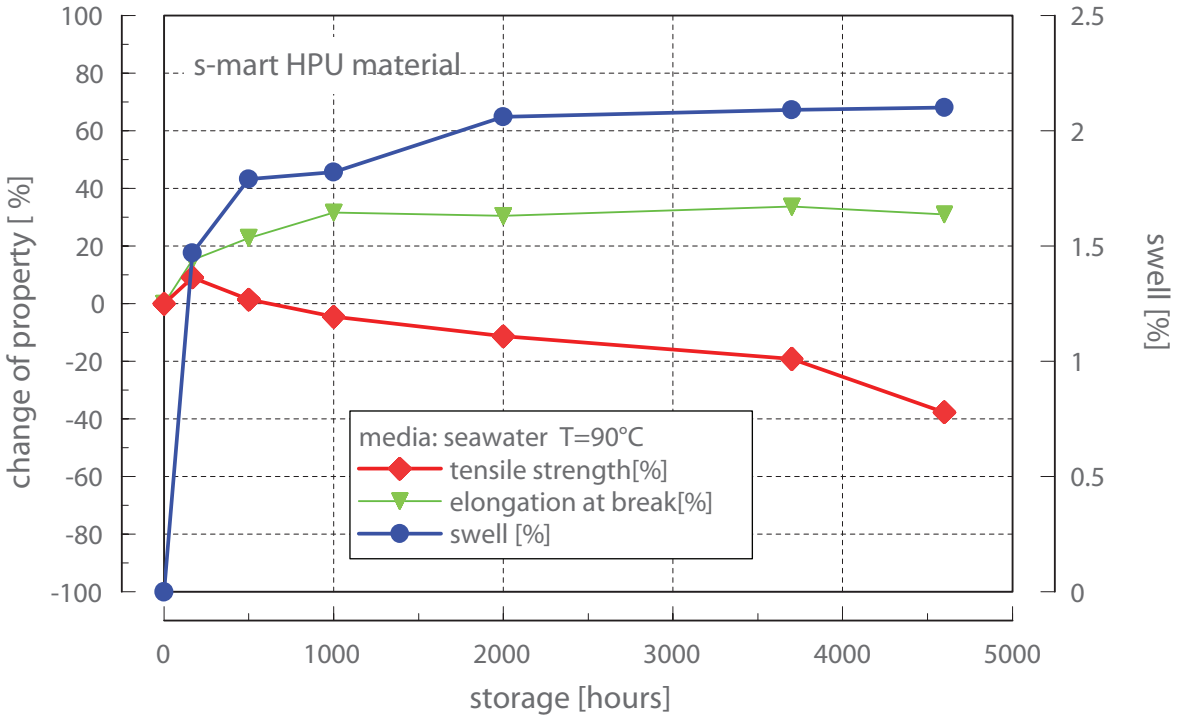


fig. 2 influence of hot sea water (90°C) on the properties of s-mart HPU (tensile properties, volume change)

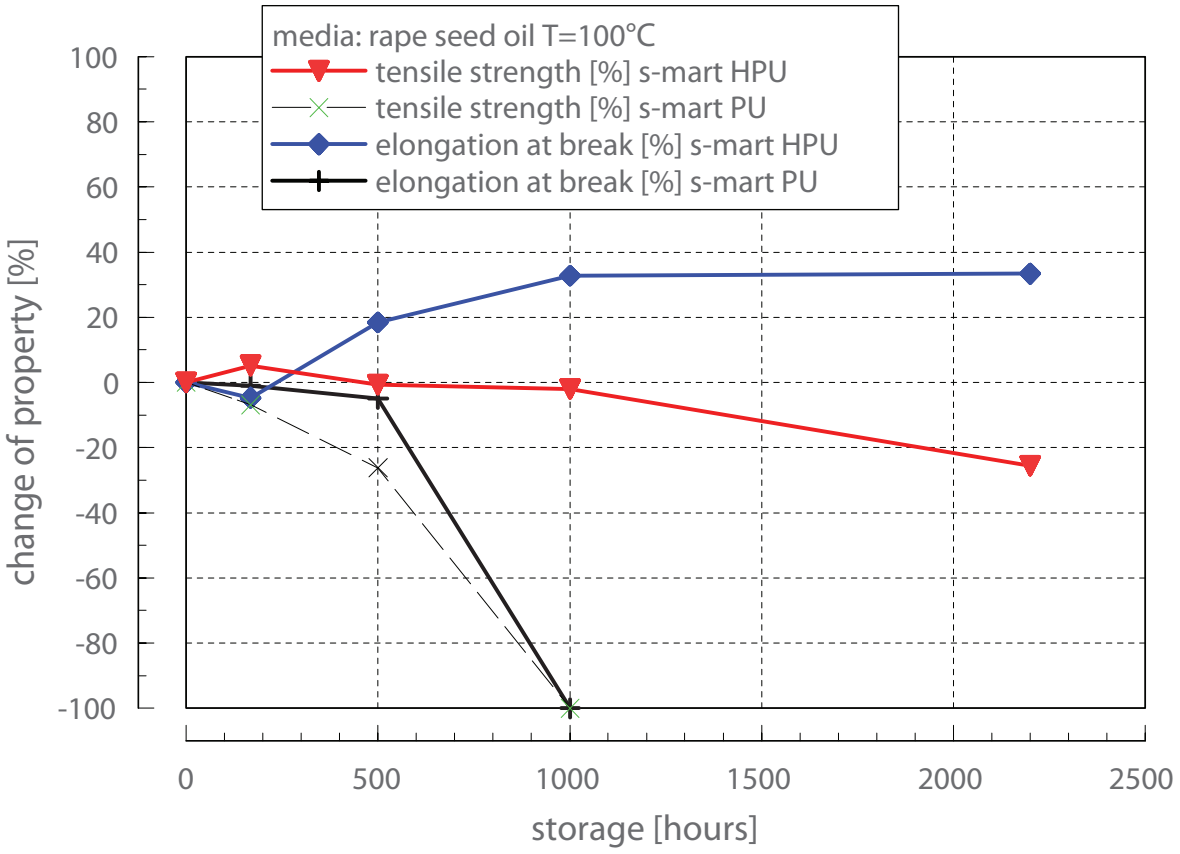


fig. 3 influence of a biologically degradable hydraulic fluid (rape seed oil, 100°C) on the tensile properties of s-mart HPU and s-mart PU

because of its saturated nature and its chemical structure s-mart HPU is highly ozone, weather and temperature resistant. due to its high hydrolysis stability, it is especially recommended for use in tropical regions. as compared to chemically crosslinked elastomers the swelling in mineral oils is very small. test results show that the gas permeability of s-mart HPU is even lower than that of s-mart PU and therefore s-mart HPU is especially recommended for the use in high pressure gases (piston-accumulator). just like with s-mart PU, s-mart HPU is highly radiation resistant.

resistance:

good resistance	medium resistance	little to no resistance
hydraulic fluids basing on mineral oil	fire-resistant fluids of type HFC (water-glycol mixture)	aromatic hydrocarbons
biologically degradable hydraulic fluids	some additives for power water (e.g. fungicides) can have destructive effects	chlorinated hydrocarbons
fire-restistant pressure fluids HFA and HFB	alcohols	ketones, glycols
mineral oils and grease (certain additives can have destructive effects)	fuels free of alcohol (except premium blend petrol and unleaded fuels)	brake fluids basing on glycol
silicone oils and grease		hot steam exceeding 100°C, alkalis, amines
aliphatic hydrocarbons (for example propane, butane)		concentrated acids and bases
hot water and sea water up to +90°C		
diluted acids and bases		

application:

s-mart HPU is mainly used for applications where high hydrolysis stability and chemical resistance (also to many polar hydraulic fluids) are required in addition to good mineral oil resistance. mechanical properties and wear resistance correspond approximately to that of s-mart PU.

s-mart HPU is best suited, when the sealing industry requires for:

- low friction,
- limited wear,
- high extrusion resistance
- simple fitting (snap in and/or slip-on installation),
- small construction size,
- hydrolysis stability (mining, water hydraulics) and
- chemical resistance (biologically degradable hydraulic oils).

attention!

for use of pre-load elements for s-mart HPU profiles in biologically degradable fluids, only s-mart FKM is recommended.

main use:

- rod seals
- piston seals
- wipers
- o-rings for water hydraulic and in degradable oils

material specification

s-mart HPU

(hydrolysis resistant polyurethane) on the basis of polyester

property	unit	value	standard
color		red	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 3	DIN 53505
density	g/cm³	1,20 ± 0,01	DIN 53479
tensile strength	N/mm²	≥ 50	DIN 53504
elongation at break	%	≥ 330	DIN 53504
100 % modulus	N/mm²	≥ 13	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	≤ 27	----
compression set: 100°C / 24h, 20 % compression	%	≤ 33	----
compression set: 70°C/70h, 10 % compression	%	20	DIN ISO 815
tear strength	N/mm	≥ 100	DIN 53515
rebound resilience	%	29	DIN 53512
abrasion	mm³	17	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

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s-mart GPU

(polyurethane for giant seals and big cross sections)

s-mart GPU is the chemical characteristics can be compared with those of s-mart HPU

application:

the same as with s-mart HPU and s-mart PU, but mainly used for material dimensions above 550mm up to 2500 mm and for special dimensions with extreme wall thickness.

material specification

s-mart GPU

(polyurethane for giant seals and big cross sections)

property	unit	value	standard
color		red	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	47 ± 3	DIN 53505
density	g/cm³	1,20 ± 0,01	DIN 53479
tensile strength	N/mm²	≥ 45	DIN 53504
elongation at break	%	≥ 280	DIN 53504
100 % modulus	N/mm²	≥ 11	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	≤ 30	----
compression set: 100°C / 24h, 20 % compression	%	≤ 40	----
compression set: 70°C/70h, 10 % compression	%	20	DIN ISO 815
tear strength	N/mm	≥ 40	DIN 53515
rebound resilience	%	43	DIN 53512
abrasion	mm³	25	DIN 53516
minimum service temperature	°C	-30	----
maximum service temperature	°C	+110	----

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s-smart LTPU

(low temperature polyurethane)

s-mart LTPU is a modified s-mart PU concept for the use at low temperature applications. the difference to s-mart PU is a considerably lower brittleness point (glass temperature -42°C), better elasticity and a compression set at -40°C of 45% (better than silicone rubber). the lowest possible operating temperature for smart LTPU is about -50°C.

application:

for low temperature applications and mainly in cold regions.

material specification

s-mart LTPU

(low temperature polyurethane) for low temperature application

property	unit	value	standard
color		blue	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 2	DIN 53505
density	g/cm³	1,17 ± 0,01	DIN 53479
tensile strength	N/mm²	≥ 50	DIN 53504
elongation at break	%	≥ 450	DIN 53504
100 % modulus	N/mm²	≥ 12	DIN 53504
compression set: 70°C / 70h, 10 % compression	%	20	DIN ISO 815
compression set: at - 40 °C	%	45	DIN ISO 815
tear strength	N/mm	80	DIN 53515
rebound resilience	%	50	DIN 53512
abrasion	mm³	15	DIN 53516
glass temperature	°C	-42	DIN 53445
minimum service temperature	°C	-50	----
maximum service temperature	°C	+110	----

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s-mart HTPU

(high temperature polyurethane)

s-mart HTPU is a modified s-mart PU concept for the use at high temperature applications. the highest possible operating temperature for smart HTPU is about 150°C for short time.

application:

for high temperature applications

material specification

s-mart HTPU

(high temperature polyurethane) for high temperature application

property	condition	unit	value	standard
color			natural	
hardness	23° C	Shore A	96 ± 2	ISO 868
hardness	23° C	Shore D	50 ± 3	ISO 868
modulus 100 %	23° C	MPa	11	DIN 53504
modulus 300 %	23° C	MPa	22	DIN 53504
tensile strength	23° C	MPa	45	DIN 53504
elongation at break	23° C	%	500	DIN 53504
tear strength	23° C	kN/m	80	DIN ISO 34-1 methode B
spec. gravity	23° C	g/cm³	1,17	ISO 1183
abrasion	23° C	mm³	15	DIN 53516
compression set	*	%	32	ISO 815
compression set	**	%	35	ISO 815
compression set	***	%	50	ISO 815
minimum service temperature		°C	-35	
maximum service temperature		°C	135	
maximum service temperature (short)		°C	150	

* 24h 70° C 25% deflection ** 24h 100° C 25% deflection *** 24h 125° C 25% deflection

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copolymer, based on aromatic isocyanate and diols
resistant to: oil, hot water, ozone
not resistant to: conc. acids, conc. lyes, conc. alcohols and aromatic solvents
turnability: bad
tool-abrasion: low

dimensions and prices on request

s-mart SPU

(self-lubricated polyurethane)

s-mart SPU is a thermoplastic polyurethane elastomer, similar to the concept of s-mart HPU, but with optimized tribological characteristics (friction and wear), achieved by an addition of a synergetic combination of solid lubricants. the effect of this modification is a significantly improved sliding property compared to other sealing materials from the group of polyurethanes and elastomers. the better sliding properties directly resulting in a higher wear resistance at dry running conditions. because of its high chemical resistance and its low coefficient of friction, s-mart SPU is best suited in tribological systems with lack of lubrication, as for example in clear water hydraulics, in water-based, fire resistant hydraulic fluids of the category HFA and HFB and in oil-free pneumatics. because of the incorporation of the solid lubricants s-mart SPU has a grey-black colouring.

characteristics:

compared to s-mart HPU, s-mart SPU has superior sliding properties. figure 4 shows the sliding friction coeffcient of s-mart HPU versus s-mart SPU against a polished steel ball.

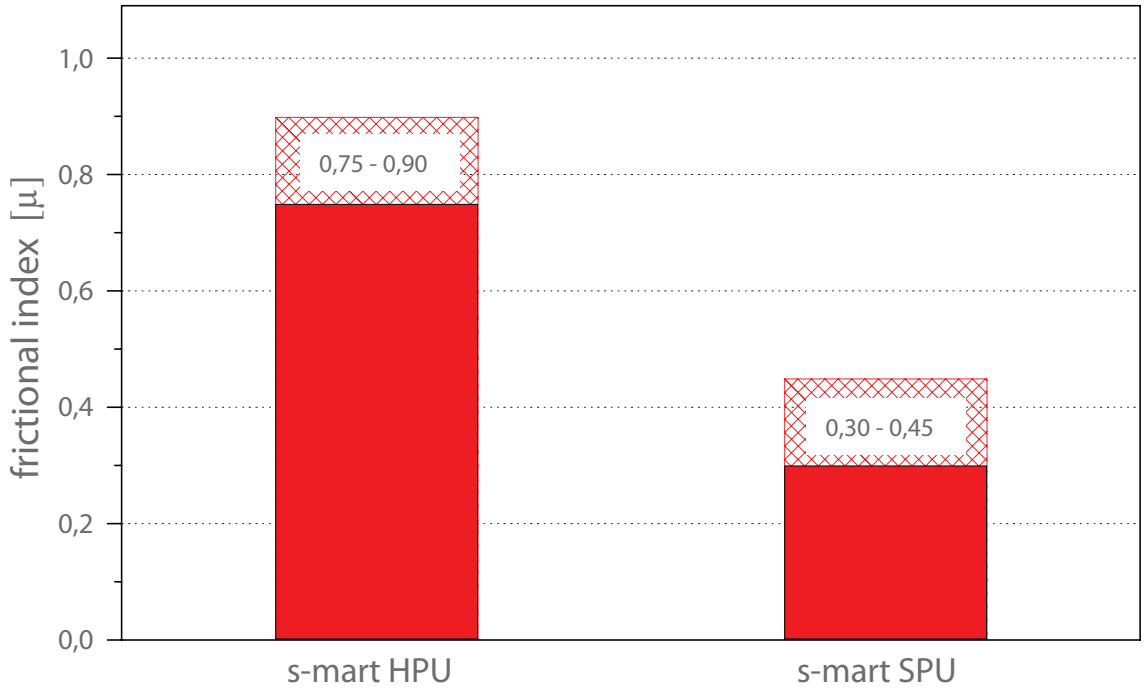

fig. 4 friction coefficient of s-mart HPU and s-mart SPU against polished steel

this figure clearly shows the superior sliding properties of s-mart SPU, which has a friction coefficient range of 0,30 to 0,45 against steel (without lubrication). the same test with s-mart HPU indicates a friction coefficient of 0,75 to 0,90 allowing the conclusion, that friction can be reduced by s-mart SPU up to an extend of 50%.

the good chemical resistance of s-mart SPU also permits its application in water-based hydraulic fluids (see to fig. 5 and 6).

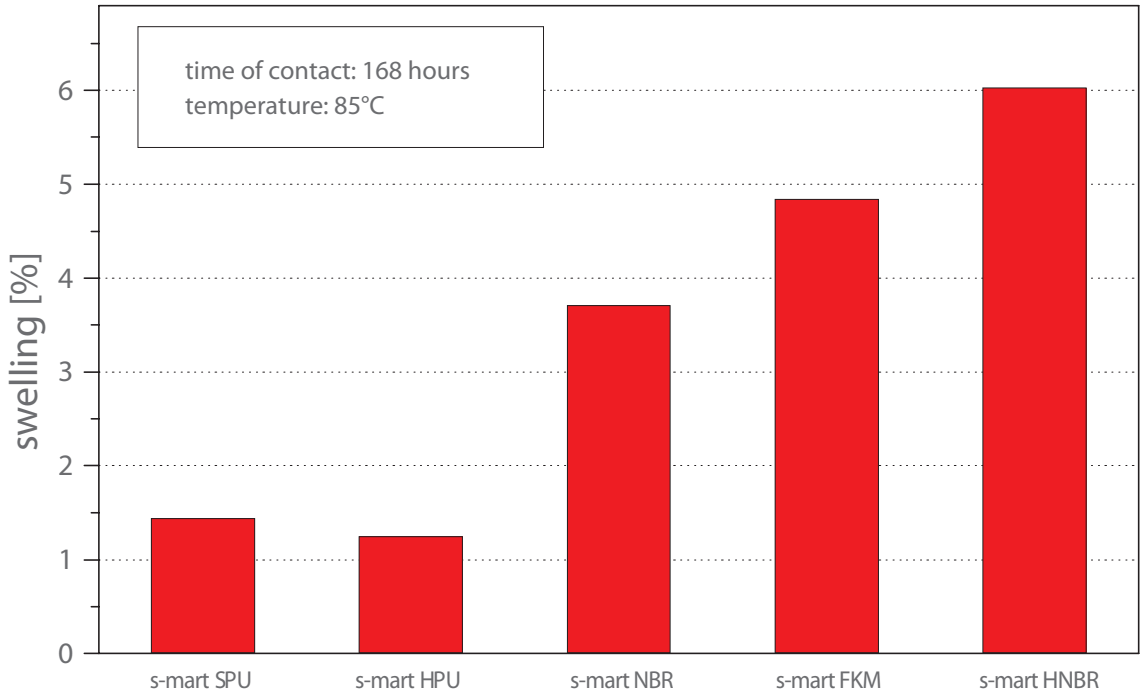

fig. 5 swelling after 168 hr. at 85^0 C of s-mart SPU and s-mart HPU in a 5 % HFA fluid

as shown in figure 2, the swelling of s-mart SPU (1,4%) is only slightly above the value of s-mart HPU, which can be considered as very low compared with other seal materials.

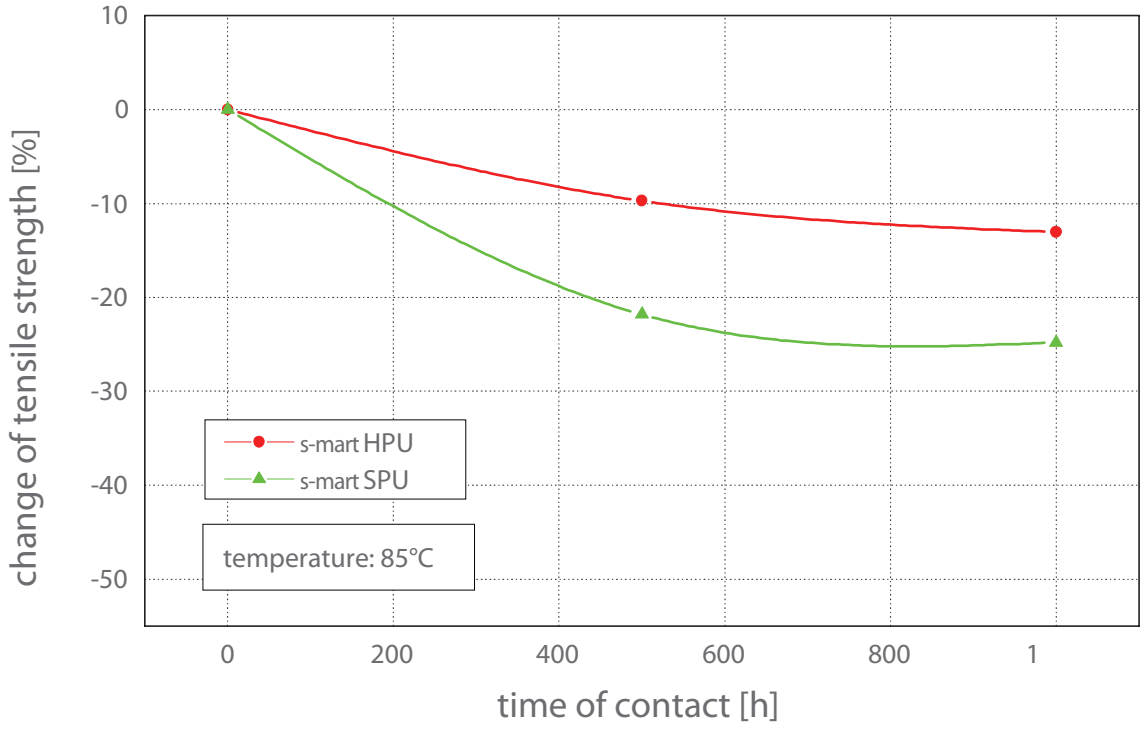

fig. 6 tensile strength of s-mart HPU and s-mart SPU as a function of the storage period in a HFA fluid at 85°C.

a long-term storage test in this HFA fluid (fig.6) is furthermore suggesting that s-mart SPU meets almost the high level of chemical resistance of s-mart HPU

after a storage time of 1000 hours at an extraordinary high temperature of 85°C the loss of the tensile strength amounts to only 25%. this loss is considered to be extremely low for polyurethane elastomers.
this high chemical resistance is obtained due to the fact that the same basic materials have been applied as for s-mart HPU. in addition we consciously refrained to use molybdenum disulphide (MoS_2).

similiar to s-mart PU and s-mart HPU, s-mart SPU has a very high extrusion resistance, a high tear strength and an extremely low compression set.

resistance:

good resistance	medium resistance	little to no resistance
hydraulic fluids basing on mineral oil	fire-resistant fluids of type HFC (water-glycol mixture)	aromatic hydrocarbons
biologically degradable hydraulic fluids	some additives for power water (e.g. fungicides) can have destructive effects	chlorinated hydrocarbons
fire-restistant pressure fluids HFA and HFB	alcohols	ketones, glycols
mineral oils and grease (certain additives can have destructive effects)	fuels free of alcohol (except premium blend petrol and unleaded fuels)	brake fluids basing on glycol
silicone oils and grease		hot steam exceeding 100°C, alkalis, amines
aliphatic hydrocarbons (for example propane, butane)		concentrated acids and bases
hot water and sea water up to +90°C		
diluted acids and bases		

application:

s-mart SPU is mainly used where special tribological characteristics of the sealing material are required. the mechanical properties and the chemical resistance almost correspond to that of s-mart HPU.

s-mart SPU is especially suited for:

- pneumatic applications,
- operating conditions like dry running, high sliding speed, high pressure and standstill under pressure,
- special requirements to friction limitation, slip-stick-conditions, starting behavior and control movements,
- working fluids with badly lubricating properties, as water, water-based fluids, gases and fluids with degreasing properties,

material specification

s-mart SPU

(self lubricated polyurethane) with lubricating agents for reduced friction applications

property	unit	value	standard
color		grey/black	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 3	DIN 53505
density	g/cm³	1,24 ± 0,02	DIN 53479
tensile strength	N/mm²	50	DIN 53504
elongation at break	%	380	DIN 53504
100 % modulus	N/mm²	17	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	25	----
compression set: 100°C / 24h, 20 % compression	%	30	----
compression set: 70°C/70h, 10 % compression	%	----	DIN ISO 815
tear strength	N/mm	120	DIN 53515
rebound resilience	%	----	DIN 53512
abrasion	mm³	17	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart XPU
(hard polyurethane)

property	unit	value	standard
color		dark green	
durometer hardness	Shore A	97 ± 1	DIN 53505
durometer hardness	Shore D	57 ± 3	DIN 53505
density	g/cm³	1,21	DIN EN ISO 1183-1
tensile strength	N/mm²	50	DIN 53504
elongation at break	%	400	DIN 53504
100 % modulus	N/mm²	21	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	24	----
compression set: 100°C / 24h, 20 % compression	%	29	----
tear strength	N/mm	140	DIN ISO 34-1
abrasion	mm³	18	DIN 53516
minimum service temperature	°C	- 30	----
maximum service temperature	°C	+110	----

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material specification

s-mart XHPU

(hard hydrolysis resistant polyurethane)

property	unit	value	standard
color		dark red/yellow	
durometer hardness	Shore A	97 ± 1	DIN 53505
durometer hardness	Shore D	60 ± 3	DIN 53505
density	g/cm³	1,22	DIN EN ISO 1183-1
tensile strength	N/mm²	50	DIN 53504
elongation at break	%	350	DIN 53504
100 % modulus	N/mm²	25	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	26	----
compression set: 100°C / 24h, 20 % compression	%	30	----
tear strength	N/mm	170	DIN ISO 34-1
abrasion	mm³	20	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

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material specification

s-mart XSPU

(hard self-lubricated polyurethane)

property	unit	value	standard
color		dark grey	
durometer hardness	Shore A	97	DIN 53505
durometer hardness	Shore D	58	DIN 53505
density	g/cm^3	1,25	DIN EN ISO 1183-1
tensile strength	N/mm^2	43	DIN 53504
elongation at break	%	350	DIN 53504
100 % modulus	N/mm^2	25	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	30	----
compression set: 100°C / 24h, 20 % compression	%	35	----
compression set: 70°C/70h, 10 % compression	%	----	DIN ISO 815
tear strength	N/mm	180	DIN ISO 34-1
rebound resilience	%	----	DIN 53512
abrasion	mm^3	29	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

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rubber elastomers

● s-mart NBR

(acrylonitrile butadiene rubber)

s-mart NBR is a semifinished material made of sulphur-vulcanised acrylo-nitrile-butadiene rubber (NBR)

characteristics:

the service temperature ranges from -30°C to +100°C (short exposure to +120°C possible). At high temperatures, ageing is accelerated and the material becomes hard and brittle. in oxygen atmosphere (air) this effect starts at about 80° C, under exclusion of air ageing occurs slower (e.g. hot oil).
due to its unsaturated structure, s-mart NBR is much less resistant to ozone, weather and ageing compared to saturated elastomers. swelling in mineral oil is **small**, but depends very much on the ingredients of the oil. gas permeability is quite high and therefore there is an inclination to explosive decompression.

fig. 7 and 8 are showing the compatibility results s-mart NBR in some typical hydraulic fluids

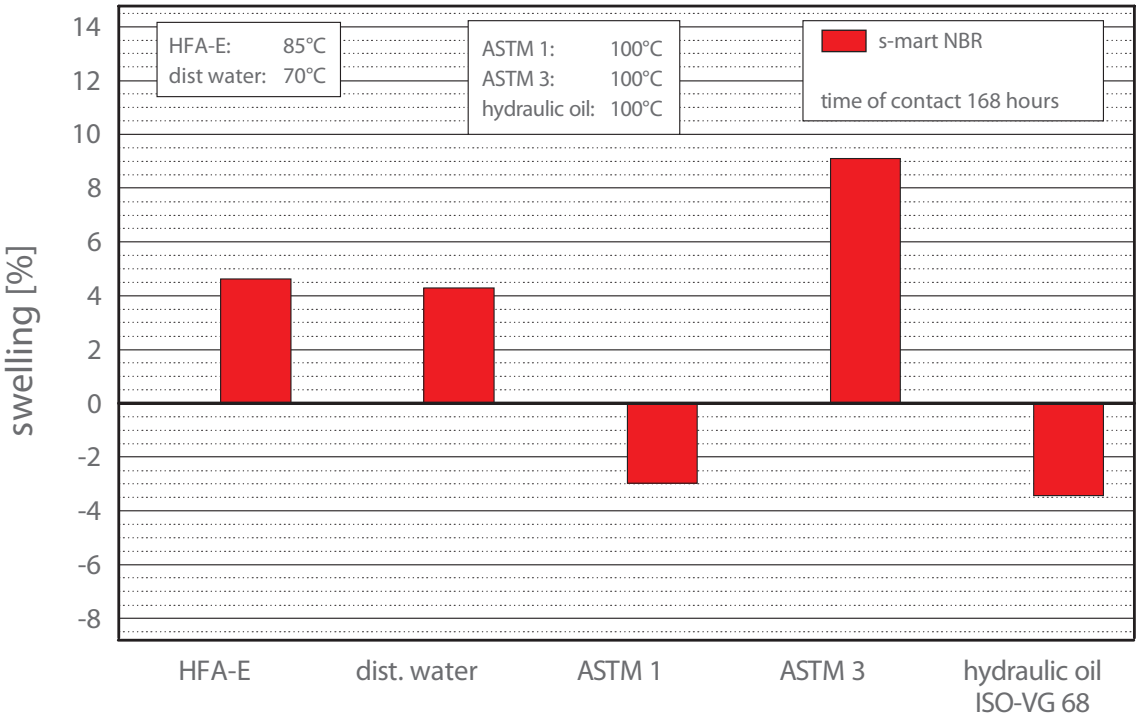

fig. 7 volume change of s-mart NBR in various hydraulic fluids after an immersion period of 168 hours

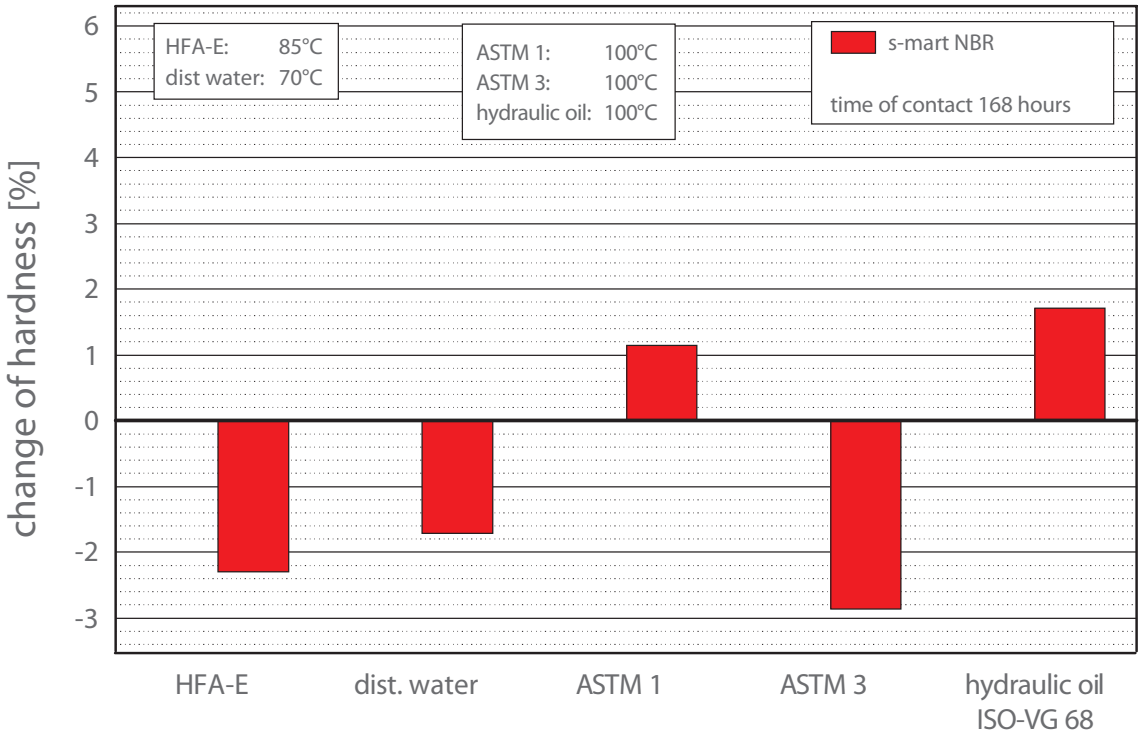

fig. 8 change of Shore A hardness of s-mart NBR in various hydraulic fluids after an immersion period of 168 hours.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and greases	fuels with aromatic parts up to 40 % (leaded fuels)	aromatic hydrocarbons (toluene, benzene)
aliphatic hydrocarbons (propane, butane)	biologically degradable hydraulic fluids (test necessary)	chlorinated hydrocarbons (trichloro- and perchloroethylene)
water		brake fluids basing on glycol
fire-resistant pressure fluids of the HFA, HFB, HFC group	silicone oils and greases (oils can cause shrinkage)	fire-resistant pressure fluids of the HFD group (phosphate ester)
vegetable and animal oils and fats	fire-resistant fluids category HFD-U	polar solvents (acetone, ethylacetate)
diesel fuel		
many diluted acids and bases, saline solutions at room temperature		

application:

s-mart NBR is mainly used in applications where high elasticity and extremely good compression set are required in addition to good fuel and mineral oil resistance.

examples:
in sealing technology where “soft seals” are essential, or as a pre-load element for less elastic materials.

main use:
rod seals for low pressure, piston seals for low pressure, wipers for special cases, rotor seals (oil seals, v-pakings) and o-rings

material specification

s-mart NBR
(acrylonitrile butadiene rubber)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,31 ± 0,02	DIN 53479
tensile strength	N/mm²	≥ 16	DIN 53504
elongation at break	%	≥ 130	DIN 53504
100 % modulus	N/mm²	≥ 11	DIN 53504
compression set: 100°C / 22h	%	≤ 15	DIN ISO 815
tear strength	N/mm	20	DIN 53515
rebound resilience	%	28	DIN 53512
abrasion	mm³	90	DIN 53516
minimum service temperature	°C	-30	----
maximum service temperature	°C	+100	----
glass transition temperature	°C	-28	DSC
swelling behavior in ASTM oil no.1 acc. DIN 53521 168h/100°C: change in durometer hardness volume change	 Shore A %	 +1 -3,0	 DIN 53505 DIN 53521
swelling behavior in ASTM oil no.3 acc. DIN 53521 168h/100°C: change in durometer hardness volume change	 Shore A %	 -3 +9,1	 DIN 53505 DIN 53521
heat resistance, air 168h/100°C: change in durometer hardness volume change	 Shore A %	 +2 -0,5	 DIN 53505 DIN 53521
swelling behavior, water 168h/70°C change in durometer hardness volume change	 Shore A %	 -3 +4,0	 DIN 53505 DIN 53521

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s-smart HNBR

(hydrogenated acrylonitrile butadiene rubber)

s-mart HNBR is a semi-finished material consisting of peroxide-crosslinked hydrogenated acrylonitrile-butadiene-rubber. s-mart HNBR belongs to the group of polar and saturated elastomers. s-mart HNBR is not filled with carbon black, but it is coloured black.

characteristics:

as compared to s-mart NBR, s-mart HNBR has better mechanical properties such as tensile strength, elongation at break and abrasion resistance. Due to its saturated structure, the temperature range is considerably wider (from -25°C up to +150°C; for a short time up to +170°C).
because of its saturated structure, excellent ozone, weather and ageing resistance are existing. swelling in mineral oil is very small, but depends very much on the composition of the oil. compatibility with highly additivated oils is better than that of s-mart NBR. gas permeability is relatively high leading to an inclination to explosive decompression.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and greases	fuels with aromatic parts up to 40 % (unleaded fuels)*	aromatic hydrocarbons (toluene, benzene)
aliphatic hydrocarbons (propane, butane)	biologically degradable hydraulic fluids (shrinking) additives may also cause swelling - test necessary	chlorinated hydrocarbons (trichloro- and perchloroethylene)
water	silicone oils and greases (oils can cause shrinkage)	brake fluids basing on glycol
fire-resistant pressure fluids of the HFA, HFB, HFC group		fire-resistant pressure fluids of the HFD group (phosphate ester)
vegetable and animal oils and fats		polar solvents (acetone, ethylacetate)
diesel fuel		hot steam
highly additivated oils (transmission hypoid oils)*		
many diluted acids and bases, saline solutions at room temperature		
crure oils (also hydrogen sulfide and amine containing)		

* test recommended

application:

s-mart HNBR is mainly used for applications where very good compression set, good temperature resistance, good resistance in mineral oil, good resistance in mineral oils with high content of additives and high elasticity is required. s-mart HNBR can be a good alternative to s-mart FKM.
example:
automotive: motor & power transmission sealings
oil-field applications, also for sour gas

main use:
rotor seals, o-rings, special seals

material specification

s-mart HNBR

(hydrogenated acrylonitrile butadiene rubber)

property	unit	value	standard
color		black/green	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,22 ± 0,02	DIN 53479
tensile strength	N/mm²	≥ 18	DIN 53504
elongation at break	%	≥ 180	DIN 53504
100 % modulus	N/mm²	≥ 10	DIN 53504
compression set: 100°C / 22h	%	≤ 22	DIN ISO 815
tear strength	N/mm	30	DIN 53515
rebound resilience	%	29	DIN 53512
abrasion	mm³	90	DIN 53516
minimum service temperature	°C	-25	----
maximum service temperature	°C	+150	----
swelling behavior in ASTM oil no.1 acc. DIN 53521 70h/100°C: change in durometer hardness volume change	 Shore A %	 +6 -8	 DIN 53505 DIN 53521
swelling behavior in ASTM oil no.3 acc. DIN 53521 70h/100°C: change in durometer hardness volume change	 Shore A %	 -8 +11	 DIN 53505 DIN 53521
heat resistance, air 70h/100°C: change in durometer hardness volume change	 Shore A %	 +5 0	 DIN 53505 DIN 53521
swelling behavior, water 70h/100°C change in durometer hardness volume change	 Shore A %	 0 +2,5	 DIN 53505 DIN 53521

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s-mart FKM

(fluorocarbon rubber - VITON)

s-mart FKM is made of a bisphenolcrosslinked fluorocarbon rubber. the material is based on a VITON terpolymer of vinylidene fluoride, hexa-fluoropropylene and tetrafluorethylene, which is showing a lot of advantages compared to other FKM brands, which normally based on a copolymer of vinylidene fluoride and hexafluoropropylene. the most important improvement of this material is the higher chemical resistance especially against low moleculare polar chemicals as for example alcohols and aromatic hydrocarbons.

s-mart FKM is belonging to the group of polar and saturated special elastomers and is colored in brown.

characteristics:

s-mart FKM has – compared to standard grades – a slightly smaller tensile strength, but a significantly improved elongation at break which leads to a better performance of the seals in critical applications and also lowers problems during the installation process. futhermore our s-mart FKM shows an increased tear strength which protects the seals against cutting during the installation process. the compression set of the material is slightly higher than that of standard grades, which, anyhow, does not influence the performance of the seals.

due to the chemical composition our s-mart FKM and the higher fluorine content, the chemical resistance is significantly higher, especially against low molecular polar organic chemicals like alcohols and also against aromatic hydrocarbons. this improved chemical resistance is demonstrated in fig. 9 and 10.

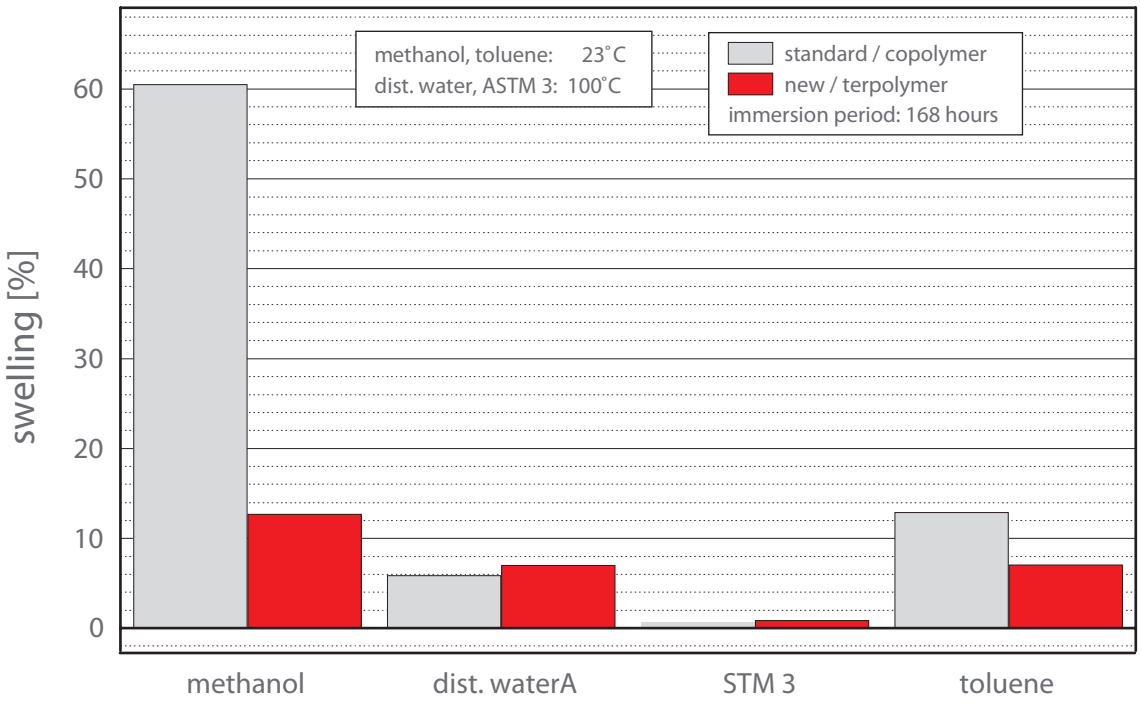

fig. 9 volume change of s-mart FKM "standard" and "new" in various hydraulic fluids after an immersion period of 168 hours

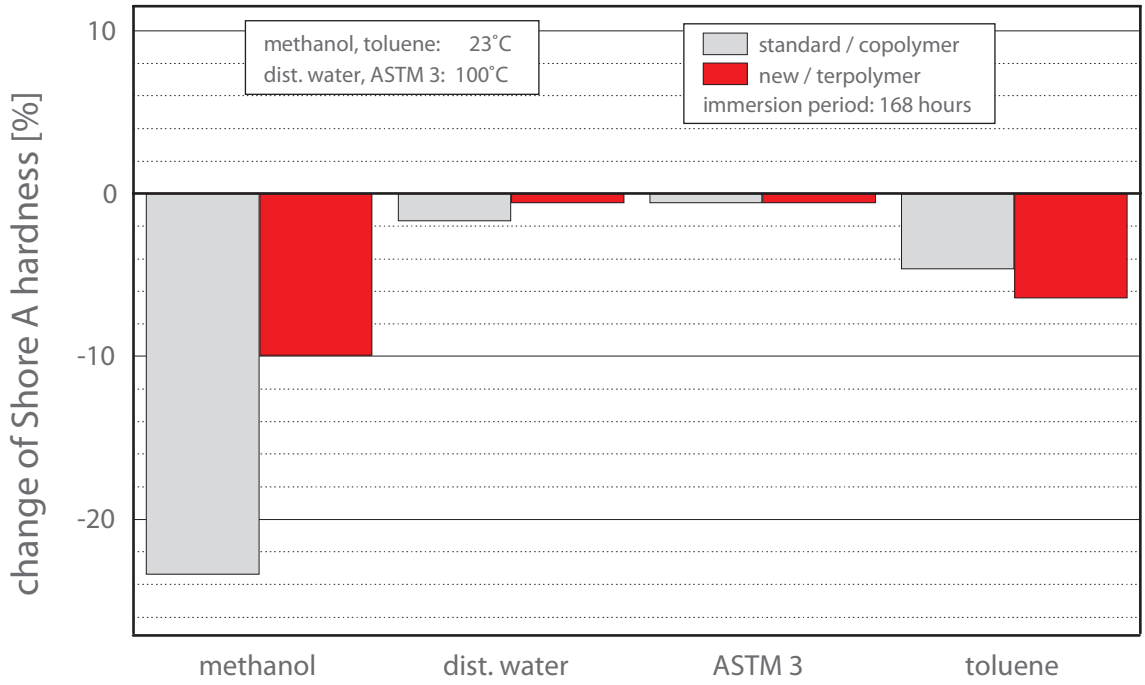

fig. 11 change of Shore A hardness of s-mart FKM "standard" and "new" in various hydraulic fluids after an immersion period of 168 hours

both pictures are clearly demonstrating the higher compatibility of the new grade, which has the same resistance in strongly affecting mineral oil like ASTM Oil No. 3 and water-based fluids and a significantly higher resistance in aromatic hydrocarbons and especially in low molecular polar medias like methanol, in which the volume change is only a fifth part of the old grade.

s-mart FKM is highly temperature and chemical resistant. operating temperatures range from -20°C up to + 200°C (short exposure to approx. +230°C possible). due to its saturated nature and its chemical structure s-mart FKM has extraordinary ozone, weather and ageing resistance. swelling in different media is very small, also in aromatic hydrocarbons. gas permeability is very low and therefore it can be used in high vacuum. s-mart FKM is not inflammable. radiation resistance is low.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and greases	hot water	
aliphatic hydrocarbons (propane, butane)	alcohols	skydrol 500
silicone oils and grease		ammonia, amines, alkali
vegetable and animal oils and fats		overheated steam
fuels, also premium blend petrol and unleaded petrol with aromatic part up to 40%	fire-resistant fluids (type HFA, HFB, HFC)	low molecular organic acid (formic & acetic acid)
sulphured and high aromatic oils		hydrofluoric acid, chlorosulfonic acid
fire-resistant pressure fluids of the HFD-S (chlorinated hydrocarbons) and HFD-R group (phosphate ester - certain types can have destructive effects)		polar solvents (acetone, methylethyl-ketone, ethylacetate, dioxane)
biologically degradable hydraulic fluids		brake fuids basing on glycol
aromatic hydrocarbons (benzene, toluene)		
chlorinated hydrocarbons		
diluted solutions and nonorganic acids		

application:

s-mart FKM is mainly used for applications where high temperatures and chemical stress can be expected. In addition to that, s-mart FKM is used in hydraulic systems working with fire-resistant hydraulic fluids of the HFD group (except some phosphate esters) and as a preload element for s-mart HPU seals in biologically degradable hydraulic fluids.

main use:
special seals for the chemical industry and in heat engineering, shaft seals for high speed, o-rings, hydraulic seals for HFD-fluids

material specification

s-mart FKM
(fluorocarbon rubber - VITON)

property	unit	value	standard
color		brown	
durometer hardness	Shore A	83 ± 5	DIN 53505
density	g/cm³	2.30 ± 0,03	DIN 53479
tensile strength	N/mm²	≥ 8	DIN 53504
elongation at break	%	≥ 200	DIN 53504
100 % modulus	N/mm²	≥ 5	DIN 53504
compression set: 175°C / 22h	%	≤ 20	DIN ISO 815
tear strength	N/mm	21	DIN 53515
rebound resilience	%	7	DIN 53512
abrasion	mm³	150	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----
heat resistance, 168h/225°C: change in durometer hardness change in tensile strength change in elongation at break	 Shore A % %	 +3 +24 -24	 DIN 53505 DIN 53504 DIN 53504
swelling behavior in ASTM oil no.3 acc. DIN 53521 168h/100°C: change in durometer hardness volume change	 Shore A %	 -1 +0,9	 DIN 53505 DIN 53521

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s-mart EPDM

(ethylene propylene diene rubber)

s-mart EPDM is made of peroxide crosslinked ethylen-propylene-diene rubber. this material belongs to the the nonpolar and saturated elastomers. s-mart EPDM is filled with carbon black and therefore not suitable for electric insulation.

characteristics:

s-mart EPDM has good mechanical properties and can be used at a very wide temperature range of -50°C up to +150°C (hot steam up to 180°C). due to its saturated structure s-mart EPDM is highly ozone, weather and ageing resistant. because of its nonpolarity, s-mart EPDM is not resistant to mineral oils. mineral oils and grease as well as animal and vegetable oils and fats cause intolerable swelling. special use of plasticizers allows the use of s-mart EPDM in glycol based brake fluids. for this application, regional permission regulations have to be observed and the corresponding release is to be obtained. gas permeability is relatively high; radiation resistance is high.

resistance:

good resistance	medium resistance	little to no resistance
hot water and hot steam up to 180°C	silicone oils and grease (oils can cause shrinkage, test recommended)	mineral oils and grease
fire-resistant pressure fluids of the HFD-R group without mineral oil addition (phosphate ester)		fire-resistant pressure fluids of the HFA, HFB and HFD-S (chlorinated hydrocarbons) group
detergents, soda lye, potash lye		aromatic and chlorinated hydrocarbons
many organic and anorganic bases and acids		aliphatic hydrocarbons (propane, butane)
saline solutions and oxidation causing media		vegetable and animal oils and fats
fire-resistant pressure fluids of the HFC group (glycol-water, if it is ensured that the fluid is free of mineral oil)		biologically degradable hydraulic fluids
many polar solvents (e.g. alcohols, ketones, esters, etc.)		
skydrol 500 und 7000		
brake fluids basing on glycol		

application:

s-mart EPDM is mainly used in the food industry, where cleaning process with polar media like detergents, soda lye are part of the process. s-mart EPDM is the best suitable material for hot water and/or steam applications

main use:
special parts for washers, piston and rod seals, o-ring, rotor seal (parts for motor vehicles)

material specification

s-mart EPDM

(ethylene propylene diene rubber) peroxide-cured

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,22 ± 0,02	DIN 53479
tensile strength	N/mm²	≥ 12	DIN 53504
elongation at break	%	≥ 110	DIN 53504
100 % modulus	N/mm²	≥ 9	DIN 53504
compression set: 100°C / 22h	%	≤ 15	DIN ISO 815
tear strength	N/mm	15	DIN 53515
rebound resilience	%	38	DIN 53512
abrasion	mm³	120	DIN 53516
minimum service temperature	°C	-50	----
maximum service temperature	°C	+150	----
heat resistance, air 70h/150°C: change in durometer hardness change in tensile strength change in elongation at break	 Shore A % %	 +4 +15 -22	 DIN 53505 DIN 53504 DIN 53504
compatibility with SL-DOT 4 - 168h/100°C change in durometer hardness volume change	 Shore A %	 0/-1 +2,1	 DIN 53505 DIN 53521

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s-mart MVQ

(vinyl methyl silicone rubber)

s-mart MVQ is a peroxide crosslinked silicone rubber. s-mart MVQ belongs to the group of polar and saturated special elastomers. s-mart MVQ is not filled with carbon black and therefore suitable for electric insulation.

characteristics:

as compared to other elastomers s-mart MVQ has a lower glass temperature. It can therefore be used down to -60°C and up to +200°C. due to its saturated structure s-mart MVQ has excellent ozone, weather and ageing resistance. swelling in mineral oils is very low, but depends very much on the composition of the oil. compatibility with mineral oils with high content of additives is better than with s-mart NBR. gas permeability is very high. s-mart MVQ is a preferred sealing material in the pharmaceutical and food industry.

resistance:

good resistance	medium resistance	little to no resistance
motor and transmission oil of aliphati nature, also sulphured oils		aromatic mineral oils
brake fluids basing on glycol		fuels
vegetable and animal oils and fats		silicone oils and grease
water up to 100°C		aromatic hydrocarbons (toluene, benzene)
fire-resistant pressure fluids of the HFD-R, HFD-S groups (phosphate esters and chlorinated hydrocarbons)		low molecular chlorinated hydrocarbons (trichloroethylene)
diluted saline solutions		low-molecular esters and ethers
		overheated steam above 120°C (short time steam sterilisation possible)
		acids and alkalis

application:

s-mart MVQ has very poor mechanical properties and should therefore be limited to static applications. s-mart MVQ is only used in dynamic applications, when there is no other alternative because of temperature and chemical stress.

main use:
special seals in the chemical and food industry, rotor-seals for special use, o-rings, flange seals

material specification

s-mart MVQ

(vinyl methyl silicone rubber)

property	unit	value	standard
color		reddish brown/ blue	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,52 ± 0,03	DIN 53479
tensile strength	N/mm²	≥ 7	DIN 53504
elongation at break	%	≥ 130	DIN 53504
100 % modulus	N/mm²	≥ 5	DIN 53504
compression set: 175°C / 22h	%	≤ 15	DIN ISO 815
tear strength	N/mm	8	DIN 53515
rebound resilience	%	44	DIN 53512
abrasion	mm³	----	----
minimum service temperature	°C	-60	----
maximum service temperature	°C	+200	----
heat resistance, 168h/225°C:			
change in durometer hardness	Shore A	+3	DIN 53505
change in tensile strength	%	+10	DIN 53504
change in elongation at break	%	-40	DIN 53504

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

s-mart TFE/P

(tetrafluoroethylene propylene rubber - AFLAS)

s-mart TFE/P is a semi-finished material. it is made on the chemical basis of tetrafluoroethylene-propylene-rubber (AFLAS®). this material is chemical related to fluorocarbon-rubber. s-mart TFE/P has a lower fluorine content than s-mart FKM but for certain applications it provides a better chemical resistance. the material is black coloured and can be manufactured in certain dimension.

characteristics:

compared to FPM-elastomers s-mart TFE/P shows slightly higher tensile strength and a quite similar heat resistance. the restistance of s-mart TFE/P to mineral oils is not as high compared to s-mart FKM, but better than the mineral oil restistance of s-mart NBR and s-mart HNBR. generally s-mart TFE/P can be seen as a combination of s-mart FKM and s-mart EPDM. this results in an outstanding resistance to hot water and hot steam. the resistance to sour gas and amines, brake fluids (based on glycol, mineral oil or silicon oil) and fire-resistant hydraulic fluids is excellent as well. s-mart TFE/P shows in contrast to s-mart FKM a good radiation resistance.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and greases		aromatic hydrocarbons
steam and hot water		chlorinated hydrocarbons
sour gas		ethers
alcohols, amines		low-molecular weight organic acids and acetates
fire-resistant hydraulic fluids (categories HFA, HFB, HFC and HFD)		coolants
acids and bases		
brake fluids on glycol basis		

application:

generally for seals and construction parts, which have to withstand an extensive exposure to chemicals.
it is well suited for a number of applications in oil and gas exploration and in the chemical industry.

material specification

s-mart TFE/P

(tetrafluoroethylene propylene rubber - AFLAS)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	83 ± 5	DIN 53505
density	g/cm³	1,60	DIN 53479
tensile strength	N/mm²	13	DIN 53504
elongation at break	%	220	DIN 53504
100 % modulus	N/mm²	8	DIN 53504
compression set: 175°C / 22h	%	29	DIN ISO 815
tear strength	N/mm	19	DIN 53515
rebound resilience	%	----	DIN 53512
abrasion	mm³	110	DIN 53516
minimum service temperature	°C	-10	----
maximum service temperature	°C	+200	----

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thermoplastics

s-mart PTFE virgin
(polytetrafluoro ethylen)

s-mart PTFE virgin is a crystalline thermoplastic on the chemical basis of polytetrafluoro-ethylene. because of its structure, PTFE cannot be processed with the usual thermoplastic methods. s-mart PTFE virgin is not coloured and therefore white.

characteristics:

s-mart PTFE virgin can be used at an extraordinarily wide temperature range (-200°C up to +260°C), excels with the lowest coefficient of friction (μ = 0.1) of all plastics and is highly resistant to nearly all media. s-mart PTFE virgin has an antiadhesive surface, does not absorb moisture, and has very good electric properties. the plastic deformation depending on time (creeping) even under small stress (cold flow) has to be observed.

resistance:

To almost all chemicals with the exception of elementary fluor, chlortrifluoride and melted alkali metals.
s-mart PTFE has the lowest radiation resistance of all plastics.
dynamic use in water is not recommended (high wear)

applications:

s-mart PTFE virgin is mainly used in cases where no other material can be used because of thermal and chemical stress, and where antiadhesive surfaces and the lowest friction coefficients are called for. in seal engineering, the otherwise often unwanted cold flow is used (o-ring-back-up rings).

main use:
sealing elements for high and low temperature ranges, gliding and supporting elements, rotor seals, o-rings, construction parts for chemical and electrical purposes

material specification

s-mart PTFE virgin
(polytetrafluoro ethylene)

property	unit	value	standard
color		○ white	
durometer hardness	Shore D	57	DIN 53505
density	g/cm³	2,17	DIN 53479
tensile strength	N/mm²	27	DIN 53455
elongation at break	%	300	DIN 53455
tensile modulus	N/mm²	750	DIN 53457
impact resistance, charpy	kJ/m²	no break	DIN 54453
coefficient of thermal expansion (25°C)	K^{-1}	$16 . 10^{-5}$	DIN 52328
coefficient of sliding	----	0,08	----
coefficient of thermal conductivity	W/m.K	0,23	----
minimum service temperature	°C	-200	----
maximum service temperature	°C	+260	----

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s-smart PTFE glass

(polytetrafluoro ethylen filled with 15% glassfiber, 5% MoS_2)

s-mart PTFE glass is a semi-crystalline thermoplastic, on the chemical basis of polytetrafluoro ethylene. s-mart PTFE glass is a PTFE filled with 15% glass fibre and 5% molybdenum sulfide (MoS_2). it is not coloured and its inherent colour is grey.

characteristics:

s-mart PTFE glass can be used over an extraordinar wide temperature range (-200°C up to +260°C), has a very low friction coefficient and is very highly resistant to chemicals. s-mart PTFE glass has an antiadhesive surface and does not absorb moisture. because of the fillers creeping is smaller than with s-mart PTFE virgin (reduction of cold flow, higher extrusion resistance).

resistance:

basic material and glass fibres are resistant to most chemicals, only the MoS_2 can be attacked by several chemicals and a resistance test might be required. s-mart PTFE glass can not be used at exposure to radiation. dynamic use in water is also not recommended (high wear).

applications:

s-mart PTFE glass is mainly used in applications with high thermal and chemical stress and in cases where antiadhesive surfaces, little friction and high extrusion and deformation resistance are called for and pure PTFE cannot be used.

main use:
sealing elements for lowest friction at high stress,sliding and back-up elements, sealing elements with elastic support (elastomers, springs)

critical pv-values (p = power, v = speed)

v = 0,05 m/s	pv = 0,032 (N.m/mm^2.s)
v = 0,5 m/s	pv = 0,039 (N.m./mm^2.s)*
V = 5 m/s	pv = 0,05 (N.m./mm^2.s)*

* temperature rising beyond 150°C, steel counter surface turns blue

material specification

s-mart PTFE glass

(polytetrafluoro ethylene filled with 15% glassfiber, 5% MoS_2)

property	unit	value	standard
color		grey	
durometer hardness	Shore D	60	DIN 53505
density	g/cm^3	2,25	ASTM D 1457
tensile strength	N/mm^2	18	ASTM D 1457
elongation at break	%	200	ASTM D 1457
coefficient of thermal expansion (25°C)	K^{-1}	$11 . 10^{-5}$	DIN 52328
deformation under load, unloaded (14 N/mm^2, 24 h, 25°C)	%	4,3	----
coefficient of thermal conductivity	W/m.K	0,48	DIN 62612
minimum service temperature	°C	-200	----
maximum service temperature	°C	+260	----

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material specification

s-mart PTFE bronze

(polytetrafluoro ethylene filled with 40% bronze)

property	unit	value	standard
color		brown (bronze)	
durometer hardness	Shore D	64	DIN 53505
density	g/cm^3	3,00	ASTM D 1457
tensile strength	N/mm^2	22	ASTM D 1457
elongation at break	%	280	ASTM D 1457
coefficient of thermal expansion (25°C)	K^{-1}	$6 . 10^{-5}$	DIN 52328
deformation under load, unloaded (14 N/mm^2, 24 h, 25°C)	%	4,6	----
coefficient of thermal conductivity	W/m.K	----	DIN 62612
minimum service temperature	°C	- 200	----
maximum service temperature	°C	+ 260	----

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material specification

s-mart PTFE carbon

(polytetrafluoro ethylene filled with 25% carbon)

property	unit	value	standard
color		● black	
durometer hardness	Shore D	65	DIN 53505
density	g/cm^3	2,10	ASTM D 1457
tensile strength	N/mm^2	15	ASTM D 1457
elongation at break	%	180	ASTM D 1457
coefficient of thermal expansion (25°C)	K^{-1}	9 . 10^{-5}	DIN 52328
deformation under load, unloaded (14 N/mm^2, 24 h, 25°C)	%	----	----
coefficient of thermal conductivity	W/m.K	0,60	DIN 62612
minimum service temperature	°C	- 200	----
maximum service temperature	°C	+ 260	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart PTFE graphite

(polytetrafluoro ethylene filled with 15% graphite)

property	condition	unit	value	standard
color			dark grey	
density/specific gravity	23° C	g/cm³	2,13	DIN 53479
hardness	23° C	Shore D	60 ± 3	ISO 868
ball indentation hardness	23° C	MPa	26 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	16	ASTM D 4745-79
elongation at break	23° C	%	140	ASTM D 4745-79
compressive strength	23° C	MPa		DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	4,0	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	11,2	
coefficient of friction*	23° C	µ	0,14	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa		DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

resistant to: almost all chemicals
not resistant to: halogenides, elemental uorine, CF3, molten alkali metals
turnability: good
tool-abrasion: medium

material specification

s-mart PTFE ekonol

(polytetrafluoro ethylene filled with 10% ekonol)

property	condition	unit	value	standard
color			cream	
density/specific gravity	23° C	g/cm³	2,04	DIN 53479
hardness	23° C	Shore D	56 ± 3	ISO 868
ball indentation hardness	23° C	MPa	28 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	20	ASTM D 4745-79
elongation at break	23° C	%	250	ASTM D 4745-79
compressive strength	23° C	MPa	11	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	5,4	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	8,4	
coefficient of friction*	23° C	µ	0,18	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

resistant to: almost all chemicals
not resistant to: halogenides, elemental uorine, CF3, molten alkali metals
turnability: good
tool-abrasion: medium

●○s-mart POM

(polyoxymethelene - polyacetal)

s-mart POM is made of polyacetal (polyoxymethylene) and belongs to the group of technical thermoplastics. s-mart POM is coloured in black.

characteristics:

s-mart POM is highly dimensionally stable, stiff and absorbs only little moisture. s-mart POM has a high creep resistance, the cold-flow tendency is low at temperatures below 80°C. s-mart POM shows excellent sliding and wear behaviour.

sliding friction coeffcient μ = 0.25 - 0.32 (dry run against steel 16 MnCr5 - p = 0.5 kp/cm^2, V = 0.6 m/s/5h)
standard value for pv-values (dry run):
v = 0.05 m/s pv = 0,11 (N.m/mm^2.s)
v = 0.5 m/s pv = 0,1 (N.m/mm^2.s)
v = 5 m/s pv = 0,07 (N.m/mm^2.s)

it can be used at temperatures between -50° C and +100°C (for short time up to + 130°C). temperature resistance of s-mart POM is only 800 C, when high pressure needs to be maintained over a long period of time (retaining rings, rotary shaft lip seals).
s-mart POM has good electric properties and high resistance to chemicals and stress cracks. for linear change of dimensions due to water absorption see fig. 12 below.

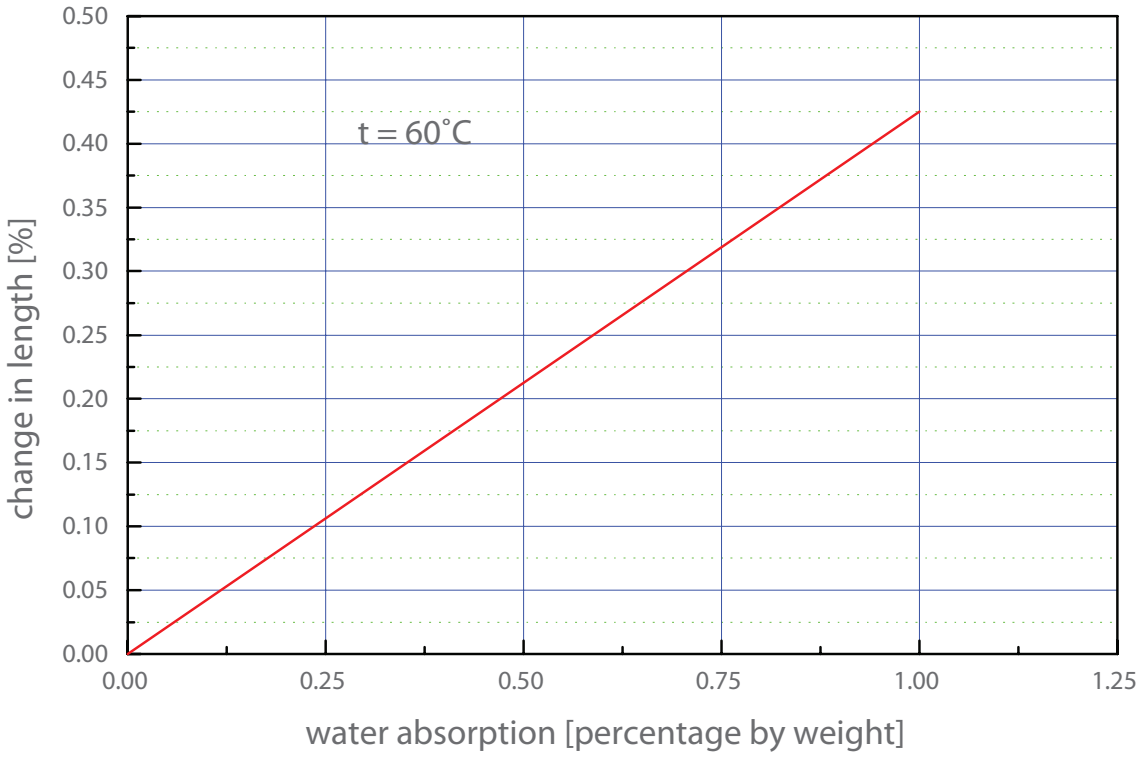

fig. 12 change of length of s-mart POM when water is absorbed

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and grease	ketones	strong acids and bases
vegetable and animal fats and oils		oxidizing agents
fuels		
alcohols		
water		
weak acids and bases		
aliphatic and aromatic hydrocarbonsses		

application:

s-mart POM is mainly used for applications where high hardness and low coefficients of friction are required,

typical examples: guiding and support elements up to 100°C.

main use:
guide ring, back-up rings, special seal parts, wipers for special applications, valve parts/seats, construction parts, bearing shells/ bushes

material specification

s-mart POM
(polyoxymethelene - polyacetal)

property	unit	value	standard
color		● ○ black/white	
density	g/cm³	1,40	DIN 53479
ball hardness H 358/30	N/mm²	135	DIN 53456
durometer hardness	Shore D	82	DIN 53505
yield stress	N/mm²	62	DIN 53455
elongation at yield	%	8 - 10	DIN 53455
elongation at break	%	40	DIN 53455
tensile-modulus	N/mm²	2600	DIN 53457
Izod-Impact resistance at + 23°C at - 30°C	 kJ/m² kJ/m²	 70 40	 ISO 180 ISO 180
water absorption, 23°C, saturation	%	0,8	DIN 53495/L2
coefficient of sliding	µ	0,17 to 0,43	----
minimum service temperature	°C	- 50	----
maximum service temperature	°C	+100	----

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s-smart PA
(polyamide)

s-mart PA is a cast polyamide and belongs to the group of technical thermoplastics. s-mart PA is coloured in black. smart PA is used instead of s-mart POM for diameters above 250 mm.

characteristics:

s-mart PA has very good dimensional stability, stiffness and hardness values, but relatively high moisture absorption. moisture absorption leads to decrease of stability and volume change. s-mart PA has good sliding functions.

sliding friction coeffcient μ = 0.35 - 0.42 (dry run against steel 16 MnCr5 - p = 0.5 kp/cm^2, V = 0.6 m/S/24h)
standard value for pv-values (dry run):
v = 0.05 m/s pv = 0.09 (N.m/mm^2.s)
v = 0.5 m/s pv = 0.06 (N.m/mm^2.s)
v = 5 m/s pv = 0,05 (N.m/mm^2.s)

suitable for temperatures between -40°C and +100°C (for short time up to 140°C). good resistance to chemicals, poor electric properties due to high water absorption. the moisture content influences the mechanical characteristics. hardness and stiness decrease with increasing water content. water absorption (8,5 % at saturation at 23°C) leads to dimensional changes. The dimensional change caused by water absorption cannot be exactly calculated, since influences of shape, production method and processing are very important (change in crystallisation). fig. 13 below shows the values for changes of length when water is absorbed.

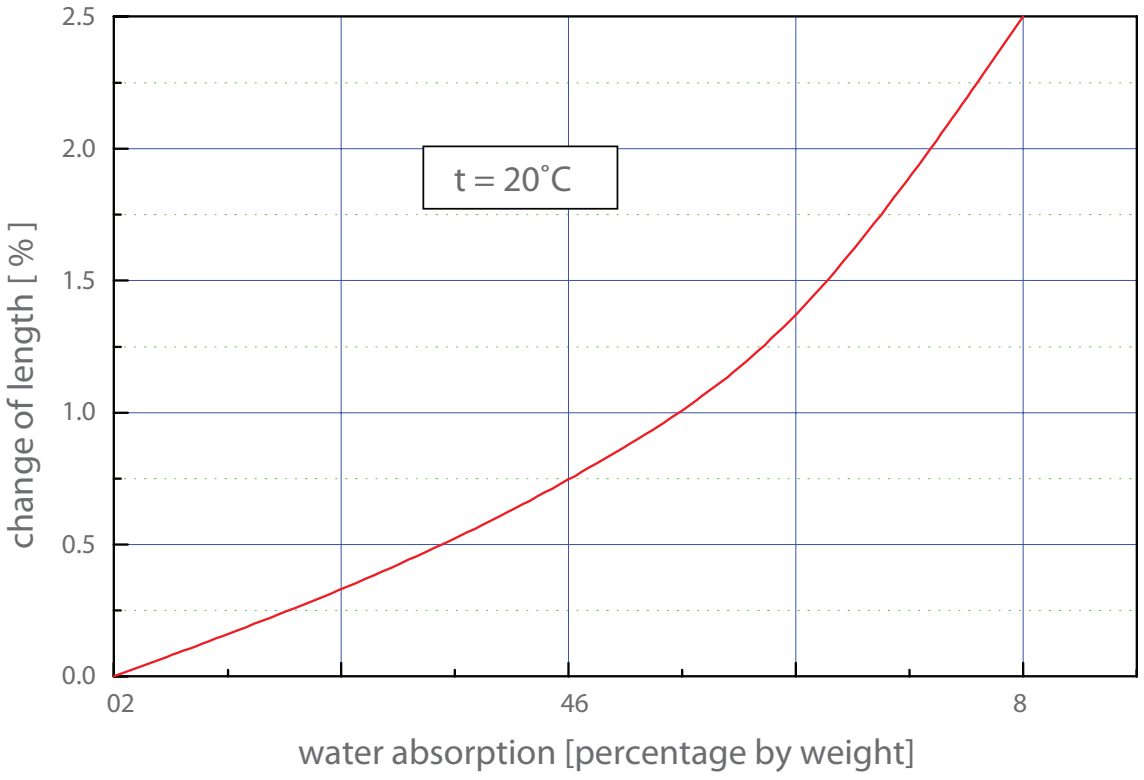

fig. 13 change of length of s-mart PA when water is absorbed

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and grease	chlorinated hydrocarbons	acids and strong bases
vegetable and animal fats and oils		
aliphatic and aromatic hydrocarbons		
esters		
ketones		
alcohols		
weak bases		
fuels		

application:

s-mart PA is mainly used for applications where high hardness (hardness loss at water absorption), low coefficient of friction and excellent gliding and wear properties are called for, i.e. for guide and back-up elements up to approx. 100°C. the use in watery media is not recommended because of the high water absorption of s-mart PA and consequent loss of hardness.

main use:
guide ring, back-up rings, special seal parts, wipers for special applications, valve parts/seats, construction parts, bearing shells/bushes

material data sheet

s-mart PA
(polyamide)

property	unit	value	standard
color		●○ black/natural	
density	g/cm³	1,15	DIN 53479
ball hardness, wet	N/mm²	125	DIN 53456
durometer hardness, wet	Shore D	77	DIN 53505
yield stress, wet	N/mm²	65	DIN 53455
elongation at break, wet	%	120	DIN 53455
tensile-modulus	N/mm²	1800	DIN 53457
impact resistance, Charpy, 23°C, wet	kJ/m²	no break	DIN 53453
water absorption, 23°C, saturation	%	8,5	DIN 53495/12
moisture absorption 23°C, saturation	%	2,2	DIN 53714
coefficient of sliding	P=0,05 N/mm² V=0,6 m/s	0,35 - 0,42	----
minimum service temperature	°C	-40	----
maximum service temperature	°C	+100	----

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s-smart PAEK

(polyaryletherketone)

s-mart PAEK belongs to the group of partly crystalline thermoplastics from the line of high temperature resistant plastics.

characteristics:

s-mart PAEK is a polymer with high tensile strength, stiffness, high heat distortion temperature and good sliding and friction behaviour. as far as strength and stiffness are concerned, s-mart PAEK exceeds most technical plastics especially at high temperatures. the torsional vibration test (see fig. 14) provides a good insight to the mechanical and thermal behaviour of these materials.

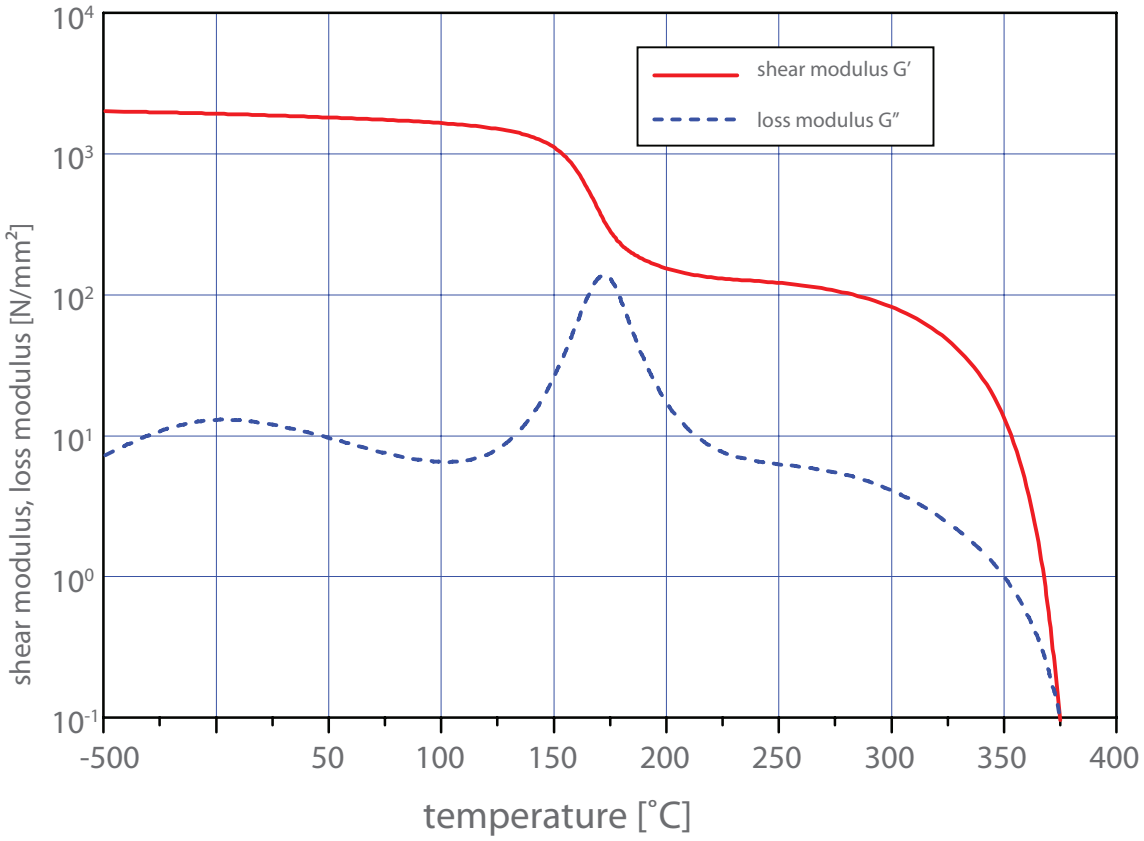

fig. 14 shear and loss modulus of s-mart PAEK

the peak of the dashed line (loss of modulus line) shows the glass transition temperature and thus the softening range of the amorphous parts, whereas the crystalline parts melt above 380°C, ensuring dimensional stability and strength over a wide temperature range. the modulus (full line) data remains almost constant up to the glass transition temperature. then, within a small range of temperature, modulus falls to a new level and changes only slightly until melting temperature is reached.

the comparison of tensile strength data of s-mart PAEK and s-mart POM underlines that these materials can still tolerate mechanical stress at high temperatures which could not be sustained by conventional plastics at room temperature. figure 15 illustrates this comparision.

s-mart PAEK has also a high impact resistance and ductility; just like the most thermoplastics it is sensitive to notches.

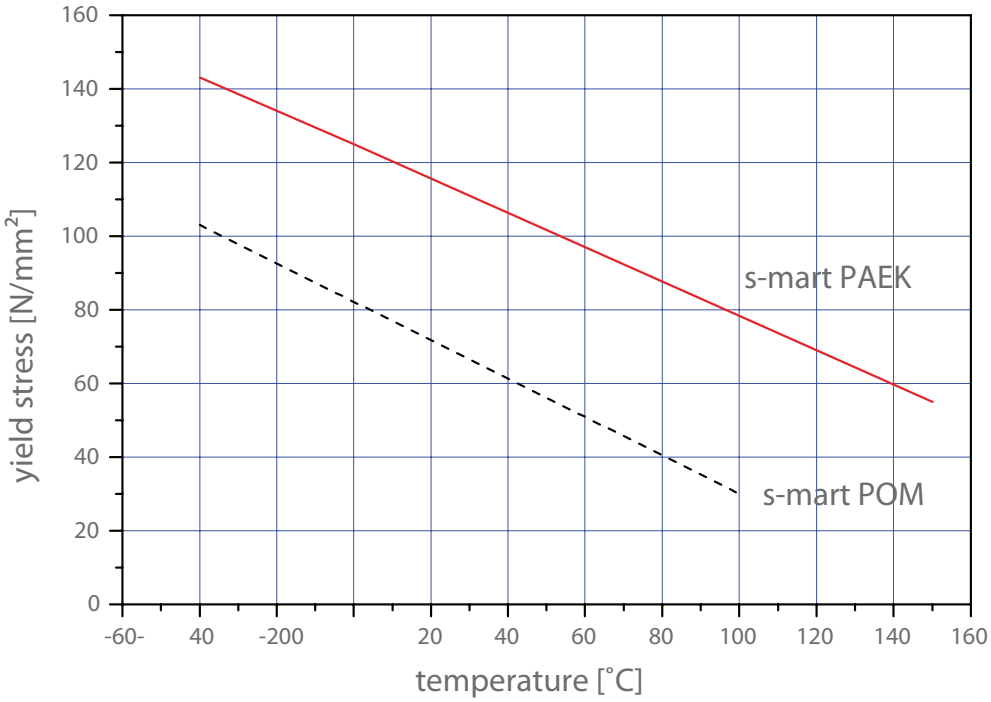

fig. 15 yield stress of s-mart PAEK and s-mart POM as a function of temperature

the peak of the dashed line (loss of modulus line) shows the glass transition temperature and thus the softening range of the amors-mart PAEK absorbs moisture from the air (0.25 % when stored at standard laboratory atmosphere according to DIN 50014-23/50-2). the maximum moisture absorption at storage in water of 23°C is 0.8 % after 90 days. hydrolysis resistance is extraordinar good (after 5000 hrs in water of 140°C no change of tensile strength and elongation at tear is found).
heat distortion temperature of s-mart PAEK measured according to DIN 53461 (ISO 75A) is at 170°C. thermoxidative stability or thermal ageing resistance of s-mart PAEK in air is excellent and one of the highest of all thermoplastics. according to UL746B a temperature index of 250°C can be expected (temperaturetime limit - tensile strength after 40,000 hours is still 50 % of the initial value). In many cases the limit can be seen as maximum application temperature. the behaviour of parts made from s-mart PAEK in heat and under the influence of various chemicals depends on time and kind of the temperature influence as well as on the design of the parts. figure 16 shows stress-strain diagrams and indicates the tensile properties over wide range of temperatures.

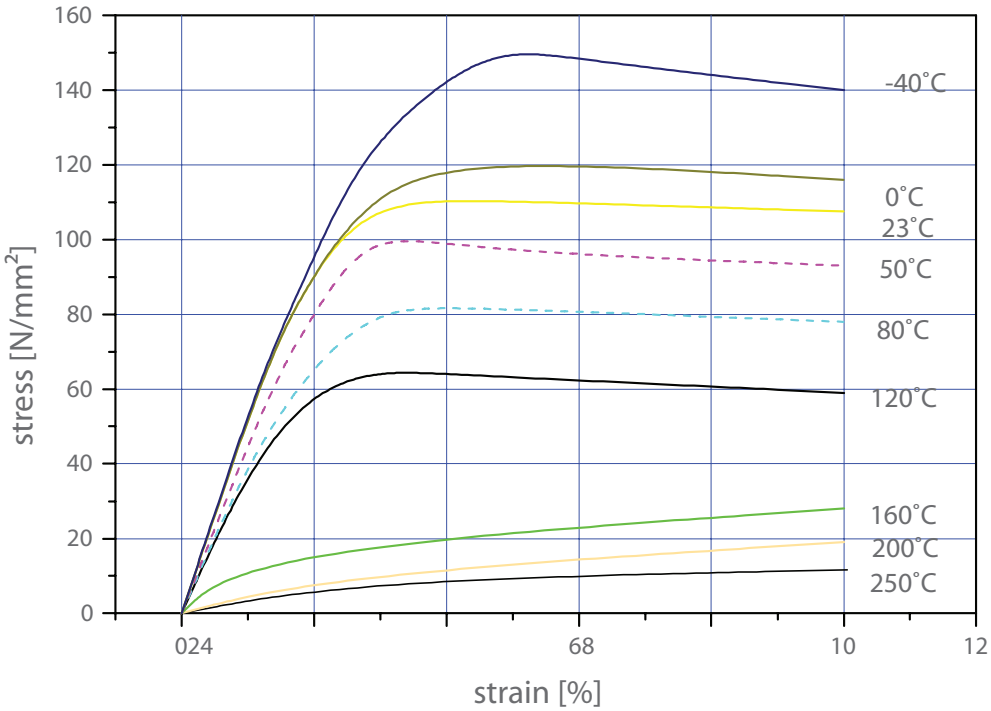

fig. 16 stress-strain diagram of s-mart PAEK at different temperatures.

resistance of s-mart PAEK against creeping is extraordinarily high. behaviour under constant static loads is shown by creep curves at 23°C, 100°C and 200°C. values in between may be interpolated (see fig. 17)

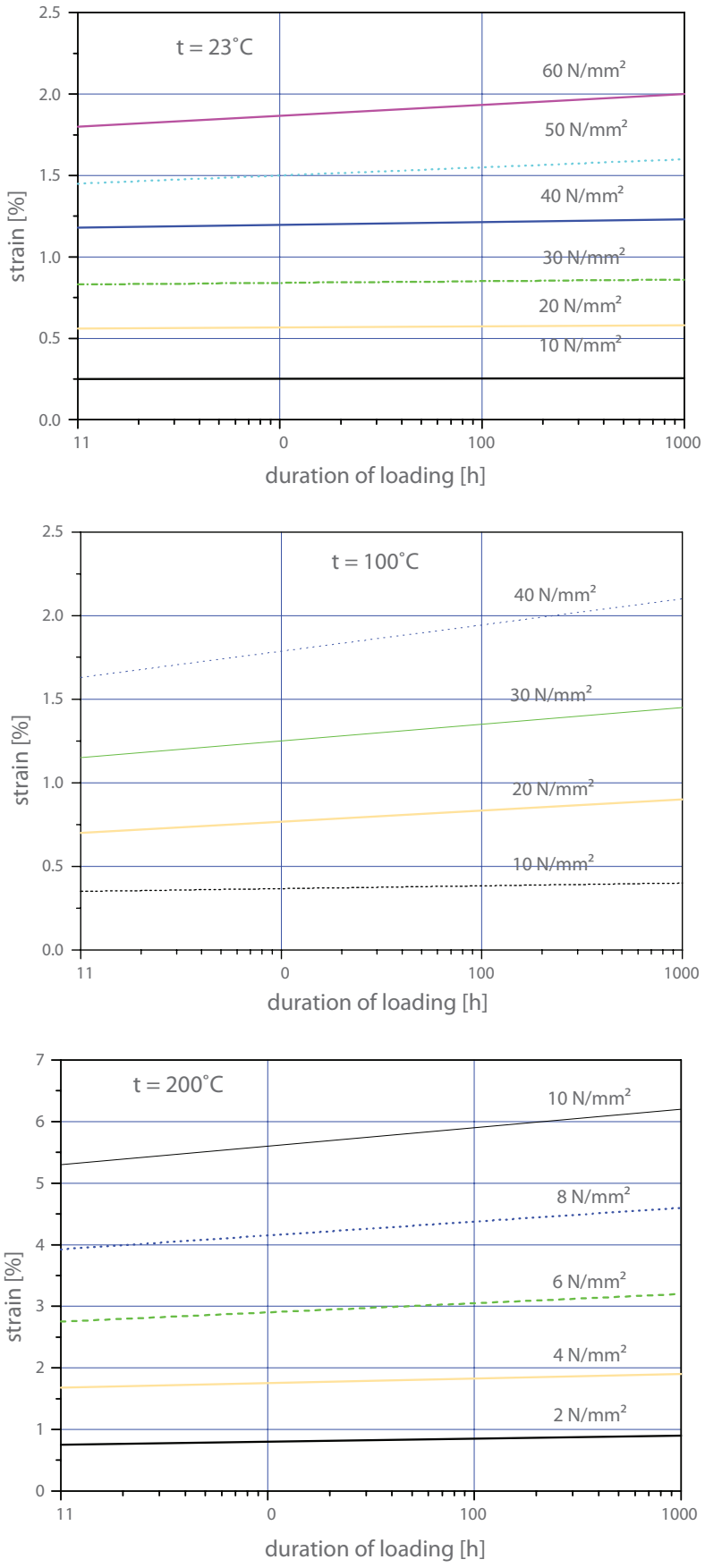

fig. 17 creep curves of s-mart PAEK at various temperatures and loads

s-mart PAEK is a good bearing material. low friction coefficients and low wear rates make s-mart PAEK interesting for tribiological applications. table below shows a comparision of the tribiological properties of s-mart PAEK and s-mart POM determined with the peg- and disc-apparatus under defined conditions.

	coefficient of sliding friction µ		rate of wear ΔS (µm / km)	
	surface temperature 40°C	surface temperature 120°C	surface temperature 40°C	surface temperature 120°C
s-mart PAEK	0,56	0,51	2,4	7,0
s-mart POM	0,45		3,0	

pressure: 1 N/mm²
rubbing velocity: 0,5 m/sec
mating steel surface: 100 Cr6/800 HV
surface roughness: 2,5 µ

the good electric properties combined with good mechanical properties and excellent heat resistance and fire behaviour allow a wide range of applications in electronics and electrical engineering.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and greases	concentrated water-free acids	concentrated sulphuric acid
silicone oils and grease	oxidizing acids	concentrated nitric acid
glycols		some halogenated hydrocarbons
fuels		
chlorinated hydrocarbons		
brake uids		
alcohols		
esters, ethers, ketones		

application:

s-mart PAEK is mainly used where high temperatures, high chemical and mechanical requirements do not allow the use of traditional technical plastics.

main use:
special construction parts, guide and back-up elements, seals and parts for oil field applications

material specification

s-mart PAEK
(polyaryletherketone)

property	unit	value	standard
color		cream	
density	g/cm³	1,32	ISO R 1183
durometer hardness	Shore D	86	DIN 53505
yield stress	N/mm²	97	ISO R 527
elongation at yield stress	%	4,9	ISO R 527
elongation at break	%	> 50	ISO R 527
tensile modulus	N/mm²	3600	ISO R 527
impact resistance, Charpy + 23°C, - 40°C	kJ/m²	no break	DIN 53453
impact resistance notched, Charpy + 23°C	kJ/m²	8,2	ISO 179
dimensional stability at high temperature HDT/A	°C	152	ISO R 75
dimensional stability at high temperature HDT/B	°C	> 250	ISO R 75
maximum service temperature	°C	260	----
water absorption 24h / 23°C	%	0,5	ISO R 262 A

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart UHMWPE

(ultra high molecular weight polyethylene)

property	condition	unit	value	standard
color			○ white/natural	
density/specific gravity	23° C	g/cm³	0,93	DIN 53479
hardness	23° C	Shore D	61 ± 3	ISO 868
ball indentation hardness	23° C	MPa	36	DIN 53456 H135/30
tensile strength	23° C	MPa	40	ASTM D 4745-79
elongation at break	23° C	%	50	ASTM D 4745-79
izod impact strength	23° C	kJ/m²	130	ISO 180/1A
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	0,41	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	15	
coefficient of friction*	23° C	µ	0,25	
minimum service temperature		°C	-200	
maximum service temperature		°C	80	
young's modulus	23° C	MPa	680	DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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high resistance to abrasive wear
good oxidation resistance
good sliding and antiadhesive behaviour
excellent izod impact strength/high resilience at shock and impact stress
excellent chemical properties; generally recognized as safe for foodstuff applications

turnability: good
tool-abrasion: low

s-smart TEX

(polyester fabric reinforced polyester resin with PTFE filler)

s-smart TEX is a compound based on a thermosetting polyester resin and reinforced with fabric inlays. due to the addition of PTFE filler the material shows very good characteristics in respect to the tribological requirements of bearing materials in gliding systems.

characteristics:

s-smart TEX shows high compressive strength and outstanding friction and wear properties. therefore s-smart TEX is very well suited for guide rings and bearing bushes. due to the very low absorption of moisture, s-smart TEX is particularly suitable for use in water and media containing water (swelling in water < 0,1 %). additional to its high form stability and damping characteristics s-smart TEX shows very good sliding and emergency running properties in systems lacking in lubrication. the textured surface of the material provides a good embedding ability of dirt particles through which a scratching or damaging of the cylinder bore by system contamination is prevented.

dynamic coefficient of friction:

lubricant	dry	water*	HFA fluids*	greese*	oils*
μ	0,18-0,21	0,01	0,019	0,013	0,02

(running against 18/8 stainless steel; bearing pressure p = 15,4 N/mm^2; speed v = 2,25 m/s)
* hydrodynamic conditions

guideline for load-bearing capacity:

use as guide ring/linear guidance:
permissible compressive strength under dynamic load (T = 60°C): p_{max}= 90 N/mm^2
permissible speed (linear movement): v ≤1 m/s

the nonlinear distribution of pressure between rod and guide ring is already considered at the indicated value for p_{max}. a safety factor of v= 3 is recommended for the calculation of the guide ring width.

use as a slide bearing for rotating applications:
the maximum load rating of a bearing in a rotary application is limited by the amount of heat generated, within the bearing. many factors influence the amount of heat generated within a system, therefore the listed pv-values give only a rough guideline for the maximum bearing load.

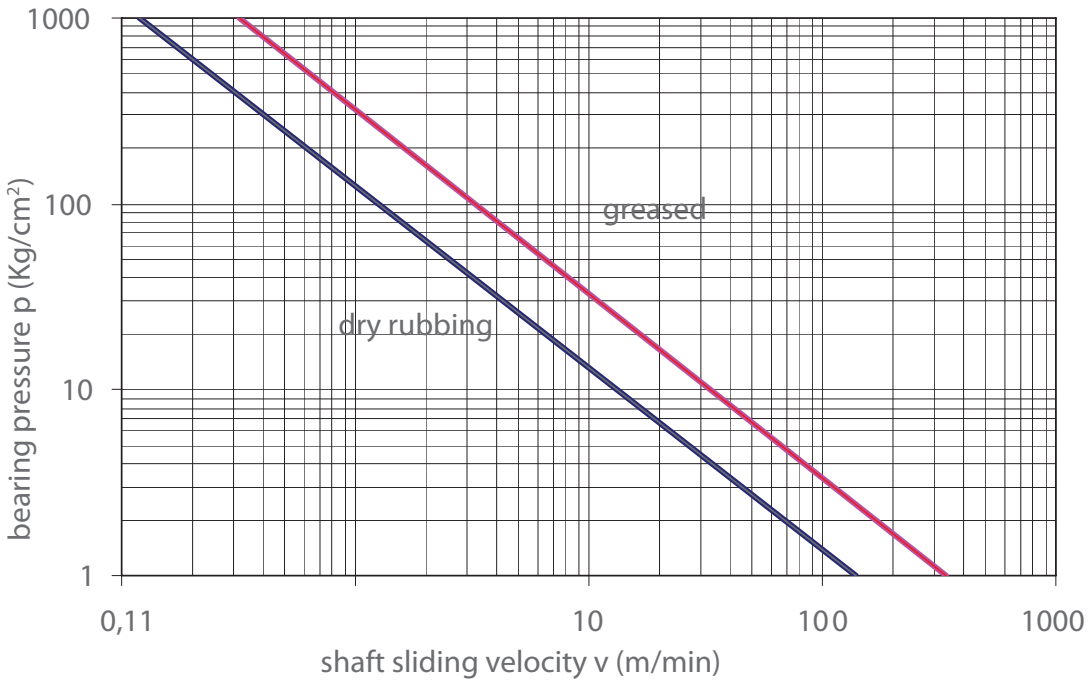

fig. 18 determenation of limiting pv-values of s-mart TEX

in some cases the calculated pv-values might be exceeded. for special requirements please contact our technical department for support.

resistance:

good resistance	medium resistance	little to no resistance
mineral oils and grease		strong acids and bases
fuels		oxidising agents
water		ketones
many diluted acids and bases		

application:

due to its high compressive strength and outstanding friction and wear properties, s-mart TEX will mainly used for guide rings and bearing bushes. guide rings exceeding a diameter of 200mm can be cut to the required length from s-mart TEX tape. s-mart TEX is therefore a suitable substitute for s-mart PA guide rings.

main use:
guide rings exceeding a diameter of 200mm, special seal parts, construction parts, bearing shell / bushes

material specification

s-mart TEX

(polyester fabric reinforced polyester resin with PTFE filler)

property	unit	value	standard
color		orange	
density	g/cm³	1,25	
tensile strength	N/mm²	90	
compressive strength static, normal to laminate, fully comprehended parallel to laminate	N/mm²	345 97	
tensile modulus (tensile test)	N/mm²	3200	
moisture absorption (saturation)	%	< 0,1	
minimum service temperature	°C	-40	
maximum service temperature (in water)	°C	130 (100)	
hardness Rockwell M		100	

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special materials

material specification

s-mart HPU 95 A blue

(hydrolysis resistant polyurethane, 95 shore A)

property	unit	value	standard
color		blue	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 3	DIN 53505
density	g/cm³	1,20 ± 0,01	DIN EN ISO 1183-1
tensile strength	N/mm²	50	DIN 53504
elongation at break	%	380	DIN 53504
100 % modulus	N/mm²	13	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	27	----
compression set: 100°C / 24h, 20 % compression	%	33	----
compression set: 70°C/70h, 10 % compression	%	20	DIN ISO 815
tear strength	N/mm²	100	DIN ISO 34-1
abrasion	mm³	17	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart HPU 95 A natural

(hydrolysis resistant polyurethane, 95 shore A)

property	unit	value	standard
color		○ natural	
durometer hardness	Shore A	95 ± 2	DIN 53505
durometer hardness	Shore D	48 ± 2	DIN 53505
density	g/cm³	1,20 ± 0,01	DIN EN ISO 1183-1
tensile strength	N/mm²	≥ 50	DIN 53504
elongation at break	%	≥ 330	DIN 53504
100 % modulus	N/mm²	≥ 13	DIN 53504
compression set: 70°C / 24h, 20 % compression	%	≤ 27	----
compression set: 100°C / 24h, 20 % compression	%	≤ 33	----
compression set: 70°C/70h, 10 % compression	%	20	DIN ISO 815
tear strength	N/mm	≥100	DIN ISO 34-1
rebound resilience	%	29	DIN 53512
abrasion	mm³	17	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+110	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart GPU 57D yellow

(polyurethane, 57 shore D casted polyurethane)

property	condition	unit	value	standard
color			yellow	
hardness	23° C	Shore D	57 ± 3	ISO 868
modulus 100 %	23° C	MPa	20	DIN 53 504
modulus 300 %	23° C	MPa	33	DIN 53 504
tensile strength	23° C	MPa	45	DIN 53 504
elongation at break	23° C	%	350	DIN 53 504
tear strength	23° C	kN/m	110	DIN ISO 34-1
spec. gravity	23° C	g/cm³	1,16	ISO 1183
abrasion	23° C	mm³	25	DIN 53 516
compression set	*	%	30	ISO 815
compression set	**	%	35	ISO 815
minimum service temperature		°C	-30	
maximum service temperature		°C	110	
* 24h 70°C 25% deflection ** 24h 100°C 25% deflection				

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

copolymer, based on aromatic isocyanate and diols
resistant to: oil, hot water, ozone, microbes
not resistant to: conc. acids, conc. lyes, conc. alcohols and aromatic solvents
turnability: good
tool-abrasion: medium

material specification

s-mart GPU 72D black

(polyurethane, 72 shore D , casted polyurethane)

property	condition	unit	value	standard
color			● black	
hardness	23⁰ C	Shore D	70 ± 3	ISO 868
modulus 100 %	23⁰ C	MPa	30	DIN 53 504
tensile strength	23⁰ C	MPa	50	DIN 53 504
elongation at break	23⁰ C	%	150	DIN 53 504
tear strength	23⁰ C	kN/m	110	DIN ISO 34-1 methode B
spec. gravity	23⁰ C	g/cm³	1,21	ISO 1183
minimum service temperature	23⁰ C	⁰C	-20	
maximum service temperature	23⁰ C	⁰C	110	

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

copolymer, based on aromatic isocyanate and diols
resistant to: oil, petrol, hot water, hot air, ozone
not resistant to: conc. acids, conc. lyes, conc. alcohols and aromatic solvents
turnability: good
tool-abrasion: medium

material specification

s-mart NBR 85A white

(acrylonitrile butadiene rubber, 85 shore A)

property	condition	unit	value	standard
color			white	
hardness	23° C	Shore A	85 ± 5	ISO 868
modulus 100 %	23° C	MPa	8	DIN 53 504
tensile strength	23° C	MPa	15	DIN 53 504
elongation at break	23° C	%	200	DIN 53 504
tear strength	23° C	kN/m	18	DIN 53 515
spec. gravity	23° C	g/cm³	1,44	ISO 1183
rebound elasticity	23° C	%	23	DIN 53 512
abrasion	23° C	mm³	140	DIN 53 516
compression set	*	%	7	ISO 815
compression set	**	%	9	ISO 815
minimum service temperature		°C	-30	
maximum service temperature		°C	110	
temp maximum water steam		°C		
temp maximum hot air		°C		
* 24h 70°C 25% deflection ** 24h 100°C 25% deflection				

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

copolymer, based on butadiene and acrylonitrile
resistant to: oil, petrol, hot water, hot air, ozone, crude oil
not resistant to: conc. acids, conc. lyes, polare solvents
turnability: good
tool-abrasion: medium

dimensions and prices on request

material specification

s-mart NBR 85A LT black

(acrylonitrile butadiene rubber, 85 shore A, for low temperature)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	84	DIN 53505
density	g/cm³	1,29	DIN EN ISO 1183-1
tensile strength	N/mm²	16	DIN 53504
elongation at break	%	130	DIN 53504
100 % modulus	N/mm²	13	DIN 53504
compression set: 100°C / 22h	%	14	DIN ISO 815
tear strength	N/mm	17	DIN ISO 34-1
abrasion	mm³	90	DIN 53516
minimum service temperature	°C	-50	----
maximum service temperature	°C	100	----
glass transition temperature	°C	-48	DSC

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material specification

s-mart HNBR 85A FG black

(hydrogenated acrylonitrile butadiene rubber, 85 shore A, food grade)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,35	DIN EN ISO 1183-1
tensile strength	N/mm²	11	DIN 53504
elongation at break	%	300	DIN 53504
100 % modulus	N/mm²	5	DIN 53504
compression set: 100°C / 22h	%	35	DIN ISO 815
tear strength	N/mm	28	DIN ISO 34-1
rebound resilience	%		DIN 53512
abrasion	mm³	170	DIN 53516
minimum service temperature	°C	-25	----
maximum service temperature	°C	+150	----

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● s-mart HNBR 85A LT black

(hydrogenated acrylonitrile butadiene rubber, 85 shore A, for low temperature)

s-mart HNBR 85A LT black is a peroxide–cured hydrogenated nitrile rubber (HNBR) with outstanding properties at low temperatures in a hardness of 83 ± 5 Shore A and is colored black.

characteristics:

the outstanding cold flexibility of this hydrogenated nitrile rubber makes it useful for applications down to minus 40°C e.g. as sealing elements for the oil-field exploration or in motors and other equipment working in arctic climate.
tensile strength and elongation at break are nearly at the same level as our standard material s-mart HNBR, 100% modulus is on a lower level due to the reduced hardness; compression set is nearly on the same level.

the cold flexibility of the material was characterised by using thermoanalytical methods like DSC (differential scanning calorimetry) and DMA (dynamical mechanical analysis). a comparison of the low temperature properties of s-mart HNBR 85A LT black and two further HNBR grades, standard s-mart HNBR and a competitor material for low temperature use, is shown in figure 19 and 20.
s-mart HNBR 85A LT black shows an appr. 3 to 4°C lower dynamical glass temperature TG (the dynamical glass temperature measured as the peak maximum ot the loss modulus is the characteristic value for the lower working temperature for dynamical applications) and app. 10°C lower than the standard grade. this difference is more strongly developed by the glass temperature measured by differential scanning calorimetry (fig. 20).

regarding the fluid compatibility slight changes in swelling characteristics in mineral oil is to be expected; in water-based fluids the volume change seems to be similar to the standard grade (fig. 21 and 22).

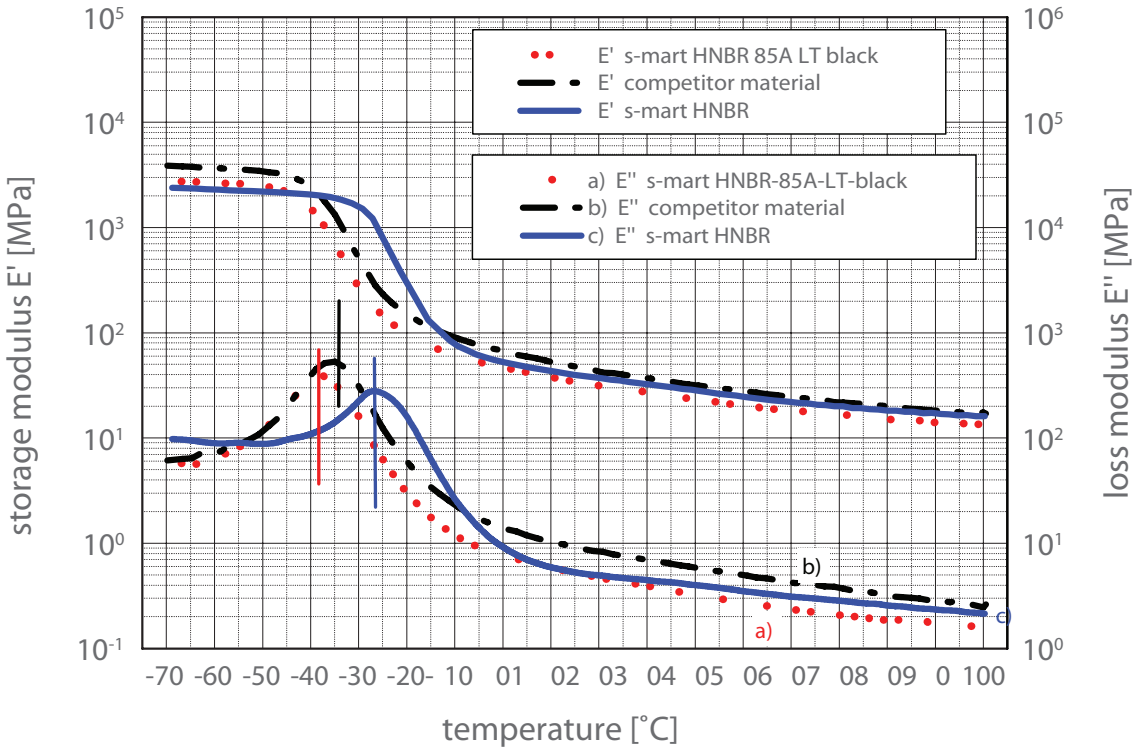

fig. 19 storage and loss modulus of various HNBR grades vs. temperature

cold flexibility of various HNBR's

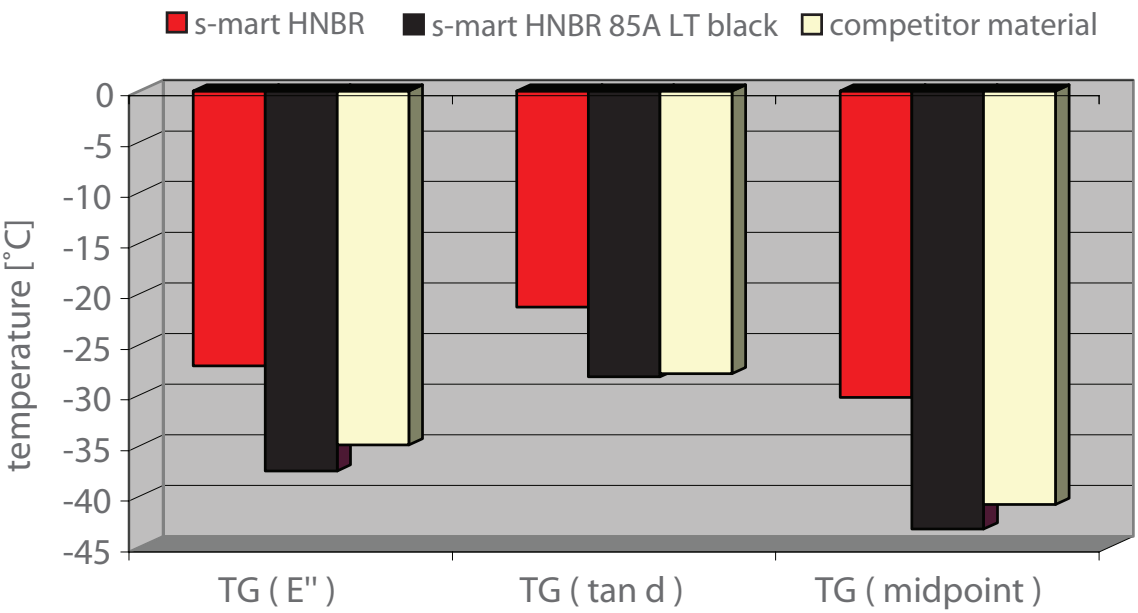

fig. 20 glass transition temperatures of HNBR grades characterised by different test methods

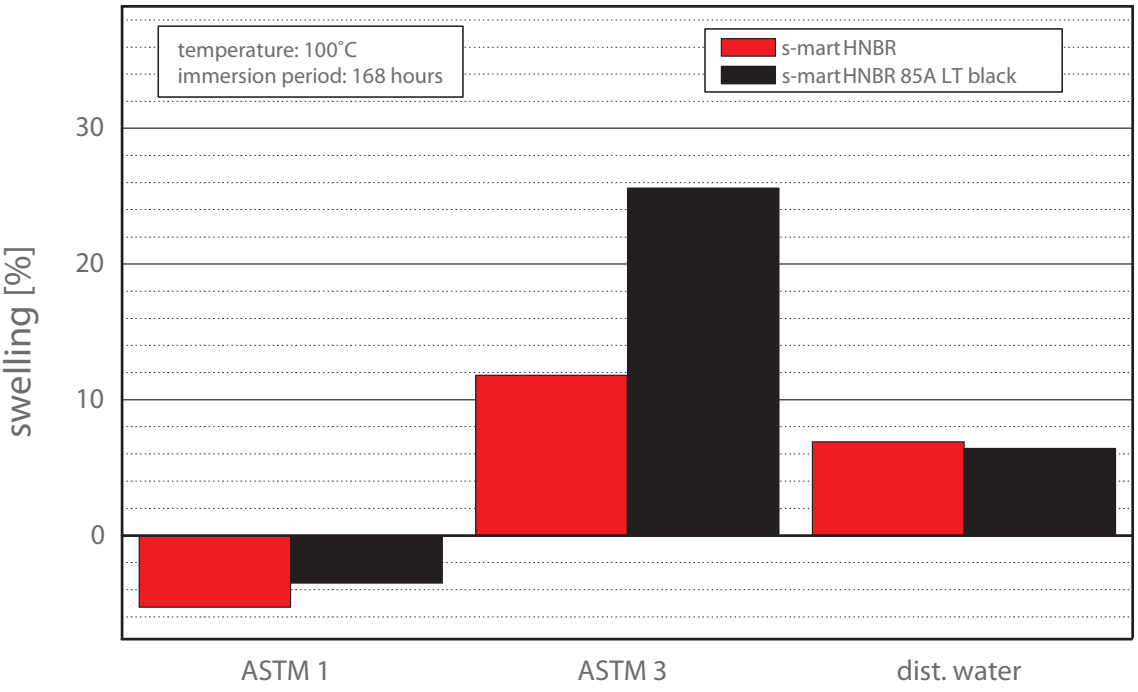

fig. 21 volume change of HNBR grades in various fluids

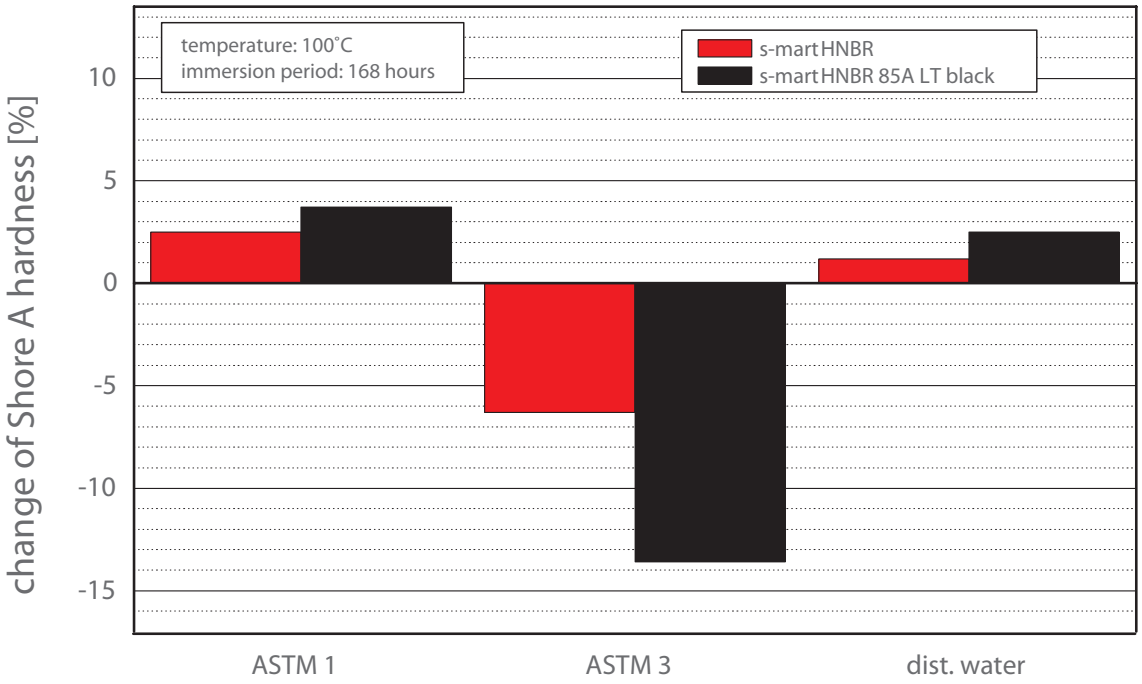

fig. 22 change of hardness of HNBR grades in various fluids

material specification

s-mart HNBR 85A LT black

(hydrogenated acrylonitrile butadiene rubber, 85 shore A, for low temperature)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	83 ± 5	DIN 53505
density	g/cm³	1,21 ± 0,02	DIN 53479
tensile strength	N/mm²	18	DIN 53504
elongation at break	%	180	DIN 53504
100 % modulus	N/mm²	9,0	DIN 53504
compression set: 100°C / 22h	%	23	DIN ISO 815
tear strength	N/mm	15	DIN 53515
rebound resilience	%		DIN 53512
abrasion	mm³	94	DIN 53516
minimum service temperature	°C	-40	----
maximum service temperature	°C	150	----

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material specification

s-mart HNBR 85A ED black

(hydrogenated acrylonitrile butadiene rubber, 85 shore A, explosive decompression grade)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,40 ± 0,02	DIN EN ISO 1183-1
tensile strength	N/mm²	≥ 18	DIN 53504
elongation at break	%	≥ 250	DIN 53504
100 % modulus	N/mm²	≥ 10	DIN 53504
compression set: 100°C / 22h	%	≤ 18	DIN ISO 815
tear strength	N/mm	≥ 25	DIN ISO 34-1
abrasion	mm³	90	DIN ISO 4649
minimum service temperature	°C	-20	----
maximum service temperature	°C	+150	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart HNBR 90A black

(hydrogenated acrylonitrile butadiene rubber, 90 shore A)

property	condition	unit	value	standard
color			● black	
hardness	23° C	Shore A	90 ± 5	ISO 868
modulus 100 %	23° C	MPa	6	DIN 53 504
tensile strength	23° C	MPa	9	DIN 53 504
elongation at break	23° C	%	220	DIN 53 504
tear strength	23° C	kN/m	20	DIN ISO 34-1 Methode B
spec. gravity	23° C	g/cm³	1,32	ISO 1183
rebound elasticity	23° C	%	30	DIN 53 512
abrasion	23° C	mm³	130	DIN 53 516
compression set	*	%	26	ISO 815
compression set	**	%	32	ISO 815
compression set	***	%		ISO 815
minimum service temperature		°C	-20	
maximum service temperature		°C	150	
temp maximum water steam		°C	120	
temp maximum hot air		°C	180 short	

* 24h 70°C 25% deflection ** 24h 100°C 25% deflection *** 24h 150°C 25% deflection

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

copolymer, based on butadiene and acrylonitrile
resistant to: oil, petrol, hot water, hot air, ozone, crude oil
not resistant to: conc. acids, conc. lyes, polare solvents
turnability: good
tool-abrasion: medium

dimensions and prices on request

material specification

s-mart HNBR 93A black

(hydrogenated acrylonitrile butadiene rubber, 93 shore A)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	94	DIN 53505
density	g/cm³	1,23	DIN EN ISO 1183-1
tensile strength	N/mm²	21	DIN 53504
elongation at break	%	94	DIN 53504
100 % modulus	N/mm²		DIN 53504
compression set: 100°C / 22h	%	16	DIN ISO 815
tear strength	N/mm	28	DIN ISO 34-1
rebound resilience	%		DIN 53512
abrasion	mm³	117	DIN 53516
minimum service temperature	°C	-25	----
maximum service temperature	°C	+150	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM 75A PEROX black

(fluorocarbon rubber, 75 shore A, peroxide cured)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	78 ± 5	DIN 53505
density	g/cm³	1,90	DIN EN ISO 1183-1
tensile strength	N/mm²	≥ 13	DIN 53504
elongation at break	%	≥ 230	DIN 53504
100 % modulus	N/mm²	≥ 4	DIN 53504
compression set: 75°C / 22h	%	30	DIN ISO 815
tear strength	N/mm	18	DIN ISO 34-1
rebound resilience	%		DIN 53512
abrasion	mm³	100	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM-75A-LC-black

(fluorocarbon rubber, 75 shore A, low compression set)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	75 ± 5	DIN 53505
density	g/cm³	1,86	DIN EN ISO 1183-1
tensile strength	N/mm²	11	DIN 53504
elongation at break	%	210	DIN 53504
100 % modulus	N/mm²	5,8	DIN 53504
compression set: 175°C / 22h	%	7	DIN ISO 815
tear strength	N/mm	17	DIN ISO 34-1
rebound resilience	%		DIN 53512
abrasion	mm³	135	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM 80A black

(fluorocarbon rubber, 80 shore A)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	81	DIN 53505
density	g/cm³	1,85	DIN EN ISO 1183-1
tensile strength	N/mm²	8,3	DIN 53504
elongation at break	%	260	DIN 53504
100 % modulus	N/mm²	5	DIN 53504
compression set: 175°C / 22h	%	26	DIN ISO 815
tear strength	N/mm	22	DIN ISO 34-1
abrasion	mm³	118	DIN 53516

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM 80A FG black

(fluorocarbon rubber, 80 shore A, food grade)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	80 ± 5	DIN 53505
density	g/cm³	1,85 ± 0,03	DIN EN ISO 1183-1
tensile strength	N/mm²	≥ 8	DIN 53504
elongation at break	%	≥ 230	DIN 53504
100 % modulus	N/mm²	5	DIN 53504
compression set: 175°C / 22h	%	≤ 26	DIN ISO 815
tear strength	N/mm	22	DIN ISO 34-1
abrasion	mm³	118	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM 85A FG white (brown)

(fluorocarbon rubber, 85 shore A, food grade)

property	unit	value	standard
color		white/brown	
durometer hardness	Shore A	86	DIN 53505
density	g/cm³	2,53	DIN EN ISO 1183-1
tensile strength	N/mm²	10	DIN 53504
elongation at break	%	180	DIN 53504
100 % modulus	N/mm²	8	DIN 53504
compression set: 175°C / 22h	%	16	DIN ISO 815
tear strength	N/mm	21	DIN ISO 34-1
abrasion	mm³	205	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

material specification

s-mart FKM 90A black

(fluorocarbon rubber, 90 shore A)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	90 ± 5	DIN 53505
density	g/cm³	1,79	DIN EN ISO 1183-1
tensile strength	N/mm²	9	DIN 53504
elongation at break	%	120	DIN 53504
100 % modulus	N/mm²	8	DIN 53504
compression set: 175°C / 22h	%	14	DIN ISO 815
tear strength	N/mm	22	DIN ISO 34-1
abrasion	mm³	210	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

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material specification

s-mart FKM 95A black

(fluorocarbon rubber, 95 shore A)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	95 ± 5	DIN 53505
density	g/cm³	1,82	DIN EN ISO 1183-1
tensile strength	N/mm²	13	DIN 53504
elongation at break	%	105	DIN 53504
100 % modulus	N/mm²	12	DIN 53504
compression set: 175°C / 22h	%	15	DIN ISO 815
tear strength	N/mm	23	DIN ISO 34-1
abrasion	mm³	200	DIN 53516
minimum service temperature	°C	-20	----
maximum service temperature	°C	+200	----

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

s-mart EPDM 85A FG white

(ethylene propylene diene rubber, 85 shore A, food grade)

this material is made of a sulfur-cured ethylene-propylene-diene rubber which is suitable for applications in the food industry. It is white coloured and has the same range of hardness as s-mart EPDM.

characteristics:

acompared to the standard material this special material shows similar tensile strength and elongation at break, the 100 % modulus value is smaller and the compression set is on a slightly higher level. Its structure causes a slightly decreased processibility in machining. the material possesses the same chemical resistance as the standard material, but is not suitable for the use with brake fluids based on glycol. this special material is designed according the FDA- and BGA-guidelines (see also enclosure) and therefore suitable for food applications.

resistance:

good resistance	medium resistance	little to no resistance
hot water and hot steam up to 180° C	silicone oils and greases (oils can cause shrinkage, test recommended)	aliphatic hydrocarbons (propare, butane, benzine)
fire-resistant pressure fluids of the HFD-R group without mineral oil addition (phosphate ester)		mineral oils and greases
detergents, soda lye, potash lye		aromatic and chlorinated hydrocarbons
many organic and anorganic bases and acids		Vegetable and animal oils and greases
saline solutions and oxidation causing media		biodegradable hydraulic fluids
fire-resistant pressure fluids of the HFC group (glycol-water, if it is ensured that the fluid is free of mineral oil)		fire-resistant hydraulic fluids of group HFA, HFB and HFD-S (chlorinated hydrocarbons)
many polar solvents (e.g. alcohols, ketones, esters, etc.)		
skydrol 500 and 7000		break fluids on glycol basis

application:

seals for the food industry free of greases and oils

material specification

s-mart EPDM 85A FG white

(ethylene propylene diene rubber, 85 shore A, food grade)

property	unit	value	standard
color		white	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,26	DIN 53479
tensile strength	N/mm²	12	DIN 53504
elongation at break	%	280	DIN 53504
100 % modulus	N/mm²	5,5	DIN 53504
compression set: 100°C / 22h	%	33	DIN ISO 815
tear strength	N/mm	28	DIN 53515
rebound resilience	%		DIN 53512
abrasion	mm³	120	DIN 53516
minimum service temperature	°C	-50	----
maximum service temperature	°C	+150	----

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material specification

s-mart EPDM 85A FG black

(ethylene propylene diene rubber, 85 shore A, food grade)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,20	DIN EN ISO 1183-1
tensile strength	N/mm²	11	DIN 53504
elongation at break	%	160	DIN 53504
100 % modulus	N/mm²	7,0	DIN 53504
compression set: 100°C / 22h	%	26	DIN ISO 815
tear strength	N/mm	15	DIN ISO 34-1
rebound resilience	%		DIN 53512
abrasion	mm³	150	DIN 53516
minimum service temperature	°C	-50	----
maximum service temperature	°C	+150	----

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material specification

s-mart EPDM 93A black

(ethylene propylene diene rubber, 93 shore A)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	93	DIN 53505
density	g/cm³	1,17	DIN EN ISO 1183-1
tensile strength	N/mm²	15	DIN 53504
elongation at break	%	95	DIN 53504
100 % modulus	N/mm²		DIN 53504
compression set: 100°C / 22h	%	16	DIN ISO 815
tear strength	N/mm	16	DIN ISO 34-1
abrasion	mm³	105	DIN 53516
minimum service temperature	°C	-50	----
maximum service temperature	°C	+150	----

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material specification

s-mart MVQ 85A FG translucent

(vinyl methyl silicone rubber, 85 shore A, food grade)

property	condition	unit	value	standard
color			translucent	
hardness	23° C	Shore A	85 ± 5	ISO 868
modulus 100 %	23° C	MPa	4	DIN 53 504
tensile strength	23° C	MPa	9	DIN 53 504
elongation at break	23° C	%	300	DIN 53 504
tear strength	23° C	kN/m	8	DIN ISO 34-1 methode B
spec. gravity	23° C	g/cm³	1,18	ISO 1183
rebound elasticity	23° C	%	38	DIN 53 512
abrasion	23° C	mm³		DIN 53 516
compression set	*	%	4	ISO 815
compression set	**	%	7	ISO 815
compression set	**	%	20	ISO 815
minimum service temperature	***	°C	-60	
maximum service temperature		°C	220	
temp maximum water steam		°C	110	
temp maximum hot air		°C	300 short	

* 24h 70°C 25% deflection ** 24h 100°C 25% deflection *** 24h 175°C 25% deflection

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copolymer, based on methyl, vinyl and silicone
resistant to: hot air, ozone, hot water and acetic acid
not resistant to: alipahtic and aromatic hydrocarbons and esters
foodstuff approval: FDA compliant in it's active substances to 177.2600, CFR 21
(rubber articles intended for repeated use)
turnability: bad
tool-abrasion: low

material specification

s-mart TFE/P 85A ED black

(tetrafluoroethylene prolyline rubber - AFLAS, 85 shore A, explosive decompression grade)

property	unit	value	standard
color		● black	
durometer hardness	Shore A	85 ± 5	DIN 53505
density	g/cm³	1,60 ± 0.02	DIN EN ISO 1183-1
tensile strength	N/mm²	≥ 18	DIN 53504
elongation at break	%	≥ 220	DIN 53504
100 % modulus	N/mm²	≥ 8	DIN 53504
compression set: 175°C / 22h	%	≤ 39	DIN ISO 815
tear strength	N/mm	≥ 19	DIN ISO 34-1
abrasion	mm³	110	DIN ISO 4649
minimum service temperature	°C	-10	----
maximum service temperature	°C	+200	----

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dimensions and prices on request

material specification

s-mart PTFE 57D turquoise

(polytetrafluoro ethylene, 57 shore D, filled with 1% pigments)

property	condition	unit	value	standard
color			turquoise	
density/specific gravity	23° C	g/cm³	2,17	DIN 53479
hardness	23° C	Shore D	57 ± 3	ISO 868
ball indentation hardness	23° C	MPa	28 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	31	ASTM D 4745-79
elongation at break	23° C	%	270	ASTM D 4745-79
compressive strength	23° C	MPa	4	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	0,8	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	19	
coefficient of friction*	23° C	µ	0,08	
minimum service temperature		°C	- 200	
maximum service temperature		°C	260	
young's modulus		MPa	540	DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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Resistant to: almost all chemicals
Not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals
turnability: good
tool-abrasion: low

material specification

s-mart PTFE 60D GF25 grey

(polytetrafluoro ethylene, 60 shore D, filled with 25% clean milled glass fibers)

property	condition	unit	value	standard
color			grey	
density/specific gravity	23° C	g/cm³	2,21	DIN 53479
hardness	23° C	Shore D	60 ± 3	ISO 868
ball indentation hardness	23° C	MPa	24 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	17	ASTM D 4745-79
elongation at break	23° C	%	170	ASTM D 4745-79
compressive strength	23° C	MPa	8	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	1,3	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	10,7	
coefficient of friction*	23° C	µ	0,16	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa	1320	DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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resistant to: almost all chemicals
not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals
turnability: good
tool-abrasion: high

material specification

s-mart PTFE 60D GF15 turquoise

(polytetrafluoro ethylene, 60 shore D, filled with 15% clean milled glass fibers & 1% pigments)

property	condition	unit	value	standard
color			turqouise	
density/specific gravity	23° C	g/cm³	2,21	DIN 53479
hardness	23° C	Shore D	60 ± 3	ISO 868
ball indentation hardness	23° C	MPa	30 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	19	ASTM D 4745-79
elongation at break	23° C	%	255	ASTM D 4745-79
compressive strength	23° C	MPa	8	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	1,1	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	10	
coefficient of friction*	23° C	µ	0,13	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa		DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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resistant to: almost all chemicals
not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals
turnability: good
tool-abrasion: medium

material specification

s-mart PTFE 62D GP orange

(polytetrafluoro ethylene, 62 shore D, filled with glass & pigments)

property	condition	unit	value	standard
color			orange	
density/specific gravity	23° C	g/cm³	2,23	DIN 53479
hardness	23° C	Shore D	62 ± 3	ISO 868
ball indentation hardness	23° C	MPa	24 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	26	ASTM D 4745-79
elongation at break	23° C	%	300	ASTM D 4745-79
compressive strength	23° C	MPa	8	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	1,1	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	10	
coefficient of friction*	23° C	µ	0,13	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa		DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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resistant to: almost all chemicals
not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals
turnability: good
tool-abrasion: medium

material specification

s-mart PTFE 63D BR46 blue

(polytetrauoro ethylene, 63 shore D, filled with 46% bronze and 1% pigment)

property	condition	unit	value	standard
color			bronze blue	
density/specific gravity	23° C	g/cm³	3,2	DIN 53479
hardness	23° C	Shore D	63 ± 3	ISO 868
ball indentation hardness	23° C	MPa	35 ± 5	DIN 53456 H135/30
tensile strength	23° C	MPa	24	ASTM D 4745-79
elongation at break	23° C	%	170	ASTM D 4745-79
compressive strength	23° C	MPa	10	DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	4,2	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	8,5	
coefficient of friction*		µ	0,15	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa	1420	DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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resistant to: almost all chemicals
not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals
turnability: good
tool-abrasion: medium

material specification

s-mart PTFE 60D CA black

(polytetrafluoro ethylene, 60 shore D, filled with carbon & additives)

property	condition	unit	value	standard
color			● black	
density/specific gravity	23° C	g/cm³	2,14	DIN 53479
hardness	23° C	Shore D	60 ± 3	ISO 868
ball indentation hardness	23° C	MPa	30 ± 3	DIN 53456 H135/30
tensile strength	23° C	MPa	24	ASTM D 4745-79
elongation at break	23° C	%	250	ASTM D 4745-79
compressive strength	23° C	MPa		DIN 53455
thermal conductivity	23° C	$\frac{J \times 10^3}{m \times h \times K}$	3,5	DIN 52612
coefficient of thermal expansion	25° C - 200° C	$K^{-1} \times 10^{-5}$	10,9	
coefficient of friction*	23° C	µ	0,18	
minimum service temperature		°C	-200	
maximum service temperature		°C	260	
young's modulus		MPa		DIN 53457
* dynamic coefficient of friction, dry, steel 16MnCr5: v=0,6m/s; p=0,05 MPa; t=5h				

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turnability: good
tool-abrasion: medium
resistant to: almost all chemicals
not resistant to: halogenides, elemental fluorine, CF3, molten alkali metals

material specification

s-mart TEXGRA

(polyester fabric reinforced polyester resin with graphite filler)

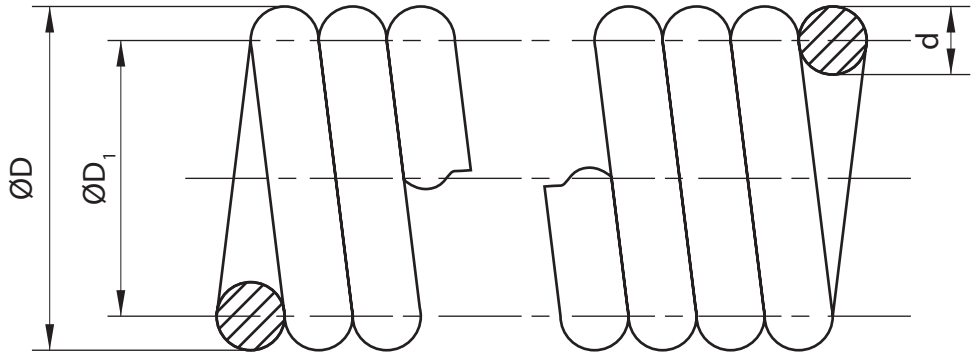
property	unit	value
color		grey
durometer hardness	Shore D	67 - 77
density	g/cm³	1,3
tensile strength	N/mm²	55
compessive stregth normal to laminate parallel to laminate	N/mm²	 413 (unbroken) 165 (unbroken)
moisture absorption	%	< 0,1
coefficient of friction (dry)		0,13 - 0,15
minimum service temperature	°C	- 40
maximum service temperature (in water)	°C	120 (100)

the mentioned data are only valid for test pieces of the corresponding ISO, DIN and ASTM standards and cannot be directly related to gaskets and joints. the values which are marked with the symbols greater than (≥) and smaller than (≤) are nominal values and must be fulfilled of each batch. all values which are not marked are typical values which are only tested on selected samples.

standard springs

standard springs - spring spec

s-mart tension spring



standard dimensions

dimension	D [mm]	d [mm]	D_1 [mm]	n [mm^{-1}]	F_0 [N]	$F_{20\%}$ [N]	L [mm]
1,6 x 0,25	1,6	0,25	1,35	400	0,30	1,01	500
2,0 x 0,32	2,0	0,32	1,68	312,5	1,00	2,26	500
2,2 x 0,36	2,2	0,36	1,84	278	1,75	3,48	500
2,5 x 0,40	2,5	0,40	2,10	250	3,00	4,98	1000
2,8 x 0,45	2,8	0,45	2,35	222,2	4,50	7,04	1000
3,5 x 0,63	3,5	0,63	2,87	158,7	6,00	13,5	1000
4,0 x 0,80	4,0	0,80	3,20	125	12,00	29,87	1000
6,0 x 1,10	6,0	1,10	4,90	90,9	28,00	52,47	1000
8,0 x 1,60	8,0	1,60	6,40	62,5	40,00	111,5	1000

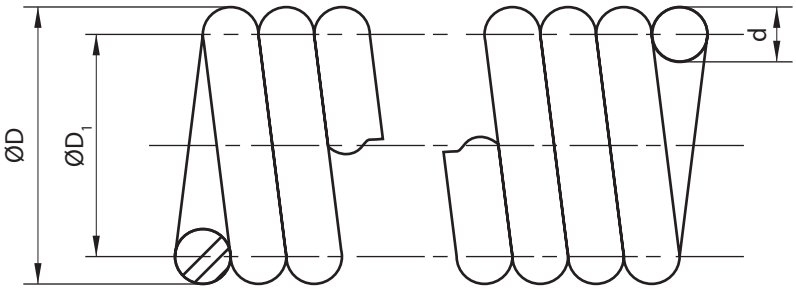
D : spring outside diameter
d : wire diameter
D_1 : average coil diameter
F_0 : internal preload
n : number of turns per 100 mm
c : spring rate
L : length

material

nomenclature	DIN Nr.	usability*
X12 CrNi 177	1.4310	standard usage up to 250 °C

* further details referring to the material according to materials of spring overview

calculation



D : spring outside diameter
d : wire diameter
D_1 : average coil diameter
n : number of turns per 100 mm
s : spring deflection

tension springs according to DIN 2089, part 2

required spring deflection

the requirded spring deflection is a result of the construction type and of the load during operation.
due to inadmissible deformations, the spring force is limited to $F_{20\%}$.

required spring force

R01-P; R01-R; R01-AF: rotating:..... $F = 0{,}0125\ d_{seal}$
R01-P; R01-R; R01-AF: swivel movement: ..... $F = 0{,}025\ d_{seal}$
R01-AS rotating: ..... $F = 0{,}025\ d_{seal}$
R01-AS swivel movement:..... $F = 0{,}05\ d_{seal}$

d_{seal} ..... nominal inside diameter of seal

calculation of the spring length:

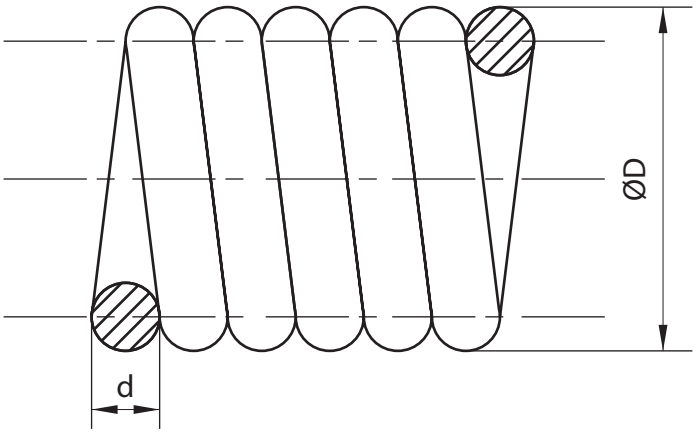
the calculation of the necessary spring length is done by the formula below, spring specific data are included in the factor f1. This factor has to be calculated seperately for non standard springs.

$$FL = \frac{ID \cdot 100}{100 + f_1 \cdot (F - F_0)} \cdot \pi \qquad f_1 = \frac{8 \cdot n \cdot D^3}{G \cdot d^4}$$

FL : required spring length
ID : spring slot diameter
G : torsional strength (according to materials of spring overview)
F_0 : internal preload

D [mm]	1,6	2	2,2	2,5	2,8	3,5	4	6	8
d [mm]	0,25	0,32	0,36	0,40	0,45	0,63	0,80	1,10	1,60
n [mm^{-1}]	400	312,5	278	250	222,2	158,7	125	90,9	62,5
f_1 [N^{-1}]	28,189	15,811	11,536	10,119	7,868	2,665	1,119	0,817	0,280
F_0 [N]	0,3	1	1,75	3	4,5	6	12	28	40
$F_{20\%}$ [N]	1,01	2,26	3,48	4,98	7,04	13,5	29,87	52,47	111,5

s-mart tension spring lock



D : spring outside diameter
d : wire diameter
L : length

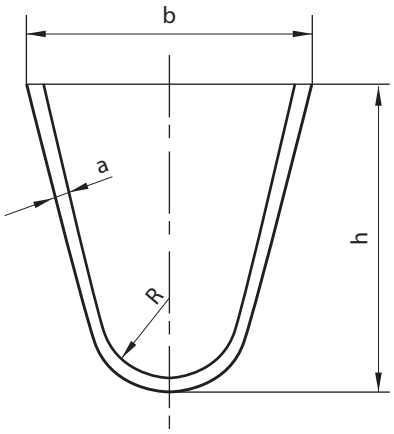
D [mm]	d [mm]	for spring	L [mm]
1,2	0,25	1,6 x 0,25	500
1,46	0,32	2,0 x 0,32	500
1,58	0,36	2,2 x 0,36	500
1,80	0,40	2,5 x 0,40	1000
2	0,45	2,8 x 0,45	1000
2,39	0,63	3,5 x 0,63	1000
2,6	0,8	4,0 x 0,80	1000
4	1,1	6,0 x 1,10	1000
5	1,6	8,0 x 1,60	1000

material

nomenclature	DIN Nr.	usability*
X12 CrNi 177	1.4310	standard usage up to 250 °C

* further details referring to the material according to materials of spring overview

s-mart meander spring

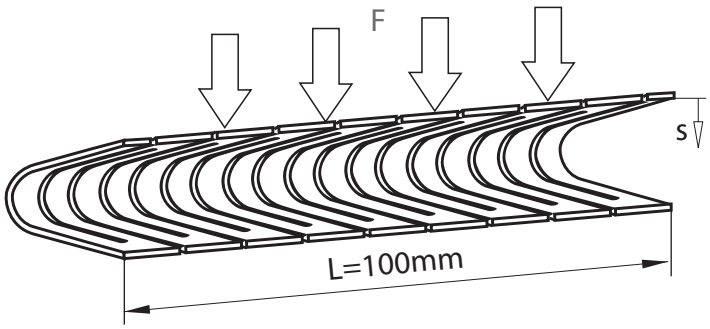


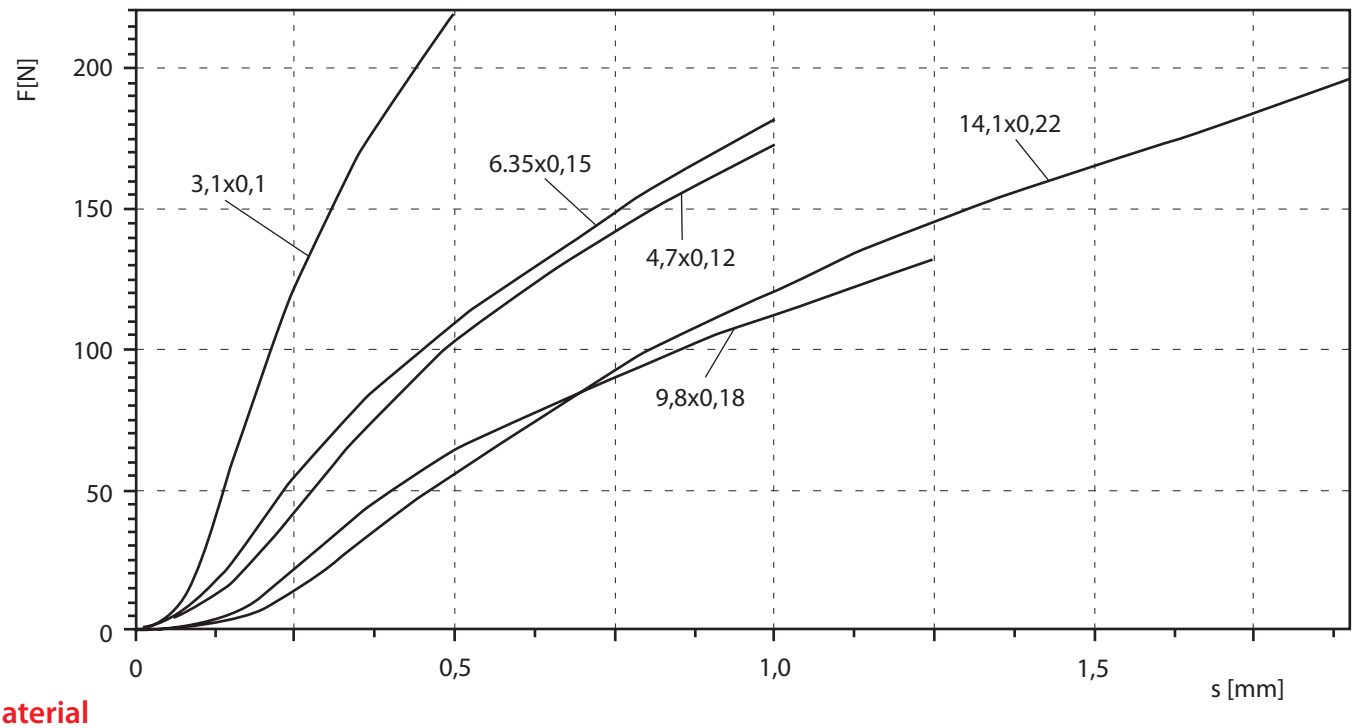
standard dimensions

dimension	width b [mm]	height h [mm]	thickness a [mm]	radius R [mm]	lenght L [mm]
3,1x0,10	1,5	1,3	0,10	0,25	250
4,7x0,12	2,0	2,0	0,12	0,35	250
6,35x0,15	2,9	2,9	0,15	0,7	10000
9,8x0,18	4,5	4,3	0,18	1,0	10000
14,1x0,22	6,6	6,0	0,22	1,8	10000

spring diagram

the illustrated spring force refers to a spring length of 100 mm.



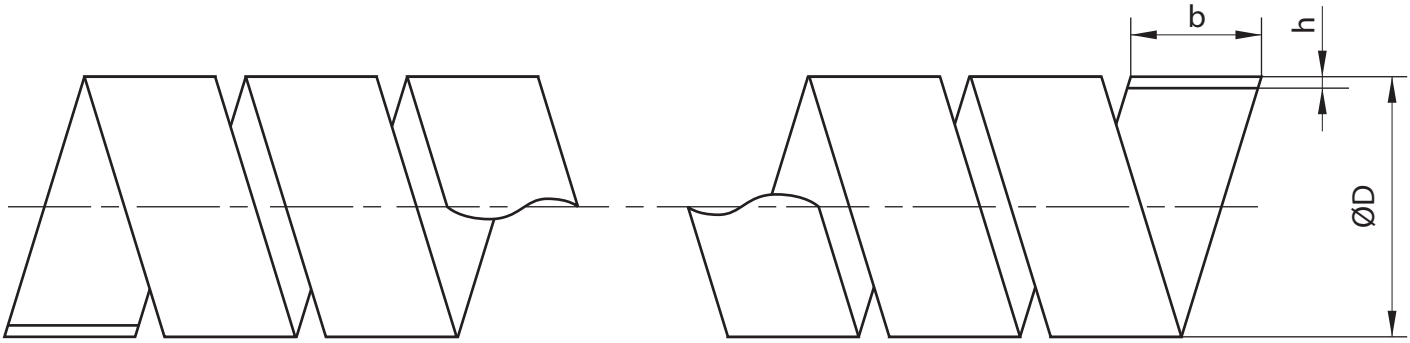


material

nomenclature	DIN Nr.	usability*
X12 CrNi 17 7	1.4310	standard usage up to 250 °C

* further details referring to the material according to materials of spring overview

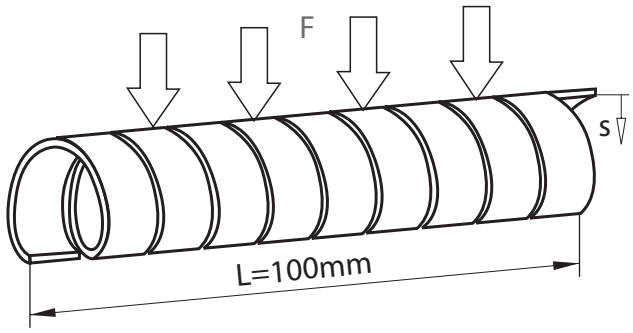
s-mart helicoil spring



standard dimensions

width b [mm]	height h [mm]	outside diameter D [mm]	maximum load F_{max} [N]	max deflection s_{max} [mm]	spring rate c [N/mm]
0,6	0,06	1,5	360	0,40	900
0,6	0,12	2,5	600	0,60	1000
1,2	0,15	4	900	0,66	1363
2,0	0,15	6	760	0,94	808
3,0	0,30	8,5	1300	1,36	956
4,0	0,4	11,7	2200	1,90	1158

the tabulated spring force and the spring rate refer to a spring length of 100 mm.



material

nomenclature	DIN Nr.	usability*
X12 CrNi 17 7**	1.4310	standard usage up to 250 °C

* further details referring to the material according to materials of spring overview
** standard lenght is 1000 mm

materials of spring overview

materials of spring overview

stainless spring steel DIN 1.4310 material

DIN : X 12 Cr Ni 17 7
material number 1.4310

chemical composition:

C	Si	Mn	P	S	Cr	Mo	Ni
max. 0,12%	max. 1,5%	max. 2%	max. 0,045%	max. 0,03%	16 - 18%	max. 0,8%	6 - 9 %

material properties

torsion modulus	G	=	71500 N/mm^2
tensile modulus	E	=	190000 N/mm^2
tensile strength	R_m	=	1600 N/mm^2
permissible torsional strength	τ_{zul}	=	720 N/mm^2 (=0,45xRm)
temperature range	T	=	- 200...+250 ^{0}C
densitiy	ρ	=	7,9 kg/dm^3

properties

- high tensile strength
- good corrosion resistance (in most cases sufficient)
- minor relaxation

hastelloy C-276 material

DIN : Ni Mo 16 Cr 15 W
material number 2.4819

chemical composition:

nikel as base material

C	Si	Mn	P	S	Cr	Mo	Fe	Co	W
max. 0,01%	max. 0.08%	max. 1%	max. 0,04%	max. 0,03%	14,5 - 16,5%	15 - 17%	4 - 7 %	max. 2,5%	3 - 4,5%

material properties

torsion modulus	G	=	no data
tensile modulus	E	=	218000 N/mm^2
tensile strength	R_m	=	900 N/mm^2
permissible torsional strength	τ_{zul}	=	405 N/mm^2 (=0,45xRm)
temperature range	T	=	no data
densitiy	ρ	=	8,98 kg/dm^3

properties

- excellent corrosion resistance against aggressive media, e.g. Iron-III-Chloride, Copper-II-Chloride, hot and soiled media (organic and anorganic), Chloride, Formic acid, Acetic anhydride, sea water and brine.
- C-276 is one of the few alloys, which resist the attack of humid chloride gas, hypochlordie and chloride dioxide.
- it has an outstanding resistance against pittings and stress cracking in oxidating media.

hastelloy C-276 is a special quality, which is only required in extreme working conditions. springs made of this material are not stored in our stock.

hastelloy C-4 material

DIN : Ni Mo 16 Cr 16 Ti
material number 2.4610

chemical composition:

nikel as base material

C	Si	Mn	P	S	Cr	Mo	Fe	Co
max. 0,015%	max. 0.08%	max. 1%	max. 0,04%	max. 0,03%	14 - 18%	14 - 17%	max. 3 %	max. 2%

material properties

torsion modulus	G	=	81400 N/mm^2
modulus of elasticity	E	=	211000 N/mm^2
tensile strength	R_m	=	750 N/mm^2
permissible torsional strength	τ_{zul}	=	337,5 N/mm^2 (=0,45xRm)
temperature range	T	=	up to +450 ^{0}C
densitiy	ρ	=	8,64 kg/dm^3

properties

excellent corrosion resistance, especially against intensive oxidating media, e.g. sea water, chloride and chloridous media

hastelloy C-4 is a special quality, which is only required in extreme working conditions. springs made of this material are not stored in our stock.

elgiloy material

DIN : Co Cr 20 Ni 15 Mo
material number 2.4711

chemical composition:

cobalt as base material

C	Ni	Mn	Co	Be	Cr	Mo	Fe
max. 0,15%	14 - 16%	1,5 - 2,5%	39 - 41%	max. 0,1%	19 - 21%	6 - 8%	rest/balance

material properties

torsion modulus	G	=	no data
tensile modulus	E	=	270000 N/mm^2
tensile strength	R_m	=	1700 - 2000 N/mm^2
permissible torsional strength	τ_{zul}	=	765 - 900 N/mm^2 (=0,45xRm)
temperature range	T	=	-184 ...+454 ^{0}C
densitiy	ρ	=	8,30 kg/dm^3

properties

the properties of this alloy referring to chemical resistance are almost without expection better than the data of hastelloy C-276. only against phosphoric and sulfuric acid is hastelloy C-276 the better choice

use in the oil industry and with sour gas.

elgiloy is a special quality, which is only required in extreme working conditions. springs made of this material are not stored in our stock.

appendix

media resistance & resistance in pressure fluids

the information in the following table has been processed, compiled from our own testing, on many years of experience production of seals and on information from the specialised literature or our suppliers of base materials and experience reports from our customers. in spite of all the experiences, unknown factors in the application of seals can influence the correctness of general recommendation tremendously, for which reason the recommendations and prop resulting from this list cannot be regarded as binding.

however, this information can only be used as a general guide. it cannot be transferred to all operating conditions without additional testing.

with the variety of factors affecting seals and moulded components the chemical resistance is a very important factor but still only part of the overall operating conditions. other factors that must be considered include the selection of material by seal-mart and the shape of the sealing component:
- rotational speed and stroke length
- stroke speed for parts with axial movement
- static or dynamic loading
- surface characteristics of metal components
- type of material of machine components to be sealed.

if there are no special instructions given in the table, standard purity, concentration and room temperature are specified with the media. in case of doubt, particularly with untested or new applications, we recommend consulting us to allow us to conduct special testing if necessary.

legend:
+ good resistance
0 limited resistance
- no resistance
( ) assumed resistance (without test)
n.a. no test results available

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
A											
ACETALDEHYDE	23	-	-	-	-	-	+	0	+	0	+
ACETAMIDE	23	-	-	+	+	+	+	0	+	+	+
ACETIC ACID, GLACIAL	70	-	-	0	0	-	+	0	-	-	+
ACETIC ACID 10 %	50	-	0	-	-	+	+	+	-	-(0)	+
ACETIC ACID 50 %	50	-	-	-	-	-	+	0	-	-	+
ACETIC ANHYDRIDE	23	-	-	-	-	-	+	0	-	0	+
ACETONE (DIMETHYLKETONE)	23	-	-	-	-	-	+	0	+	+	+
ACETOPHENONE	23	-	-	-	-	-	+	0	+	+	+
ACETYLCHLORIDE	23	-	-	-	-	+	-	-	-	-	+
ACETYLENE	23	+	+	+	+	+	+	-	+	+	+
ACETYLENE TETRACHLORIDE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ACRYLONITRILE	23	-	-	-	-	-	-	-	+	+	+
ADIPIC ACID, AQ. SOL.	23	0	+	+	+	+	+	0	n.a.	0	+
AEROSHELL FLUID 4 (SHELL)	80	+	+	+	+	+	-	-	+	+	+
AEROSHELL 7A	50	+	+	+	+	+	-	0	+	+	+
AEROSHELL 17	50	+	+	+	+	+	-	0	+	+	+
AEROSHELL 750	50	-	n.a.	0	0	+	n.a.	-	+	+	+
AIR, HOT [°C] (LIMITING VALUE)		110	110	80	130	200	130	200	100	100	260
AIR, HOT (LONG TIME TEST)	100	+	+	-	+	+	+	+	-	0	+
AIR, HOT (LONG TIME TEST)	200	-	-	-	-	+	-	+	-	-	+
AIR (LONG TIME WEATHERING TEST)	n.a.	+	+	0	+	+	+	+	(+)	+	+
ALCOHOL (DRINKING-ALCOHOL ~40 VOL.%)	23	-	0(+)	+	+	+	+	+	+	+	+
ALUMINIUM ACETATE, AQ. SOL.	50	-	n.a.	+	+	0	+	-	+	+	+
ALUMINIUM CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	0	+	+	+
ALUMINIUM FLUORIDE, AQ. SOL.	50	-	0(+)	+	+	+	+	0	+	+	+
ALUMINIUM NITRATE, AQ. SOL.	50	-	0(+)	+	+	+	+	0	+	+	+
ALUMINIUM PHOSPHATE, AQ. SOL.	50	-	0(+)	+	+	+	+	+	+	0	+
AMMONIA GAS, COLD	23	0	+	+	+	-	+	+	n.a.	n.a.	+
AMMONIA GAS, HOT	80	-	-	0	0	-	0	+	n.a.	n.a.	+
AMMONIA SOLUTION 25%	23	-	0(+)	0	0	0	+	+	+	0	+
AMMONIUM CARBONATE, AQ. SOL.	50	-	0(+)	+	+	+	+	0	+	0	+
AMMONIUM CHLORIDE, AQ. SOL.	50	-	0(+)	+	+	+	+	0	+	0	+
AMMONIUM HYDROXIDE 25%	23	-	0(+)	+	+	+	+	+	+	0	+
AMMONIUM PERSULFATE, AQ. SOL.	50	-	-	+	+	+	+	-	+	0	+
AMMONIUM SULFIDE, AQ. SOL.	23	0	+	+	+	-	+	(+)	+	0	+
AMYL ACETATE	23	-	-	-	-	-	+	-	+	+	+
AMYL ALCOHOL (N-AMYL ALCOHOL)	50	-	0	+	+	+	+	-	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
A											
AMYL CHLORIDE	40	-	0	-	-	+	-	-	-	+	+
AMYL CHLORONAPHTHALENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ANILINE	23	-	-	-	-	+	+	+	0	0	+
ANILINE	100	-	-	-	-	-	+	n.a.	0	0	+
ANILINE HYDROCHLORIDE	23	-	-	-	-	+	+	-	n.a.	n.a.	+
AQUA REGIA	23	-	-	-	-	+	0	-	-	-	+
ARAL VITAM GX 32	80	+	+	+	+	+	-	-	+	+	+
ARAL VITAMOL 3865	80	+	+	+	+	+	-	-	+	+	+
ARAL VITAMOL 4004	80	+	+	+	+	+	-	-	+	+	+
ARGON	23	+	+	+	+	+	+	0	+	+	+
ARSENIC ACID, AQ. SOL.	50	-	0	+	+	+	+	+	+	0	+
ASPHALT / BITUMEN	100	0	+	0	0	+	-	-	+	+	+
ASTM-REFERENCE FUEL A	23	+	+	+	+	+	-	-	+	+	+
ASTM-REFERENCE FUEL B	23	0	0	0	-	+	-	-	+	+	+
ASTM-REFERENCE FUEL C	23	0	0	-	-	+	-	-	+	+	+
ASTM-REFERENCE FUEL D	23	+	+	-	-	+	-	-	+	+	+
ASTM-REFERENCE NO. 1 OIL	100	+	+	+	+	+	-	+	+	+	+
ASTM-REFERENCE NO. 2 OIL	100	0	+	+	+	+	-	0	+	+	+
ASTM-REFERENCE NO. 3 OIL	100	0	+	+	+	+	-	-	+	+	+
AVIATION FUEL	23	+	+	+	+	+	-	-	+	+	+
B											
BARIUM CHLORIDE, AQ. SOL.	50	-	+	+	+	+	+	+	+	0	+
BARIUM HYDROXIDE, AQ. SOL.	50	-	n.a.	+	+	+	+	+	+	0	+
BEER	23	-	+	+	+	+	+	+	+	+	+
BEER WORT	90	-	n.a.	+	+	+	0	0	n.a.	n.a.	+
BENZALDEHYDE	23	-	-	-	-	-	+	0	+	0	+
BENZALDEHYDE	100	-	-	-	-	-	+	-	-	-	+
BENZENE	23	-	-	-	-	+	-	-	+	+	+
BENZENE SULFONIC ACID	23	-	-	-	-	+	-	-	n.a.	n.a.	+
BENZOIC ACID, AQ. SOL.	23	-	-	-	-	+	0	-	0	0	+
BENZOPHENONE	40	-	-	0	0	+	0	-	n.a.	n.a.	+
BENZYL ALCOHOL	23	-	-	-	-	+	0	0	+	-(0)	+
BENZYL CHLORIDE	23	-	-	-	-	+	-	-	+	+	+
BIOMIL H (HUNGARY)	80	-	+	-	-	+	-	-	+	+	+
BISULFITE WASTE LIQUOR	23	-	n.a.	0	0	+	+	(+)	+	0	+
BLAST-FURNACE GAS	23	-	-	-	-	+	-	+	+	+	+
BLEACH LIQUOR	23	-	n.a.	-	-	+	+	0	-	-(0)	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
B											
BONE OIL	23	(+)	+	+	(+)	+	-	0	+	+	+
BORAX, AQ. SOL.	50	-	(0)	+	+	+	+	0	+	0	+
BORIC ACID 10%	23	0	+	+	+	+	+	0	+	0	+
BP BIOHYD 46	80	-	+	-	-	+	-	-	+	+	+
BP BIOHYD SE 46	80	-	+	-	-	+	-	-	+	+	+
BP ENERGOL SF-C 15	50	-	0(+)	+	+	0	+	0	+	0	+
BP ENERGOL SF-C 15	60	-	-(0)	+	+	0	+	0	+	0	+
BRAKE FLUID (BASED ON GLYCOL, DOT-4)	50	-	-	-	-	-	+	0	-	-	+
BRAKE FLUID (BASED ON GLYCOL, DOT-4)	100	-	-	-	-	-	+	0	-	-	+
BRENNTAG TR 32	50	-	0	+	+	+	-	+	+	+	+
BRENNTAG TR 32	60	-	-	+	+	+	-	+	+	+	+
BRENNTAG TR 46	50	-	+	+	+	+	-	+	+	+	+
BRENNTAG TR 46	60	-	0	+	+	+	-	+	+	+	+
BROMINE, LIQUID	23	-	-	-	-	+	-	-	-	-	+
BROMINE PENTAFLUORIDE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
BROMINE TRIFLUORIDE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
BROMINE WATER	23	-	-	-	-	+	-	-	-	-	+
BUNKER OIL	70	0	+	+	+	+	-	-	+	+	+
BUTADIEN (MONOMER)	n.a.	-	-	-	-	+	-	-	+	+	+
BUTANE	23	+	+	+	+	+	-	-	+	+	+
BUTANOL	23	-	n.a.	+	+	+	+	0	+	+	+
BUTANOL	50	-	n.a.	+	+	+	+	-	+	+	+
BUTANOL TERT.	50	-	-	0	0	+	0	0	+	+	+
BUTTER	23	0	+	+	+	+	-	+	+	+	+
BUTTER FAT(WITHOUT WATER)	23	0	+	+	+	+	-	+	+	+	+
BUTYL ACETATE	23	-	-	-	-	-	0	-	+	+	+
BUTYL ACETYL RICINOLEATE	23	-	n.a.	0	0	+	+	-	n.a.	n.a.	+
BUTYL ACRYLATE	23	-	-	-	-	-	-	+	n.a.	n.a.	+
BUTYL AMINE	23	-	-	0	0	-	0	0	n.a.	n.a.	+
BUTYLENE	23	(+)	(+)	+	+	+	-	-	+	+	+
BUTYRALDEHYDE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
C											
CALCIUM ACETATE, AQ. SOL.	50	-	n.a.	+	+	-	+	-	+	0	+
CALCIUM CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
CALCIUM HYDROXIDE, AQ. SOL.	23	-	+	+	+	+	+	-	+	0	+
CALCIUM HYPOCHLORITE 15%	23	-	(0)	-	-	+	+	0	+	0	+
CALCIUM PHOSPHATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
C											
CAMPHOR OIL	23	0	+	+	+	+	-	-	+	+	+
CARBOLIC ACID	23	-	-	-	-	+	-	-	n.a.	n.a.	+
CARBON DIOXIDE, DRY	23	+	+	+	+	+	0	0	+	+	+
CARBON DIOXIDE, WET	23	0	+	+	+	+	0	0	n.a.	n.a.	+
CARBON DISULFIDE	23	-	-	-	-	+	-	-	+	+	+
CARBONIC ACID	23	+	+	+	+	+	+	+	+	+	+
CARBON MONOXIDE, DRY	23	+	+	+	+	+	+	+	+	+	+
CASTOR OIL	80	+	+	+	(+)	+	0	+	+	+	+
CASTROL ALPHA SP 68	80	+	+	+	+	+	-	0	+	+	+
CASTROL BIOTEC ALPIN 22	80	0	+	-	-	+	-	-	+	+	+
CASTROL BIOTEC HVX	80	0	+	-	-	+	-	-	+	+	+
CASTROL HYSPIN AWS 32	80	+	+	+	+	+	-	-	+	+	+
CETANE	23	-	n.a.	+	+	+	-	-	n.a.	n.a.	+
CHLORACETIC ACID	23	-	-	-	-	-	+	-	-	-	+
CHLORBUTADIENE	n.a.	-	-	-	-	+	-	-	n.a.	n.a.	+
CHLORINE DIOXIDE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
CHLORINE, DRY GAS	23	-	-	-	-	0	-	-	-	-	+
CHLORINE, WET GAS	23	-	-	-	-	0	-	-	-	-	+
CHLORINE WATER	23	-	-	-	-	-	0	-	-	-	+
CHLOROACETONE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
CHLOROBENZOL	50	-	-	-	-	+	-	-	+	+	+
CHLOROFORM	23	-	-	-	-	+	-	-	-	-(0)	+
CHLORONAPHTHALENE	23	-	-	(-)	(-)	+	-	-	n.a.	n.a.	+
CHLORONITROETHANE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
CHLOROPHENOL (O-CHLOROPHENOL)	23	-	-	-	-	+	-	-	n.a.	n.a.	+
CHLOROSULFONIC ACID 10%	23	-	-	-	-	-	0	-	n.a.	n.a.	+
CHLOROTOLUENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
CHROME PLATING SOLUTIONS	23	-	-	-	-	+	-	0	-	-(0)	+
CHROMIC ACID, AQ. SOL.	23	0	n.a.	-	-	+	0	0	-(0)	-(0)	+
CHROMIUM-POTASSIUM ALUM, AQ. SOL.	50	-	n.a.	+	+	+	+	+	n.a.	n.a.	+
CICO H 3000	80	-	+	-	0	+	-	-	+	+	+
CITRIC ACID, AQ. SOL.(SATURATED)	23	0	+	+	+	+	+	+	+	0	+
COAL GAS	23	(-)	0	-	-	+	+	n.a.	n.a.	n.a.	+
COBALT CHLORIDE, AQ. SOL.	23	-	n.a.	+	+	+	+	0	+	0	+
COCA-COLA®	bp.	n.a.	n.a.	0	0	(-)	+	+	n.a.	n.a.	+
COCONUT FATTY ACID	80	0	(+)	+	+	+	-	+	+	+	+
COCONUT OIL	80	0	+	+	+	+	0	+	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
C											
COD-LIVER OIL	23	+	+	0	0	+	+	0	+	+	+
COFFEE	50	-	+	+	+	+	+	+	+	0	+
COPPER ACETATE, AQ. SOL.	50	-	-	0	0	-	+	-	+	0	+
COPPER CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
COPPER SULFATE, AQ. SOL.	50	-	0(+)	+	+	+	+	+	+	+	+
COTTAGE CHEESE 60%	50	0	(+)	+	+	+	+	+	n.a.	n.a.	+
COTTONSEED OIL	70	+	+	+	+	+	0	0	+	+	+
CREAM 30%	50	n.a.	+	+	+	+	+	+	+	(+)	+
CREOSOLS	23	-	-	-	-	+	-	-	n.a.	n.a.	+
CREOSOTE-WOOD TAR	23	0	n.a.	+	+	+	-	-	n.a.	n.a.	+
CRESOL (O-CRESOL)	70	-	-	-	-	+	-	-	n.a.	-	+
CRUDE OIL	50	+	+	+	+	+	-	-	+	+	+
CRUDE OIL - AROMATIC BASE	80	0	+	+	+	+	-	-	+	+	+
CRUDE OIL - PARAFFIN BASE	80	0	+	+	+	+	-	-	+	+	+
CUMENE	n.a.	-	-	-	-	+	-	-	n.a.	n.a.	+
CYCLOHEXANE	23	+	+	+	+	+	-	-	+	+	+
CYCLOHEXANOL	23	-	-	+	+	+	-	-	+	+	+
CYCLOHEXANONE	23	-	-	-	-	-	0	-	+	+	+
D											
DEKALIN	23	(0)	n.a.	-	-	+	-	-	+	+	+
DEXTRIN, AQ. SOL.	23	+	+	+	+	+	+	+	+	+	+
DIBENZYL ETHER	23	0	n.a.	-	-	-	0	0	n.a.	n.a.	+
DIBENZYL SEBACATE	23	0	n.a.	-	-	0	0	-	n.a.	n.a.	+
DIBUTYLAMINE	23	-	-	-	-	-	(0)	-	n.a.	n.a.	+
DIBUTYL ETHER	23	0	n.a.	-	-	-	0	-	n.a.	n.a.	+
DIBUTYL PHTHALATE	23	-	n.a.	-	-	0	+	0	+	+	+
DIBUTYL SEBACATE	23	-	n.a.	-	-	+	+	0	+	n.a.	+
DICHLOROBENZENE	23	-	-	-	-	+	-	-	0	+	+
DICHLOROMETHYL ACETATE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
DICHLOROETHYLENE	23	-	-	-	-	+	-	-	+	-	+
DICYCLOHEXYLAMINE	23	-	-	0	0	-	-	-	n.a.	n.a.	+
DIESEL FUELS	23	+	+	+	+	+	-	-	+	+	+
DIETHYLAMINE	23	-	-	-	-	-	0	0	+	n.a.	+
DIETHYLENE GLYCOL	50	-	-	+	+	+	+	0	n.a.	n.a.	+
DIETHYL ETHER	23	0	n.a.	-	-	-	-	-	n.a.	n.a.	+
DIETHYL SEBACATE	23	(+)	n.a.	-	-	+	0	0	n.a.	n.a.	+
DIGLYCOLIC ACID, AQ. SOL.	50	-	-	0	0	+	+	(+)	n.a.	0	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
D											
DIISOBUTYL KETONE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
DIISOPROPYL KETONE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
DIMETHYLAMINE	23	-	-	-	-	-	0	-	+	n.a.	+
DIMETHYLANILINE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
DIMETHYLBUTANE	n.a.	(+)	(+)	+	+	+	-	-	n.a.	n.a.	+
DIMETHYLETHER	23	-	-	-	-	-	+	-	+	n.a.	+
DIMETHYLFORMAMIDE	23	(-)	-	-	-	-	+	0	+	+	+
DIMETHYLHYDRAZINE	23	(-)	(-)	0	0	-	+	-	n.a.	n.a.	+
DIMETHYLPHTHALATE	n.a.	-	(-)	-	-	+	+	-	n.a.	n.a.	+
DIOCTYL PHTHALATE	n.a.	-	(-)	-	-	+	+	-	+	+	+
DIOCTYL SEBACATE	23	0	0	-	-	0	0	-	n.a.	n.a.	+
DIOXANE	23	-	-	-	-	-	+	-	+	+	+
DIOXOLANES	23	-	-	-	-	-	0	-	n.a.	n.a.	+
DIPENTENE (LACQUER SOLVENT)	23	-	-	0	0	+	-	-	n.a.	n.a.	+
DIPHENYL ETHER	23	-	-	-	-	+	-	-	+	+	+
DIPHYL	150	-	-	-	+	+	-	-	-	-	+
DODECYL ALCOHOL	23	-	-	+	+	+	+	(+)	n.a.	n.a.	+
DOW CORNING 550 E	80	-	+	-	-	+	-	-	+	+	+
DOWTHERM A	150	-	-	-	+	+	-	-	-	-	+
DOWTHERM E	150	-	-	-	+	+	-	-	-	-	+
E											
ELECTROPLATING BATH (CHROME)	n.a.	n.a.	n.a.	(+)	(+)	+	+	-	-	0	+
ELECTROPLATING BATH (NOT CHROME)	n.a.	n.a.	n.a.	+	(+)	+	+	-	-	0	+
EPICHLOROHYDRIN	50	-	-	-	-	-	0	-	n.a.	n.a.	+
ERIFON HD 856	60	-	+	+	+	0	(+)	(+)	+	0	+
ESSO CAZAR K1	80	+	+	+	+	+	-	-	+	+	+
ESSO ESSTIC 42, 43	23	0	+	+	+	+	-	-	+	+	+
ESSO FUEL 208	23	-	n.a.	+	+	+	-	-	n.a.	n.a.	+
ESSO NUTO H 22	80	+	+	+	+	+	-	-	+	+	+
ESSO NUTO H 68	80	+	+	+	+	+	-	0	+	+	+
ESSO SPINESSO 10	80	+	+	+	+	+	-	-	+	+	+
ESSO THERMALOIL T	200	-	-	-	-	+	-	-	-	-	+
ETHANE	23	+	+	+	+	+	-	-	+	+	+
ETHANOL (ETHYL ALCOHOL)	60	-	-	+	+	0	+	-	+	0(+)	+
ETHANOLAMINE	23	-	0	0	0	-	+	0	n.a.	n.a.	+
ETHER	23	0	0	0	0	-	0	-	n.a.	n.a.	+
ETHYL ACETATE	23	-	0	-	-	-	+	0	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
E											
ETHYL ACRYLATE	23	-	-	-	-	-	0	0	+	+	+
ETHYL BENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ETHYL CHLORIDE	23	(0)	n.a.	+	+	+	+	-	+	+	+
ETHYLENE	23	+	+	+	+	+	-	-	+	+	+
ETHYLENE CHLORIDE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ETHYLENE CHLOROHYDRIN	23	-	0	-	-	+	0	-	n.a.	n.a.	+
ETHYLENE DIAMINE	23	-	-	+	+	-	+	+	+	+	+
ETHYLENE DIBROMIDE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ETHYLENE GLYCOL	100	-	-	+	+	+	+	+	n.a.	n.a.	+
ETHYLENE OXIDE	23	-	-	-	-	-	0	-	+	0(+)	+
ETHYL ETHER	23	0	0	-	-	-	-	-	+	+	+
ETHYL FORMIC ESTER	23	-	n.a.	-	-	-	0	(-)	n.a.	n.a.	+
ETHYL HEXANOL	23	-	-	+	+	+	+	0	n.a.	n.a.	+
ETHYL MERCAPTAN	23	+	+	-	-	+	0	-	n.a.	n.a.	+
ETHYL PENTACHLOROBENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
F											
FAM-REFERENCE FUEL T1 (DIN 51604)	23	-	-	-	-	+	-	-	+	+	+
FAM-REFERENCE FUEL T2 (DIN 51604)	23	-	-	-	-	0	-	-	+	+	+
FAM-REFERENCE FUEL T3 (DIN 51604)	23	-	-	-	-	0	-	-	+	+	+
FERRIC CHLORIDE, AQ. SOL.	30	0	+	+	+	+	+	0	0	0	+
FERRIC SULFATE, AQ. SOL.	50	0	+	+	+	+	+	0	n.a.	0	+
FISH OIL	50	+	+	+	+	+	-	+	+	+	+
FLUORINE, DRY	23	-	-	-	(-)	+	0	-	-	-	+
FLUORINE, LIQUID	23	-	-	-	-	0	-	-	-	-	+
FLUOROBENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
FORMALDEHYDE 40%	23	-	-	+	(+)	+	+	+	+	0	+
FORMIC ACID CONCENTRATED	23	-	-	-	-	-	+	-	-	-	+
FREON / FRIGEN 11	23	0	n.a.	+	+	0	-	-	+	+	+
FREON / FRIGEN 112 (WITH / WITHOUT OIL)	23	0	0	+	+	+	-	-	+	+	+
FREON / FRIGEN 113	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN 114	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN 114 B2	23	n.a.	n.a.	0	0	0	-	-	+	+	+
FREON / FRIGEN 115	23	(+)	(+)	+	+	+	+	-	+	+	+
FREON / FRIGEN 12	23	+	+	+	+	0	0	-	+	+	+
FREON / FRIGEN 13	23	-	n.a.	+	+	+	+	-	+	+	+
FREON / FRIGEN 13 B1	23	+	+	+	+	+	+	-	+	+	+
FREON / FRIGEN 134A	23	(+)	(+)	+	+	0	n.a.	-	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
F											
FREON / FRIGEN 14	23	+	+	+	+	+	+	-	+	+	+
FREON / FRIGEN 142 B	23	(+)	(+)	+	+	-	+	-	+	+	+
FREON / FRIGEN 152 A	23	(+)	(+)	+	+	-	+	(-)	+	+	+
FREON / FRIGEN 21	23	-	n.a.	-	-	-	-	-	+	+	+
FREON / FRIGEN 218	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN 22	23	-	n.a.	-	-	-	+	-	+	+	+
FREON / FRIGEN 31	23	-	n.a.	-	-	-	+	-	+	+	+
FREON / FRIGEN 32	23	(+)	+	+	+	-	+	-	+	+	+
FREON / FRIGEN 502	23	n.a.	n.a.	0	0	0	(+)	-	+	+	+
FREON / FRIGEN BF(F112)	23	0	0	0	0	0	-	-	+	+	+
FREON / FRIGEN C 316	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN C 318	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN MF	23	(0)	(0)	+	+	0	-	-	+	+	+
FREON / FRIGEN PCA	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN T-P 35	23	+	+	+	+	+	+	+	+	+	+
FREON / FRIGEN T-WD 602	23	+	+	0	0	+	0	-	+	+	+
FREON / FRIGEN TA	23	+	+	+	+	-	+	+	+	+	+
FREON / FRIGEN TC	23	+	+	+	+	+	0	-	+	+	+
FREON / FRIGEN TF	23	+	+	+	+	+	-	-	+	+	+
FREON / FRIGEN TMC	23	0	0	0	0	+	0	-	+	+	+
FRUIT-JUICE	23	0	+	+	+	+	+	+	+	+	+
FUEL OIL, HEAVY	40	0	+	0	0	+	-	0	+	+	+
FUEL OIL, LIGHT	40	0	n.a.	+	+	+	-	0	+	+	+
FURAN	n.a.	(-)	n.a.	-	-	(-)	-	(-)	n.a.	n.a.	+
FURFURAL	n.a.	(-)	(-)	-	-	-	0	-	n.a.	n.a.	+
FURFUR ALCOHOL	n.a.	(-)	-	-	-	(-)	+	-	n.a.	n.a.	+
FURFUROL (A-FURFURYLALDEHYDE)	23	(-)	(-)	-	-	-	+	(-)	+	0(+)	+
FYRQUEL LT (AKZO NOBEL)	80	-	-	n.a.	n.a.	+	-	-	n.a.	n.a.	+
G											
GAMMA-RAYS	20	+	+	0	0	-	0	0	-	0	-
GAS OIL	23	0(+)	0(+)	+	+	+	-	-	+	+	+
GASOLINE	23	0	0	+	+	+	-	-	+	+	+
GASOLINE (20% ETHANOL)	23	-	-	(0)	0	+	-	-	n.a.	n.a.	+
GASOLINE (20% METHANOL)	23	-	-	-	-	0	-	-	n.a.	n.a.	+
GASOLINE HIGH-OCTANE	23	0	0	0	0	+	-	-	+	+	+
GASOLINE M-15 (15% METHANOL)	23	-	-	-	-	0	-	-	+	+	+
GASOLINE, 92 OCTANE	23	0	0	+	+	+	-	-	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
G											
GASOLINE, 98 OCTANE	23	0	0	0	-	+	-	-	+	+	+
GASOLINE, REFINED	23	+	+	+	+	+	-	-	+	+	+
GEAR LUBES, HYPOID LUBES, ATF	80	n.a.	n.a.	0	+	+	-	-	-(0)	+	+
GEAR LUBES SAE 80 / SAE 90	80	n.a.	n.a.	+	+	+	-	0	n.a.	n.a.	+
GELATINE, AQ. SOL.	50	0	n.a.	+	+	+	+	+	+	+	+
GENERATOR GAS	23	+	+	+	+	+	-	0	+	+	+
GLUCOSE, AQ. SOL.	50	0	+	+	+	+	+	+	n.a.	n.a.	+
GLUE	n.a.	+	+	+	+	+	+	+	+	+	+
GLYCERIN (GLYCEROL)	50	-	(+)	+	+	+	+	+	+	+	+
GLYSANTINE (ANTIFREEZE)	60	-	-	+	+	+	+	+	n.a.	n.a.	+
GLYSANTINE / WATER (40 : 60 VOL%)	100	(-)	n.a.	0	0	+	+	n.a.	+	0(+)	+
GREASE, ANIMAL BASE	50	+	+	+	+	+	0	+	+	+	+
GREASE, PETROLEUM BASE	50	+	+	+	+	+	-	-	+	+	+
GREASE, VEGETABLE BASE	50	+	+	+	+	+	-	+	+	+	+
H											
HALON 1211 (FIRE-EXTINGUISHING MEDIUM)	23	+	+	-	-	0	-	-	n.a.	n.a.	+
HALON 1301	23	+	+	+	+	+	+	-	n.a.	n.a.	+
HELIUM	23	+	+	+	+	+	+	+	+	+	+
HEPTANE (n-HEPTANE)	23	+	n.a.	+	+	+	-	-	+	+	+
HEPTANONE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
HESSOL BIOL HE 46	80	0	+	-	-	+	-	-	+	+	+
HESSOL BIOL HR 37	80	0	+	-	-	+	-	-	+	+	+
HEXACHLOROCYCLOHEXANE	23	0	n.a.	-	-	+	-	-	+	-(0)	+
HEXANE (n-HEXANE)	23	+	+	+	+	+	-	-	+	+	+
HEXYL ALCOHOL	23	-	-	0	0	+	0	0	n.a.	+	+
HOUGHTO-SAFE 271, 620	50	-	0	+	+	0	+	0	+	0	+
HOUGHTO-SAFE 1010, 1055	50	-	-	-	-	+	+	-	n.a.	n.a.	+
HOUGHTO-SAFE 5040	50	-	(+)	+	+	+	-	-	+	0	+
HYDRAULIC FLUID HFA (OIL IN WATER)	50	-	+	+	+	+	-	0	+	0	+
HYDRAULIC FLUID HFB (WATER IN OIL)	50	-	+	+	+	+	-	(+)	+	0	+
HYDRAULIC FLUID HFC (POLYALKYLENE-GLYCOL)	60	-	0	+	+	0	+	(+)	+	0	+
HYDRAULIC FLUID HFD-R (PHOSPHATE ESTER)	100	-	-	-	-	+	+	-	n.a.	n.a.	+
HYDRAULIC FLUID HFD-S (CHLOR.HYDROCARB.)	100	-	-	-	-	+	-	(+)	n.a.	n.a.	+
HYDRAULIC FLUID HFD-U (SYNTH. ESTER)	80	-(0)	+	-	0(+)	+	-	(-)	+	+	+
HYDRAULIC OIL (PETROLEUM BASE)	80	+	+	+	+	+	-	0	+	+	+
HYDRA - VIS (HOUGHTON VAUGHAN)	70	-	-	-	-	-	-	-	+	0	+
HYDRAZINE	23	-	-	0	0	-	+	-	+	n.a.	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
H											
HYDROBROMIC ACID, AQ. SOL.	50	-	-	-	-	+	+	-	-	-	+
HYDROCHLORIC ACID 10%	40	-	0	0	0	+	+	0	-	-	+
HYDROCHLORIC ACID FUMING	23	-	-	-	-	-	0	-	-	-	+
HYDROFLUORIC ACID 48%	23	-	-	-	(-)	+	+	-	-	-	+
HYDROFLUORIC ACID 75%	23	-	-	-	(-)	0	+	-	-	-	+
HYDROGEN CHLORIDE, GAS	23	-	-	-	-	+	+	-	-	-	+
HYDROGEN FLUORIDE, DRY	23	-	-	-	-	+	0	-	n.a.	n.a.	+
HYDROGEN, GAS	23	+	+	+	+	+	+	-	+	+	+
HYDROGEN PEROXIDE 30%	23	+	+	-	-	+	+	0	-	-	+
HYDROGEN PEROXIDE 90%	23	-	0	-	-	+	0	0	-	-	+
HYDROGEN SULFIDE	23	0	n.a.	0	0	-	+	-	+	0(+)	+
HYDROLUBRIC 120 B (HOUGHTON VAUGHAN)	60	-	+	+	+	+	+	+	+	0	+
HYDROQUINONE	23	-	-	-	-	+	0	-	n.a.	-	+
HYDROXYL-AMINE SULFATE, AQ. SOL.	23	-	n.a.	+	+	+	+	+	+	0	+
HYPOCHLOROUS ACID	23	-	-	-	-	+	+	-	n.a.	n.a.	+
HY-TRANS-PLUS MS 1207 (CASE)	80	+	+	0	+	+	-	-	n.a.	n.a.	+
H-17(HUNGARY)	60	-	+	+	+	+	-	-	+	0	+
I											
IODINE PENTAFLUORIDE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
IODOFORM	23	n.a.	-	n.a.	n.a.	n.a.	+	n.a.	-	-	+
ISOPROPANOL	23	-	-	0	0	+	+	+	+	+	+
ISOPROPYL CHLORIDE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
ISOPROPYL ETHER	23	0	n.a.	0	0	-	-	-	n.a.	n.a.	+
J											
JAM	23	0	+	+	+	+	+	+	+	+	+
JET FUEL A1	80	-	0(+)	+	+	+	-	-	n.a.	n.a.	+
K											
KEROSENE	23	+	+	+	+	+	-	-	+	+	+
KETCHUP	50	0	+	+	+	+	+	+	n.a.	n.a.	+
KLÜBER SYNTHESO D 220 - EP	80	n.a.	n.a.	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
KLÜBER SYNTHESO PROBA 270	50	+	+	+	+	+	+	n.a.	n.a.	n.a.	+
L											
LARD, ANIMAL FAT	60	+	+	+	+	+	0	+	+	+	+
LAUGHING GAS	23	+	+	+	+	+	+	+	+	+	+
LAURYL ALCOHOL	23	-	-	+	+	0	+	(+)	n.a.	n.a.	+
LAVENDER OIL	23	-	n.a.	0	0	+	-	-	+	+	+
LEAD ACETATE	50	-	n.a.	0	0	-	+	-	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
L											
LIME SULFUR-WET	50	n.a.	n.a.	-	0	+	+	+	n.a.	n.a.	+
LINSEED OIL	23	+	+	+	+	+	-	0	+	+	+
LIQUEUR (MAX. 30% ALCOHOL)	23	-	(+)	+	+	+	+	+	+	0	+
LITHIUM BROMIDE, AQ. SOL.	50	-	n.a.	+	+	+	+	+	+	0	+
LUBRICATING OIL	80	+	+	+	+	+	-	-	+	+	+
M											
MAGNESIUM CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
MAGNESIUM HYDROXIDE, AQ. SOL.	50	-	(+)	+	+	+	+	+	+	0	+
MAGNESIUM SULFATE (EPSOM SALTS), AQ. SOL	50	0	+	+	+	+	+	+	+	0	+
MAIZE OIL	n.a.	+	+	+	+	+	-	+	+	+	+
MALEIC ACID, AQ. SOL.	50	-	0	0	0	+	+	-	n.a.	n.a.	+
MALIC ACID	23	-	n.a.	+	+	+	-	0	+	0	+
MARGARINE	40	-	n.a.	+	+	+	-	+	+	+	+
MARSH GAS	23	0	n.a.	+	+	+	-	-	+	+	+
MAYONNAISE	50	-	n.a.	+	+	0	-	+	+	+	+
MERCURY	23	+	+	+	+	+	+	+	+	+	+
MERCURY CHLORIDE, AQ. SOL.	50	-	n.a.	+	+	+	+	+	+	-	+
MESITYL OXIDE	23	-	-	-	-	-	+	-	+	0(+)	+
METHANE	23	0	n.a.	+	+	+	-	-	+	+	+
METHANOL	50	-	-	0	0	-	+	+	+	+	+
METHYL ACRYLATE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
METHYL AMINE, AQ. SOL.	50	-	-	0	0	-	+	(-)	+	+	+
METHYL BROMIDE	23	-	-	-	-	+	-	-	+	+	+
METHYL BUTYL KETONE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
METHYL CHLORIDE	23	-	-	-	-	+	-	-	+	+	+
METHYL CYCLOPENTANE	23	-	-	-	-	+	-	0	n.a.	n.a.	+
METHYLENE CHLORIDE	23	-	-	-	-	0	-	-	0	0	+
METHYLENE DICHLORIDE	23	-	-	-	-	0	-	-	0	0	+
METHYL ETHER	23	n.a.	n.a.	+	+	+	+	+	n.a.	n.a.	+
METHYL ETHYL KETONE	23	-	-	-	-	-	+	-	0	+	+
METHYL FORMATE	23	-	-	-	-	-	0	0	n.a.	n.a.	+
METHYL ISOBUTYL KETONE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
METHYL ISOPROPYL KETONE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
METHYL METHACRYLATE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
METHYL OLEATE	23	-	n.a.	-	-	+	0	-	n.a.	n.a.	+
MILK	50	0	+	+	+	+	+	+	+	0	+
MILK ACID, AQ. SOL.	50	0	+	0	0	+	0	+	+	+	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
M											
MILK, CONDENSED	50	0	+	+	+	+	+	+	+	0	+
MINERAL OIL	80	+	+	+	+	+	-	0	+	+	+
MOBIL AMBREX 33	80	0	+	+	+	+	-	-	+	+	+
MOBIL AMBREX 830	80	+	+	+	+	+	-	0	+	+	+
MOBIL DELVAC 1100, 1110, 1120, 1130	70	0	+	+	+	+	-	-	+	+	+
MOBIL DTE 25	80	+	+	+	+	+	-	-	+	+	+
MOBILOIL SAE 20	70	+	+	+	+	+	-	-	+	+	+
MOBIL THERM 600	80	-	n.a.	+	+	+	-	-	+	+	+
MOBIL VACTRA NR.2	80	+	+	+	+	+	-	0	+	+	+
MOLASSES	23	0	(+)	+	+	+	+	+	+	+	+
MOLYDUVAL MOLYKOTE-GREASE	50	+	+	+	+	+	-	-	+	+	+
MONOBROMOBENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
MONOCHLOROACETIC ACID	23	-	-	-	-	-	+	-	n.a.	n.a.	+
MONOCHLOROBENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
MONOETHANOLAMINE	23	-	-	0	0	-	+	0	n.a.	n.a.	+
MORPHOLINE	23	-	n.a.	-	-	-	-	-	n.a.	n.a.	+
MOTOR OIL	80	0	+	+	+	+	-	0	+	+	+
MUSTARD	50	+	+	+	+	+	+	+	n.a.	n.a.	+
MUSTARD GAS	23	n.a.	n.a.	n.a.	n.a.	+	+	+	n.a.	n.a.	+
MUSTARD OIL	60	n.a.	n.a.	+	+	+	n.a.	n.a.	n.a.	n.a.	+
N											
NAPHTHALENE	23	0	n.a.	-	-	+	-	-	+	+	+
NATURAL GAS	23	0	n.a.	+	+	+	-	-	+	+	+
NEON	23	+	+	+	+	+	+	+	+	+	+
NICKEL ACETATE, AQ. SOL.	50	-	n.a.	0	0	-	+	-	+	0	+
NICKEL SULFATE, AQ. SOL.	50	0	(+)	+	+	+	+	+	+	0	+
NITRIC ACID 10%	50	-	0	-	-	+	+	0	-	-	+
NITRIC ACID 65%	23	-	-	-	-	0	-	-	-	-	+
NITRIC ACID FUMING	23	-	-	-	-	-	-	-	-	-	+
NITROBENZENE	50	-	-	-	-	+	+	-	0	0	+
NITRO DILUTION	23	-	-	-	-	-	-	-	n.a.	n.a.	+
NITROETHANE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
NITROGEN	23	+	+	+	+	+	+	+	+	+	+
NITROGEN TETROXIDE	23	-	-	-	-	-	0	-	-	0	+
NITROMETHANE	23	-	-	-	-	-	0	-	n.a.	0(+)	+
1-NITROPROPANE	23	-	(0)	-	-	-	0	-	n.a.	n.a.	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
O											
OCEANIC HW 443	60	-	0	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 443	70	-	-	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 540	60	-	+	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 540	70	-	0	+	+	0	n.a.	n.a.	n.a.	n.a.	+
O-CHLOROETHYLBENZENE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
OCTADECANE	23	+	+	+	+	+	-	-	+	+	+
OCTANE (N-OCTANE)	23	-	-	0	0	+	-	-	+	+	+
OCTYL ALCOHOL	23	-	n.a.	0	0	0	0	0	n.a.	n.a.	+
OCTYL CRESOL	23	-	n.a.	0	0	0	-	-	n.a.	n.a.	+
OLEIC ACID	23	0	(+)	+	+	+	-	-	+	+	+
OLIVE OIL	50	+	+	+	+	+	-	0	+	+	+
ORANGE ESSENCE	50	n.a.	n.a.	-	-	0	-	-	+	+	+
OXALIC ACID 25%	23	0	n.a.	0	0	+	+	0	n.a.	0	+
OXYGEN	23	+	+	0	+	+	+	+	+	+	+
OZONE AIR MIXTURE , 50 PPHM OZONE	40	+	+	-	0	+	+	+	0	0	+
P											
PALMITIC ACID	23	+	+	+	+	+	0	-	+	+	+
PARAFFIN MOLTEN	55	+	+	+	+	+	-	0	+	+	+
PARAFFIN OIL	50	+	+	+	+	+	-	0	+	+	+
PEANUT OIL	23	0	+	+	+	+	-	+	+	+	+
PENTACHLORODIPHENYL	n.a.	-	-	-	-	+	-	-	n.a.	n.a.	+
PENTANE , N-PENTANE	23	n.	n.a.	+	+	+	-	-	n.a.	n.a.	+
PENTOSIN CHF 11S	80	0	+	+	+	+	-	-	+	+	+
PERCHLORIC ACID	23	-	-	-	-	0	0	-	n.a.	n.a.	+
PERCHLOROETHYLENE	23	-	-	-	-	+	-	-	+	0	+
PETROLEUM	23	+	+	+	+	+	-	-	+	+	+
PETROLEUM	100	-	0	0	0	0	-	-	(+)	+	+
PETROLEUM ETHER	23	+	+	+	+	+	-	-	+	+	+
PHENOL	23	-	-	-	-	+	-	-	-	-	+
PHENOL/WATER 70:30 %WEIGHT	50	-	-	-	-	+	-	-	-	-	+
PHENYL ETHYL ETHER	23	-	-	-	-	-	-	-	n.a.	n.a.	+
PHENYL HYDRAZINE	23	(-)	(-)	-	-	+	-	(-)	n.a.	n.a.	+
PHOSGENE GAS	23	(-)	-	-	-	-	+	(-)	n.a.	n.a.	+
PHOSGENE LIQUID	23	(-)	(-)	-	-	-	+	(-)	n.a.	n.a.	+
PHOSPHORIC ACID 20%	50	-	0(+)	0	0	+	+	0	-	-	+
PHOSPHORIC ACID CONCENTRATED	50	-	n.a.	-	-	+	+	-	-	-	+
PHOSPHOROUS OXYLCHLORIDE	23	(-)	-	-	-	+	+	(-)	n.a.	n.a.	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
P											
PHOSPHOROUS TRICHLORIDE	23	-	-	-	-	+	+	-	n.a.	n.a.	+
PHOTOGRAPHIC DEVELOPER	23	-	n.a.	+	(+)	+	+	+	+	0	+
PHOTOGRAPHIC FIXER	23	-	n.a.	+	(+)	+	+	+	+	0	+
PICRIC ACID 10%	23	0	(+)	+	+	+	+	-	0	n.a.	+
PINE NEEDLE OIL	40	+	+	+	+	+	-	-	+	+	+
PINE OIL	40	+	+	0	0	+	-	-	+	+	+
PIPERIDINE	23	-	-	-	-	-	-	-	n.a.	n.a.	+
PLANTOHYD 40 (GENOL)	80	0	+	-	-	+	-	-	+	0	+
POLYVINYL ACETATE EMULSION	23	n.	n.a.	+	+	0	+	-	n.a.	n.a.	+
POTASH CAUSTIC 10%	23	0	+	0	0	0	+	-	+	0	+
POTASSIUM ACETATE, AQ. SOL.	50	(-)	n.a.	0	0	-	+	-	+	0	+
POTASSIUM BORATE, AQ. SOL.	50	n.	n.a.	+	+	+	+	+	+	0	+
POTASSIUM BROMATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
POTASSIUM BROMIDE, AQ. SOL.	50	-	0(+)	+	+	+	+	+	+	+	+
POTASSIUM CARBONATE, AQ. SOL.	50	-	n.a.	+	+	+	+	0	n.a.	n.a.	+
POTASSIUM CHLORATE, AQ. SOL.	50	0	+	0	0	+	+	n.a.	n.a.	+	+
POTASSIUM CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	+	+
POTASSIUM CYANIDE, AQ. SOL.	50	0	+	+	+	0	+	+	+	n.a.	+
POTASSIUM DICHROMATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
POTASSIUM HYDROXIDE 10 %	23	0	+	0	0	0	+	-	+	0	+
POTASSIUM PERCHLORATE, AQ. SOL.	50	n.	n.a.	0	0	+	+	-	0	+	+
POTASSIUM PERMANGANATE 25 %	23	-	0(+)	(-)	(-)	0	+	n.a.	+	-	+
PROPANE	23	+	+	+	+	+	-	-	+	+	+
PROPANOL	23	-	n.a.	+	+	+	+	+	+	+	+
PROPYL ACETATE	23	-	-	-	-	-	0	-	n.a.	n.a.	+
PROPYL AMINE	23	-	-	-	-	-	+	-	n.a.	n.a.	+
PROPYLENE	23	-	n.a.	-	-	+	-	-	+	+	+
PROPYLENE GLYCOL	23	0	n.a.	+	+	+	+	+	n.a.	n.a.	+
PROPYLENE OXIDE	23	-	n.a.	-	-	-	0	-	n.a.	n.a.	+
PRUSSIC ACID	23	-	-	0	0	-	+	-	-	n.a.	+
P-TERTIARY BUTYL CATECHOL	23	-	-	-	-	+	0	n.a.	n.a.	n.a.	+
PYDRAUL 29ELT, 30E, 50E, 65E, 90E	80	-	(-)	-	-	+	+	0	n.a.	n.a.	+
PYDRAUL 312C, 540C	80	-	n.a.	-	-	+	-	-	n.a.	n.a.	+
PYDRAUL F-9	80	-	n.a.	-	-	+	0	n.a.	n.a.	n.a.	+
PYRANOL (TRANSFORMER OIL)	23	0	n.a.	+	+	+	-	-	n.a.	n.a.	+
PYRIDINE	23	-	-	-	-	-	0	-	0(+)	+	+
PYRROLE	23	-	n.a.	-	-	-	-	0	n.a.	n.a.	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
Q											
QUINTOLUBRIC N822 - 220	80	-	+	-	0	+	-	(-)	+	+	+
QUINTOLUBRIC N822 - 300	80	0	+	-	0	+	-	(-)	+	+	+
QUINTOLUBRIC N850	80	0	+	-	0	+	-	(-)	+	+	+
Q8 KIRON LT68 (KUWAIT PETROLEUM)	60	-	+	+	+	+	-	-	+	0	+
R											
RAPE OIL (RAPE SEED OIL)	80	0	+	0	0	+	-	-	+	+	+
RARE GAS	n.a.	+	+	+	+	+	+	0	+	+	+
REFERENCE FUEL A (ISO 1817)	23	+	+	+	+	+	-	-	+	+	+
REFERENCE FUEL B (ISO 1817)	23	0	0	0	-	+	-	-	+	+	+
REFERENCE FUEL C (ISO 1817)	23	-	-	-	-	+	-	-	+	+	+
REFERENCE FUEL D (ISO 1817)	23	-	-	-	-	+	-	-	+	+	+
RENOLIN MR 20 VG 68 (FUCHS)	80	+	+	+	+	+	-	0	+	+	+
S											
SALT SOLUTION	50	0	+	+	+	+	+	+	+	0	+
SAUERKRAUT	23	-	+	+	+	0	+	+	+	0	+
SHELL ALVANIA R 2	60	+	+	+	+	+	-	0	+	+	+
SHELL DIALA-OIL D	80	+	+	+	+	+	-	-	+	+	+
SHELL DROMUS OIL B	60	-	+	+	+	+	-	-	+	0	+
SHELL FIREGARD 200	60	-	0(+)	+	+	0	+	(+)	+	0	+
SHELL HSG 80W/90	80	+	+	+	+	+	-	-	+	+	+
SHELL HYDROL DO 46	80	+	+	+	+	+	-	0	+	+	+
SHELL MACOMA 72	80	+	+	+	+	+	-	-	+	+	+
SHELL NATURELLE HF-E 15	80	-	+	-	-	+	-	-	+	+	+
SHELL OMALA 68	80	+	+	+	+	+	-	0	+	+	+
SHELL TELLUS 27, 33	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS T 37	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS 68	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS 68 + 5% CASTROL CX 23	80	0	+	+	+	+	-	-	+	+	+
SHELL TIRENA WA	80	+	+	+	+	+	-	0	+	+	+
SHELL TMO SW 30	80	-	+	-	-	+	-	-	+	+	+
SIDERLUBRIC 822-200	80	-	+	-	0	+	-	-	+	+	+
SILICONE GREASE, SILICONE OIL	50	+	+	0	0	+	0	-	+	+	+
SILICONE GREASE, SILICONE OIL	80	0	+	-	-	+	-	-	+	+	+
SILVER NITRATE, AQ. SOL.	50	0	+	0	(+)	+	+	+	+	0	+
SKYDROL 500 B4 (MONSANTO)	70	-	-	-	-	-	+	-	n.a.	+	+
SKYDROL LD4 (7000) (MONSANTO)	70	-	-	-	-	-	+	-	n.a.	+	+
SODIUM ACETATE, AQ. SOL.	50	-	n.a.	0	0	-	+	-	+	0	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
S											
SODIUM BENZOATE, AQ. SOL.	50	-	n.a.	+	+	+	+	+	+	0	+
SODIUM BISULFITE, AQ. SOL.	50	0	+	+	+	+	+	+	n.a.	0	+
SODIUM BORATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM CARBONATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM CHLORATE, AQ. SOL.	50	0	+	+	+	+	+	-	+	0	+
SODIUM CHLORIDE(SALT), AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM CYANIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM DICHROMATE, AQ. SOL.	50	0	+	+	+	+	+	0	n.a.	0	+
SODIUM HYDROXIDE 10% (CAUSTIC SODA)	50	-	0	0	0	0	+	-	0	0	+
SODIUM HYDROXIDE 25% (CAUSTIC SODA)	50	-	0	0	0	-	+	-	0	0	+
SODIUM HYPOCHLORITE, AQ. SOL.	30	-	(0)	-	-	0	0	0	-	-(0)	+
SODIUM NITRITE, AQ. SOL.	50	-	n.a.	+	+	+	+	+	+	0	+
SODIUM PERBORATE, AQ. SOL.	50	0	+	0	0	+	+	0	+	n.a.	+
SODIUM STEARATE, AQ. SOL.	50	n.a.	n.a.	+	+	+	+	+	n.a.	n.a.	+
SODIUM SULFATE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM SULFIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+
SODIUM THIOSULFATE, AQ. SOL.	23	0	+	+	+	+	+	+	+	0	+
SOLUBLE OIL	n.a.	+	+	+	+	+	-	-	+	+	+
SOUP SOLUTION	50	-	+	+	+	+	+	+	+	0	+
SOUR MILK	50	-	+	+	+	+	+	+	+	0	+
SOYA OIL	50	0	+	+	+	+	-	-	+	+	+
SPIRITS, SCHNAPS	23	-	0(+)	+	+	+	+	+	+	+	+
STARCH, AQ. SOL.	50	0	+	+	+	+	+	+	n.a.	n.a.	+
STEAM, UP TO 302°F	150	-	-	-	-	-	+	-	-	-	+
STEAM, UP TO 356°F	180	-	-	-	-	-	0	-	-	-	+
STEARIC ACID	50	0	+	0	0	+	0	-	+	+	+
STYRENE, MONOMER	23	-	(0)	-	-	0	-	-	+	+	+
SULFUR CHLORIDE	23	-	n.a.	-	-	+	-	-	n.a.	n.a.	+
SULFUR DIOXIDE, DRY	50	-	n.a.	-	-	+	+	0	-	+	+
SULFUR DIOXIDE, WET	50	-	n.a.	-	-	+	+	0	-	0(+)	+
SULFUR HEXAFLUORIDE	23	0	n.a.	0	0	0	+	0	+	+	+
SULFURIC ACID 10%	23	-	+	-	0	+	+	-	0	-(0)	+
SULFURIC ACID 25%	23	-	n.a.	-	-	+	+	-	n.a.	n.a.	+
SULFURIC ACID 50%	23	-	-	-	-	+	+	-	n.a.	n.a.	+
SULFURIC ACID 60%	23	-	-	-	-	+	+	-	n.a.	n.a.	+
SULFURIC ACID 75%	100	-	-	-	-	0	+	-	n.a.	n.a.	+
SULFURIC ACID 96%	23	-	-	-	-	+	+	-	-	-	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
S											
SULFUR MOLTEN	mp.	-	-	-	-	+	+	-	+	+	+
SULFUROUS ACID	23	-	n.a.	0	0	+	+	-	-	0(+)	+
SULFUR TRIOXIDE, DRY	23	-	(+)	-	-	+	0	0	n.a.	n.a.	+
SUNFLOWER OIL	80	+	+	+	+	+	-	+	+	+	+
SUVA HP 62	23	+	+	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+
SUVA 134a	23	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+
SUVA 9000	23	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+
T											
TANNIC ACID	23	+	+	+	+	+	+	0	0	n.a.	+
TAR , TAR OIL	23	0	+	-	-	+	-	-	+	+	+
TEBIOL HVI 32 A	80	-	+	-	-	+	-	-	+	+	+
TERTIARY BUTYL MERCAPTAN	23	-	-	-	-	+	-	-	n.a.	n.a.	+
TETRABROMOETHANE	23	-	n.a.	-	-	+	-	-	n.a.	n.a.	+
TETRACHLOROETHANE	23	-	-	-	-	+	-	-	n.a.	n.a.	+
TETRACHLOROMETHANE	23	(0)	(0)	-	-	+	-	-	0	+	+
TETRAETHYL LEAD	23	0	n.a.	0	0	+	-	-	n.a.	-	+
TETRAHYDROFURAN	23	-	-	-	-	-	-	-	0	0(+)	+
TETRALIN (SULFOLANE)	23	-	-	-	-	+	-	-	+	+	+
TEXACO REGAL B	70	+	+	+	+	+	-	-	+	+	+
TEXACO UNI-TEMP	23	+	+	+	+	+	-	0	+	+	+
TEXAMATIC "A" TRANSMISSION-OIL	23	0	n.a.	+	+	+	-	-	+	+	+
THIOKOL TP-90 B	23	n.a.	n.a.	-	-	+	+	n.a.	n.a.	n.a.	+
THIOKOL TP-95	23	n.a.	n.a.	-	-	+	+	n.a.	n.a.	n.a.	+
THIONYL CHLORIDE	23	-	n.a.	-	-	0	-	-	n.a.	n.a.	+
TOLUENE	23	-	-	-	-	+	-	-	+	+	+
TOLUYLENE DIISOCYANATE	23	-	-	-	-	0	0	-	n.a.	n.a.	+
TOOTH-PASTE	50	n.a.	(+)	+	+	+	+	+	+	+	+
TRANSFORMER OIL	23	+	+	+	+	+	-	0	+	+	+
TRIACETIN	23	-	n.a.	0	0	-	+	+	n.a.	n.a.	+
TRIBUTYL PHOSPHATE	23	-	-	-	-	-	+	0	n.a.	n.a.	+
TRICHLOROACETIC ACID	23	-	-	-	-	-	0	-	-	-	+
TRICHLOROETHANE	23	-	-	-	-	+	-	-	0	(+)	+
TRICHLOROETHYLENE (TRIAD)	23	-	-	-	-	+	-	-	-	0(+)	+
TRICRESYL PHOSPHATE	23	(-)	n.a.	-	-	+	+	0	+	+	+
TRIETHANOLAMINE	23	-	-	0	0	-	+	(-)	+	+	+
TRINITROTOLUENE	23	-	-	-	-	0	-	-	n.a.	n.a.	+
TRIOCTYL PHOSPHATE	23	-	-	-	-	0	+	-	n.a.	n.a.	+

media resistance

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
T											
TURPENTINE	50	-	n.a.	0	0	+	-	-	+	+	+
U											
UNIVIS 40 (ESSO)	70	+	+	+	+	+	-	-	+	+	+
UNIVIS J 13 (ESSO)	80	+	+	+	+	+	-	-	+	+	+
UREA, AQ. SOL.	50	0	n.a.	+	+	+	+	0	+	+	+
V											
VACUUM PUMP OIL N 62 (LEYBOLD)	80	+	+	0	+	+	-	+	+	+	+
VASELINE	40	+	+	+	+	+	-	+	+	+	+
VEGETABLE OIL	23	+	+	+	+	+	-	+	+	+	+
VINEGAR 5%	23	-	+	0	0	+	+	+	+	0	+
VINYL CHLORIDE	23	-	-	-	-	+	0	-	+	+	+
W											
WAGNER 21 B	23	-	-	-	-	-	+	0	n.a.	n.a.	+
WATER, DISTILLED	100	-	0	0	+	0	+	+	(+)	0	+
WATER, DRINKING (COLD)	20	+	+	+	+	+	+	+	+	0	+
WATER, DRINKING (HOT)	80	-	+	0	+	0	+	+	+	0	+
WATER, DRINKING (HOT)	100	-	0	0	+	0	+	+	(+)	0	+
WATER, DRINKING (MINERAL)	50	-	+	+	+	+	+	+	+	0	+
WATER, SEA	80	-	+	+	+	+	+	+	+	0	+
WATER, WASTE	50	-	+	+	+	+	0	0	+	0	+
WATERGLASS	23	0	+	+	+	+	+	+	+	+	+
WHISKEY	23	-	0(+)	+	+	+	+	+	+	0	+
WINE (WHITE, RED)	23	-	+	+	+	+	+	+	+	0	+
WOOD OIL	23	0	+	+	+	+	-	-	+	+	+
X											
XENON	23	+	+	+	+	+	+	+	+	+	+
XYLENE	23	-	-	-	-	+	-	-	+	+	+
Y											
YEAST, AQ. SOL.	30	-	n.a.	+	+	+	+	+	+	+	+
YOGHURT	50	-	(+)	+	+	+	+	+	+	+	+
Z											
ZINC ACETATE, AQ. SOL.	50	-	-	0	0	0	+	-	n.a.	n.a.	+
ZINC CHLORIDE, AQ. SOL.	50	0	+	+	+	+	+	+	+	0	+

\+ good resistance
0 limited resistance
\- no resistance
( ) assumed resistance (without test)
n.a. no test results available

resistance in pressure fluids

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
BRAKE FLUID											
WAGNER 21 B	23	-	-	-	-	-	+	0	n.a.	n.a.	+
CONTROL FLUID											
ERIFON HD 856 (WATER/GLYCOL)	60	-	+	+	+	0	(+)	(+)	+	0	+
OCEANIC HW 443 (WATER/GLYCOL)	60	-	0	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 443	70	-	-	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 540 (WATER/GLYCOL)	60	-	+	+	+	0	n.a.	n.a.	n.a.	n.a.	+
OCEANIC HW 540	70	-	0	+	+	0	n.a.	n.a.	n.a.	n.a.	+
FIRE-EXTINGUISHING MEDIUM											
HALON 1211	23	+	+	-	-	0	-	-	n.a.	n.a.	+
HALON 1301	23	+	+	+	+	+	+	-	n.a.	n.a.	+
FUEL											
ESSO FUEL 208	23	-	n.a.	+	+	+	-	-	n.a.	n.a.	+
JET FUEL A1	80	-	0(+)	+	+	+	-	-	n.a.	n.a.	+
GREASE											
AEROSHELL 7A	50	+	+	+	+	+	-	0	+	+	+
AEROSHELL 17	50	+	+	+	+	+	-	0	+	+	+
AEROSHELL 750	50	-	n.a.	0	0	+	n.a.	-	+	+	+
ESSO CAZAR K1 (MINERAL-GREASE)	80	+	+	+	+	+	-	-	+	+	+
KLÜBER SYNTHESO PROBA 270 (LITHIUM-GREASE)	50	+	+	+	+	+	+	n.a.	n.a.	n.a.	+
MOLYDUVAL MOLYKOTE-FETT (MINERAL-GREASE)	50	+	+	+	+	+	-	-	+	+	+
SHELL ALVANIA R 2 (MINERAL-GREASE)	60	+	+	+	+	+	-	0	+	+	+
HEAT CARRIER OIL											
DOWTHERM A	150	-	-	-	+	+	-	-	-	-	+
DOWTHERM E	150	-	-	-	+	+	-	-	-	-	+
ESSO THERMALÖL T	200	-	-	-	-	+	-	-	-	-	+
HIGH-TEMPERATURE OIL											
MOBIL THERM 600	80	-	n.a.	+	+	+	-	-	+	+	+
LUBRICANT											
TEXACO UNI-TEMP	23	+	+	+	+	+	-	0	+	+	+

resistance in pressure fluids

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
MINERAL OIL											
ARAL VITAM GX 32	80	+	+	+	+	+	-	-	+	+	+
ARAL VITAMOL 3865	80	+	+	+	+	+	-	-	+	+	+
ARAL VITAMOL 4004	80	+	+	+	+	+	-	-	+	+	+
CASTROL ALPHA SP 68	80	+	+	+	+	+	-	0	+	+	+
CASTROL HYSPIN AWS 32	80	+	+	+	+	+	-	-	+	+	+
ESSO ESSTIC 42, 43	23	0	+	+	+	+	-	-	+	+	+
ESSO NUTO H 22	80	+	+	+	+	+	-	-	+	+	+
ESSO NUTO H 68	80	+	+	+	+	+	-	0	+	+	+
ESSO SPINESSO 10	80	+	+	+	+	+	-	-	+	+	+
MOBIL AMBREX 33	80	0	+	+	+	+	-	-	+	+	+
MOBIL AMBREX 830	80	+	+	+	+	+	-	0	+	+	+
MOBIL DELVAC 1100, 1110, 1120, 1130	70	0	+	+	+	+	-	-	+	+	+
MOBIL DTE 25	80	+	+	+	+	+	-	-	+	+	+
MOBIL VACTRA NR.2	80	+	+	+	+	+	-	0	+	+	+
MOBILOIL SAE 20	70	+	+	+	+	+	-	-	+	+	+
PENTOSIN CHF 11S (BRANCH OF AUTOMOBILE	80	0	+	+	+	+	-	-	+	+	+
RENOLIN MR 20 VG 68 (FUCHS)	80	+	+	+	+	+	-	0	+	+	+
SHELL DIALA-ÖL D	80	+	+	+	+	+	-	-	+	+	+
SHELL HYDROL DO 46	80	+	+	+	+	+	-	0	+	+	+
SHELL MACOMA 72	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS 27, 33	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS T 37	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS 68	80	+	+	+	+	+	-	-	+	+	+
SHELL TELLUS 68 + 5% CASTROL CX 23	80	0	+	+	+	+	-	-	+	+	+
SHELL TIRENA WA	80	+	+	+	+	+	-	0	+	+	+
TEXACO REGAL B	70	+	+	+	+	+	-	-	+	+	+
VACUUM PUMP OIL N 62 (LEYBOLD)	80	+	+	0	+	+	-	+	+	+	+
PRESSURE FLUID HEES											
BP BIOHYD SE 46	80	-	+	-	-	+	-	-	+	+	+
CICO H 3000	80	-	+	-	0	+	-	-	+	+	+
HESSOL BIOL HE 46	80	0	+	-	-	+	-	-	+	+	+
SHELL NATURELLE HF-E 15	80	-	+	-	-	+	-	-	+	+	+
SHELL TMO SW 30	80	-	+	-	-	+	-	-	+	+	+
TEBIOL HVI 32 A	80	-	+	-	-	+	-	-	+	+	+

resistance in pressure fluids

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
PRESSURE FLUID HEPG											
BRENNTAG TR 32	50	-	0	+	+	+	-	+	+	+	+
BRENNTAG TR 32	60	-	-	+	+	+	-	+	+	+	+
BRENNTAG TR 46	50	-	+	+	+	+	-	+	+	+	+
BRENNTAG TR 46	60	-	0	+	+	+	-	+	+	+	+
PRESSURE FLUID HETG											
BIOMIL H (UNGARN)	80	-	+	-	-	+	-	-	+	+	+
BP BIOHYD 46	80	-	+	-	-	+	-	-	+	+	+
CASTROL BIOTEC ALPIN 22	80	0	+	-	-	+	-	-	+	+	+
CASTROL BIOTEC HVX	80	0	+	-	-	+	-	-	+	+	+
HESSOL BIOL HR 37	80	0	+	-	-	+	-	-	+	+	+
PLANTOHYD 40 (GENOL)	80	0	+	-	-	+	-	-	+	0	+
PRESSURE FLUID HFA-E											
HOUGHTO-SAFE 5040	50	-	(+)	+	+	+	-	-	+	0	+
HYDRA - VIS (HOUGHTON VAUGHAN)	70	-	-	-	-	-	-	-	+	0	+
H-17(UNGARN)	60	-	+	+	+	+	-	-	+	0	+
SHELL DROMUS OIL B	60	-	+	+	+	+	-	-	+	0	+
PRESSURE FLUID HFA-S											
HYDROLUBRIC 120 B (HOUGHTON VAUGHAN)	60	-	+	+	+	+	+	+	+	0	+
PRESSURE FLUID HFB											
Q8 KIRON LT68 (KUWAIT PETROLEUM)	60	-	+	+	+	+	-	-	+	0	+
PRESSURE FLUID HFC											
BP ENERGOL SF-C 15	50	-	0(+)	+	+	0	+	0	+	0	+
BP ENERGOL SF-C 15	60	-	0	+	+	0	+	0	+	0	+
HOUGHTO-SAFE 271, 620	50	-	0	+	+	0	+	0	+	0	+
SHELL FIREGARD 200	60	-	0(+)	+	+	0	+	(+)	+	0	+
PRESSURE FLUID HFD-R											
HOUGHTO-SAFE 1010, 1055	50	-	-	-	-	+	+	-	n.a.	n.a.	+
PYDRAUL 29ELT, 30E, 50E, 65E, 90E	80	-	(-)	-	-	+	+	0	n.a.	n.a.	+
PYDRAUL 312C, 540C	80	-	n.a.	-	-	+	-	-	n.a.	n.a.	+
PYDRAUL F-9	80	-	n.a.	-	-	+	0	n.a.	n.a.	n.a.	+
SKYDROL 500 B4 (MONSANTO)	70	-	-	-	-	-	+	-	n.a.	+	+

resistance in pressure fluids

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
PRESSURE FLUID HFD-R											
SKYDROL LD4 (7000) (MONSANTO)	70	-	-	-	-	-	+	-	n.a.	+	+
PRESSURE FLUID HFD-U											
QUINTOLUBRIC N822 - 220	80	-	+	-	0	+	-	(-)	+	+	+
QUINTOLUBRIC N822 - 300	80	0	+	-	0	+	-	(-)	+	+	+
QUINTOLUBRIC N850	80	0	+	-	0	+	-	(-)	+	+	+
SIDERLUBRIC 822-200	80	-	+	-	0	+	-	-	+	+	+
PRESSURE FLUID, LOW TEMPERATURE											
AEROSHELL FLUID 4 (SHELL)	80	+	+	+	+	+	-	-	+	+	+
UNIVIS 40 (ESSO)	70	+	+	+	+	+	-	-	+	+	+
UNIVIS J 13 (ESSO)	80	+	+	+	+	+	-	-	+	+	+
PRESSURE FLUID, REMAINING											
FYRQUEL LT (AKZO NOBEL)	80	-	-	n.a.	n.a.	+	-	-	n.a.	n.a.	+
REFRIGERANTS											
FREON / FRIGEN 11	23	0	n.a.	+	+	0	-	-	+	+	+
FREON / FRIGEN 112 (WITH / WITHOUT OIL)	23	0	0	+	+	+	-	-	+	+	+
FREON / FRIGEN 113	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN 114	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN 114 B2	23	n.a.	n.a.	0	0	0	-	-	+	+	+
FREON / FRIGEN 115	23	(+)	(+)	+	+	+	+	-	+	+	+
FREON / FRIGEN 12	23	+	+	+	+	0	0	-	+	+	+
FREON / FRIGEN 13	23	-	n.a.	+	+	+	+	-	+	+	+
FREON / FRIGEN 13 B1	23	+	+	+	+	+	+	-	+	+	+
FREON / FRIGEN 134A	23	(+)	(+)	+	+	0	n.a.	-	+	+	+
FREON / FRIGEN 14	23	+	+	+	+	+	+	-	+	+	+
FREON / FRIGEN 142 B	23	(+)	(+)	+	+	-	+	-	+	+	+
FREON / FRIGEN 152 A	23	(+)	(+)	+	+	-	+	(-)	+	+	+
FREON / FRIGEN 21	23	-	n.a.	-	-	-	-	-	+	+	+
FREON / FRIGEN 218	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN 22	23	-	n.a.	-	-	-	+	-	+	+	+
FREON / FRIGEN 31	23	-	n.a.	-	-	-	+	-	+	+	+
FREON / FRIGEN 32	23	(+)	+	+	+	-	+	-	+	+	+
FREON / FRIGEN 502	23	n.a.	n.a.	0	0	0	(+)	-	+	+	+
FREON / FRIGEN BF(F112)	23	0	0	0	0	0	-	-	+	+	+

resistance in pressure fluids

medium	temperature (°C)	s-mart PU / LTPU	s-mart HPU / GPU	s-mart NBR	s-mart HNBR	s-mart FKM	s-mart EPDM	s-mart MVQ	s-mart POM	s-mart PA	s-mart PTFE virgin
REFRIGERANTS											
FREON / FRIGEN C 316	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN C 318	23	(+)	(+)	+	+	+	+	(-)	+	+	+
FREON / FRIGEN MF	23	(0)	(0)	+	+	0	-	-	+	+	+
FREON / FRIGEN PCA	23	+	+	+	+	0	-	-	+	+	+
FREON / FRIGEN T-P 35	23	+	+	+	+	+	+	+	+	+	+
FREON / FRIGEN T-WD 602	23	+	+	0	0	+	0	-	+	+	+
FREON / FRIGEN TA	23	+	+	+	+	-	+	+	+	+	+
FREON / FRIGEN TC	23	+	+	+	+	+	0	-	+	+	+
FREON / FRIGEN TF	23	+	+	+	+	+	-	-	+	+	+
FREON / FRIGEN TMC	23	0	0	0	0	+	0	-	+	+	+
SUVA HP 62	23	+	+	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+
SUVA 134a	23	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+
SUVA 9000											
SILICON OIL											
DOW CORNING 550 E	80	-	+	-	-	+	-	-	+	+	+
SOFTENER											
THIOKOL TP-90 B (POLYESTER-SOFTENER)	23	n.a.	n.a.	-	-	+	+	n.a.	n.a.	n.a.	+
THIOKOL TP-95	23	n.a.	n.a.	-	-	+	+	n.a.	n.a.	n.a.	+
SYNTHETIC OIL											
KLÜBER SYNTHESO D 220 - EP (GLYCOL)	80	n.a.	n.a.	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TRANSFORMER OIL											
PYRANOL	23	0	n.a.	+	+	+	-	-	n.a.	n.a.	+
TRANSMISSION LUBRICANT											
HY-TRANS-PLUS MS 1207 (CASE)	80	+	+	0	+	+	-	-	n.a.	n.a.	+
SHELL HSG 80W/90 (BRANCH OF AUTOMOBILE)	80	+	+	+	+	+	-	-	+	+	+
SHELL OMALA 68	80	+	+	+	+	+	-	0	+	+	+
TEXAMATIC "A" TRANSMISSION-OIL	23	0	n.a.	+	+	+	-	-	+	+	+

\+ good resistance
0 limited resistance
\- no resistance
( ) assumed resistance (without test)
n.a. no test results available

list of resistance stainless spring steel

material : stainless spring steel (material number 1.4310)
DIN : X 12 Cr Ni 17 7

the following table should give an overview of the resistance of the used steel.

the values are producer´s specifications, which are determined in the experiment with pure chemicals. the real working conditions depend on several physical, chemical or electrochemical influences, which cannot be taken into consideration in this list. for this reason the values of this table are only approximated data.

legend:
the rate of corrosion is defined with the following signs

+ the expected corrosion corresponds to a loss of weight up to 0,1 g/m^{2}h. the material can be used in this medium at the defined working conditions in most cases without invalid corrosion.
0 the expected corrosion corresponds to a loss of weight from 0,1 to 1,0 g/m^{2}h. the durability is limited. contact with our technical department is recommended.
- the expected corrosion corresponds to a loss of weight from more than 1,0 g/m^{2}h. the material is not suitable for this usage.

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Acetic acid CH_3COOH	50%	20	+
	50%	boiling	+
Acetic acid CH_3COOH	60%	20	+
	60%	boiling	0
Acetic acid CH_3COOH	80%	20	+
	80%	boiling	-
Acetic anhydride $(CH_3CO)_2O$		20	+
		boiling	+
Acetone CH_3COCH_3		20	+
		boiling	+
Acetylchloride CH_3COCl		20	0
		boiling	0
Alum, aqueous solution $(SO_4)_2.12H_2O$	10%	20	+
	10%	boiling	0
Aluminium acetate, aqueous solution $Al(C_2H_3O_2)_3$	saturated at 20°C	20	+
	saturated at 20°C	boiling	+
Aluminium chloride, aqueous solution $AlCl_3$	over 5%	50	-
Aluminium nitrate, aqueous solution $Al(NO_3)_3$		20	+
Aluminium sulfate, aqueous solution $Al_2(SO_4)_3$	10%	20	+
	10%	boiling	0
Aluminium sulfate, aqueous solution $Al_2(SO_4)_3$	cold saturated	20	0
	cold saturated	boiling	-
Ammonium alum		20	+
		boiling	-
Ammonium bicarbonate, aqueous solution NH_4HCO_3	every	20	+
Ammonium bifluoride NH_4HF_2	cold saturated	20	+
Ammonium carbonate, aqueous solution $(NH_4)_2CO_3$	cold saturated	20	+
	cold saturated	boiling	+
Ammonium chloride, aqueous solution NH_4Cl	25%	20	0
	50%	boiling	-
Ammonium hexachlorostannate (IV), aqueous solution $(NH_4)_2SnCl_6$	cold saturated	20	0
	cold saturated	60	-
Ammonium hydroxide, aqueous solution NH_4OH	every	20	+
	every	boiling	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Ammonium nitrate, aqueous solution NH_4NO_3	cold saturated	20	+
	cold saturated	boiling	+
Ammonium nitrate, melted		169	0
Ammonium oxalate, aqueous solution $(NH_4)_2C_2O_4$	5%	20	+
	5%	boiling	0
Ammonium perchlorate, aqueous solution NH_4ClO_4	10%	20	+
	10%	boiling	+
Ammonium sulfate, aqueous solution $(NH_4)_2SO_4$	every	20	+
	every	boiling	0
Ammonium sulfite, aqueous solution $(NH_4)_2SO_3$	saturated	20	+
	saturated	boiling	+
Aniline hydrochloride, aqueous solution $C_6H_5NH_2HCl$	5%	20	-
Aniline, raw $C_6H_5NH_2$	saturated	20	+
Antimony trichloride $SbCl_3$		20	-
Apple juice and cider		20	+
Aqua regia $3HCl+HNO_3$		20	-
Arsenic acid, aqueous solution H_3AsO_4		65	+
Barium chloride, aqueous solution $BaCl_2$	saturated	20	+
	saturated	boiling	0
Barium hydroxide, aqueous solution $Ba(OH)_2$	hot saturated	boiling	+
Barium nitrate, aqueous solution $Ba(NO_3)_2$	every	boiling	+
Beer, fermented		20	+
		boiling	+
Benzoic acid, aqueous solution $C_6H5COOH$	every	20	+
	every	boiling	+
Benzol C_6H_6		20	+
		boiling	+
Blood, pure			+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Borax, aqueous solution $Na_2B_4O_7$	cold saturated	20	+
	cold saturated	boiling	+
Brandy		20	+
		boiling	+
Bromine water	0,03%	20	+
Bromine water	0,3%	20	0
Bromine water	1%	20	-
Bromine, wet		20	-
Butanoic acid C_3H_7COOH	100%	20	+
	100%	boiling	-
Buttermilk und butter		20	+
Calcium bisulfite, aqueous solution $Ca(HSO_3)_2$		20	+
		boiling	0
Calcium hydroxide $Ca(OH)_2$		20	+
		boiling	+
Calcium sulfate, dissolved	saturated	20	+
Camphor $C_{10}H_{16}O$		20	+
Carbondioxide, dry or wet CO_2		20	+
		hot	+
Carbondisulfide, pure S_2C		20	+
		boiling	+
Carbontetrachloride CCl_4		20	+
		boiling	+
Chloramine $CH_3C_6H_4SO_2NClNa$		20	0
		boiling	0
Chloric acid $HClO_3$		20	-
Chloride gas, dry		20	+
Chloride gas, wet		20	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Chloride of lime, dry $CaCl(OCl)CaO.2H_2O$		20	+
Chloride of lime, wet		20	0
Chloroacetic acid, aqueous solution $CH_2ClCOOH$	50%	20	-
	saturated	20	-
Chlorobenzol C_6H_5Cl		boiling	+
Chlorophorm $CHCl_3$		20	+
		boiling	+
Chlorosulfonic acid $S0_2OHCl$	10%	20	-
	saturated	20	+
chocolate		20	+
Chromium oxide, Chrom acid, aqueous solution Cr_2O_3, H_2CrO_4	10%	20	+
	10%	boiling	0
Chromium oxide, Chrom acid, aqueous solution Cr_2O_3, H_2CrO_4	50%	20	+
	50%	boiling	-
Chromium oxide, Chrom acid, aqueous solution Cr_2O_3, H_2CrO_4 (contains H_2SO4)	50%	20	0
	50%	boiling	-
Citric acid, aqueous solution $OHC(CH_2COOH)_2COOH.H_2O$	5%	140 (at 3atü)	0
Citric acid, aqueous solution $OHC(CH_2COOH)_2COOH.H_2O$	10%	20	+
	10%	boiling	+
Citric acid, aqueous solution $OHC(CH_2COOH)_2COOH.H_2O$	50%	20	+
	50%	boiling	-
Coagulating bath (with H_2SO_4)		80	-
Coffee		20	+
		boiling	+
Copal varnish			+
			+
Copper (I)-acetat, aqueous solution $(CH_3COO)_2Cu$		20 boiling	+ +
Copper chloride, aqueous solution $CuCl_2$	1%	20	0
	1%	75	-
Copper chloride, aqueous solution $CuCl_2$	5%	20	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Copper cyanide $Cu(CN)_2$	saturated 100°C	boiling	+
Copper dinitrate, aqueous solution $Cu(NO_3)_2$	50%	20	+
	50%	boiling	+
Copper oxide ammonia (CuO saturated in 50%- Ammonia)		20	+
Copper sulfate, aqueous solution $CuSO_4$	every	20	+
	every	boiling	
Copper sulfate, aqueous solution $CuSO_4$, solution with 3% H_2SO_4	saturated	20	+
Creosote		20	+
		boiling	+
Cresol		20	+
detergent solution		20	+
		warm	+
Diazotization bath, slightly hydrochloric		20	0
		warm	-
Dichlorethane CH_2ClCH_2Cl		20	+
Dichlorethene, dry $(CHCl)_2$		20	+
		boiling	+
Disodium metasilicate, aqueous solution (Waterglass) Na_2SiO_3	saturated	20	+
	saturated	hot	+
Drinking- or freshwater		20	+
		boiling	+
Dyer´s bath alkaline or neutral		20	+
		boiling	+
Dyer´s bath organic acid		20	+
		boiling	+
Dyer´s bath slightly sulfuric (H_2SO_4 < 0,3%)		20	+
Dyer´s bath intense sulfuric (H_2SO_4 > 0,3%)		20	-
		boiling	-
Ethyl chloride, free from water C_2H_5Cl		20	+
		boiling	+
Ethylalcohol C_2H_5OH		20	+
		boiling	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Ethylene Glycol $C_2H_4(OH)_2$		20	+
Ethylether $C_2H_5OC_2H_5$		20	+
		boiling	+
Ferric sulfate, aqueous solution $Fe_2(SO_4)_3$		20	+
		boiling	+
Fixative		20	+
Flesh			+
Fluorosilicic acid, vapour H_2SiF_6		100	0
Formaldehyde, aqueous solution HCHO	40%	20	+
	40%	boiling	+
Formic acid HCOOH	10%	20	+
	10%	boiling	0
Formic acid HCOOH	25%	20	+
	25%	boiling	-
Fruit juice		20	+
		boiling	
Fruit pulp SO_2-containing			+
Furfural C4H3OCHO		boiling	+
		vapour	+
Gallic acid, aqueous solution $C_6H_2(OH)_3COOH$	saturated (25%)	boiling	+
Glue		20	+
		hot	+
Glycerin $OHCH_2CH(OH)CH_2OH$		20	+
		hot	+
Hartshorn salt, aqueous solution $NH_4HCO_3NH_4CO_2NH_2$	saturated	20	+
	saturated	hot	+
Hydrazine sulfate, aqueous solution $(NH_2)_2$	10%	boiling	-
Hydrochloric acid HCl	0,5%	20	+
	0,5%	boiling	-
Hydrochloric acid HCl	1%	20	0
	1%	boiling	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Hydrochloric acid HCl	10%	20	-
	10%	boiling	-
Hydrogen chloride (gas only), dry HCl		20	0
		100	-
Hydrogen cyanide HCN		20	+
Hydrogen fluoride dimer H_2F_2	10%	20	-
Hydrogen fluoride dimer dry gas		100	0
Hydrogen peroxyde H_2O_2	30%	20	+
	30%	warm	+
Hydrogen sulfide, dry gas H_2S		up to 200	+
Hydrogen sulfide, wet gas H_2S		20	+
Hydroxylamine sulfate, aqueous solution $(NH_2OH)_2H_2SO_4$	10%	20	+
	10%	boiling	+
Ink			+
Iodine tinkture		20	0
Iodine wet		20	0
Iodine dry		20	+
Iodomethane CHI_3		20	+
		60 (vapour)	+
Iron (II)-sulfate, aqueous solution $FeSO_4$		20	+
		boiling	+
Iron (III)-chloride, aqueous solution $FeCl_3$	10%	20	-
	10%	boiling	-
Iron (III)-nitrate, aqueous solution $Fe(NO_3)_3$		20	+
		boiling	+
Iron phosphate		98	+
Lactic acid, aqueous solution	1,5%	20	+
	1,5%	boiling	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Lactic acid, aqueous solution	10%	20	+
	10%	boiling	-
Lactic acid, aqueous solution	saturated	20	+
	saturated	boiling	-
Lard		melt	+
Lead acetate, aqueous solution CH_3COOPb	every	20	+
	every	boiling	+
Lead nitrate, aqueous solution $Pb(NO_3)_2$	50%	boiling	+
Lemon juice		20	+
Linseed oil		20	+
		hot	+
Linseed oil with 3% H_2SO_4		200	0
Liqueur		20	+
Lysol (50% Cresol + oil- and. rosin soap)		20	+
		hot	+
Magnesium chloride, aqueous solution $MgCl_2$	30%	20	+
Magnesium sulfate, aqueous solution $MgSO_4$	saturated (26%)	20	+
	saturated (26%)	boiling	+
Maleic acid, aqueous solution $(CHCOOH)_2$	50%	100	+
Malic acid, aqueous solution $COOHCH_2CH(OH)COOH$	5 - 50%	100	+
Manganese chloride, aqueous solution $MnCl_2$	50%	20	+
	50%	boiling	+
Manganese sulfate, aqueous solution $MnSO_4$	every	20	+
	every	boiling	+
Mercury		20	+
		50	+
Mercury (II)- nitrate, aqueous solution $Hg(NO_3)_2$		20	+
		boiling	+
Mercury (II)-chloride, aqueous solution $HgCl_2$	0,7%	20	+
	0,7%	boiling	0

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Mercury (II)-chloride, aqueous solution $HgCl_2$	5%	20	0
	5%	boiling	-
Mercury (II)-cyanide, aqueous solution $Hg(CN)_2$	5%	20	+
Methanol CH3OH		20	+
		boiling	+
Methylene Chloride, free of water CH_2Cl_2		20	+
		boiling	+
Milk fresh and sour		20	+
		hot	+
Mine water, acid (up to 1% H_2SO_4)		20	+
Mineral oil			+
Mustard		20	+
Nickel chloride, aqueous solution $NiCl_6$		20	+
Nickel nitrate, aqueous solution $Ni(NO_3)_2$	5-10%	20	+
Nickel sulfate, aqueous solution $NiSO_4$	warm saturated	boiling	+
Nitric acid HNO_3	50%	20	+
	50%	boiling	+
Nitric acid HNO_3	saturated	boiling	0
Nitrous acid HNO_2	saturated	20	+
Novocaine $NH_2C_6H_4CO_2(CH_2)_2N(C_2H_5)_2HCl$		20	+
Oil (mineralic)		20	+
		hot	+
Oil (vegetablic)		20	+
		hot	+
Oleic acid $CH_3(CH_2)_7(CH)_2$		150	0
Oleic acid with traces of H_2SO_4		boiling	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Orthoboric acid, aqueous solution H_3BO_3	every	20	+
	every	boiling	+
Oxalic acid $(COOH)_2$	saturated	20	+
	saturated	boiling	-
Paraffine		melt	+
Peracetic acid		50	+
petrol any kind		20	+
		boiling	+
Petroleum		20	+
		hot	+
Petroleum ether		20	+
		boiling	+
Phenol with 10% Water		20	+
		boiling	0
Phenol, pure C6H5OH		boiling	0
Phosphoric acid anhydride P_2O_5		20	0
Phosphoric acid H_3PO_4	20%	20	+
	20%	boiling	+
Phosphoric acid H_3PO_4	40%	20	+
	40%	boiling	0
Phosphoric acid H_3PO_4	50%	20	+
	50%	boiling	-
Photographic developer		20	+
Photographic fixer		20	0
Picric acid $C_6H_2OH(NO_2)_3$	every	20	+
Potassium bichromate, aqueous solution $K_2Cr_2O_7$	25%	20	+
	25%	boiling	+
Potassium bifluoride, aqueous solution KHF_2	cold saturated	20	+
Potassium bisulfate, aqueous solution $KHSO_4$	5%	20	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Potassium bitartrate, aqueous solution $KC_4H_5O_6$	cold saturated	20	+
	saturated	boiling	-
Potassium bromide, aqueous solution KBr	1-10%	50	+
Potassium carbonate, aqueous solution K_2CO_3	50%	20	+
	50%	boiling	+
Potassium chlorate, aqueous solution $KClO_3$	saturated (36%)	boiling	+
Potassium chromic sulfate, aqueous solution $KCr(SO_4)_2$	saturated	20	0
	saturated	boiling	-
Potassium cyanate, aqueous solution KCNO		20	+
Potassium cyanide, aqueous solution KCN	every	20	+
Potassium ferricyanide, aqueous solution $K_3[Fe(CN)_6]$	saturated	20	+
	saturated	boiling	+
Potassium hydroxide, aqueous solution (Caustic potash) KOH	25%	20	+
	25%	boiling	+
Potassium hydroxide, aqueous solution (Caustic potash) KOH	50%	20	+
	50%	boiling	+
Potassium hydroxide, aqueous solution (Caustic potash) KOH	hot saturated	120	+
Potassium iodide, aqueous solution KJ	saturated	20	+
	saturated	boiling	+
Potassium nitrate, aqueous solution KNO_3	saturated	20	+
	saturated	boiling	+
Potassium oxalate, aqueous solution $K_2C_2O_4$	every	20	+
	every	boiling	+
Potassium permanganate, aqueous solution $KMnO_4$	10%	20	+
	10%	boiling	+
Potassium sulfate, aqueous solution K_2SO_4	every	20	+
	every	boiling	+
Pyrogallol, aqueous solution $C_6H_3(OH)_3$	every	20	+
	every	boiling	+
Quinin salts neutral		20	+
Salicylic acid OHC_6H_4COOH		20	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
sea water		20	+
Silver bromide, dry or wet AgBr		20	+
Silver nitrate, aqueous solution $AgNO_3$	10%	20	+
	10%	boiling	+
Silver bromide, dry or wet AgBr		20	+
Soap melted			+
Sodium acetate, aqueous solution CH_3COONa	warm saturated	boiling	+
Sodium bicarbonate, aqueous solution $NaHCO_3$	alle	20	+
Sodium bisulfate, aqueous solution $NaHSO_4$	10%	20	+
	10%	boiling	0
Sodium bisulfite, aqueous solution $NaHSO_3$	50%	20	+
	50%	boiling	+
Sodium carbonate (Soda) Na_2CO_3		20	+
		boiling	+
Sodium chlorate, aqueous solution $NaClO_3$	30%	20	+
	30%	boiling	+
Sodium chlorite $NaClO_2$	5%	20	-
Sodium citrate, aqueous solution $Na_3C_6H_5O_7$	3,5%	20	+
Sodium hydroxide, aqueous solution (Caustic soda) NaOH	20%	20	+
	20%	boiling	+
Sodium hydroxide, aqueous solution (Caustic soda) NaOH	35%	20	+
	35%	boiling	0
Sodium hydroxide, aqueous solution (Caustic soda) NaOH	70%	90	0
	70%	boiling	-
Sodium nitrate, aqueous solution $NaNO_3$	saturated	20	+
	saturated	boiling	+
Sodium nitrite, aqueous solution $NaNO_2$	warm saturated	boiling	+
Sodium perborate, aqueous solution $NaBO_3$	saturated	20	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Sodium perchlorate, aqueous solution $NaClO_4$	10%	20	+
	10%	boiling	+
Sodium peroxide, aqueous solution Na_2O_2	10%	100	+
Sodium phosphate, aqueous solution Na_2HPO_4 and Na_3PO_4	cold saturated	20	+
	cold saturated	boiling	+
Sodium salicylate, aqueous solution $NaC_7H_6O_3$	saturated	20	+
Sodium sulfate, aqueous solution Na_2SO_4	cold saturated	20	+
	cold saturated	boiling	+
Sodium sulfide, aqueous solution Na2S	20%	20	+
	20%	boiling	+
Sodium sulfide, aqueous solution Na_2S	50%	boiling	+
	50%	100	0
Sodium sulfite, aqueous solution Na_2SO_3	50%	boiling	+
Sodium thiosulfate, aqueous solution $Na_2S_2O_3$	25%	20	+
	25%	boiling	+
Soft soap		20	+
Stannic chloride, aqueous solution $SnCl_4$	24%	20	0
	24%	boiling	-
Stannous chloride, aqueous solution $SnCl_2$	cold saturated	20	0
	cold saturated	boiling	-
Stearic acid $CH_3(CH_2)_{16}COOH$		130	+
Sugar solution		20	+
		hot	+
Sulfite liquor		20	+
		80	-
Sulfur chloride S_2Cl_2	100%	20	+
	100%	boiling	+
Sulfur dioxide SO_2		20-100	+
		>100	-
Sulfur melted		130	+
Sulfuric acid H_2SO_4	1%	20	+
	1%	boiling	-

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Sulfuric acid H_2SO_4	10%	20	0
	10%	boiling	-
Sulfuric acid H_2SO_4	20%	20	-
	20%	boiling	-
Sulfurous acid, aqueous solution H_2SO_3	cold saturated	20	+
Superphosphate (with 3% H_2SO_4)		20	+
Tannic acid, aqueous solution	cold saturated	20	+
	cold saturated	boiling	+
Tar pure		20	+
		hot	+
Tartaric acid, aqueous solution $(OHCHCOOH)_2$	10%	20	+
	10%	boiling	0
Tartaric acid, aqueous solution $(OHCHCOOH)_2$	25%	20	0
	25%	boiling	-
Tartaric acid, aqueous solution $(OHCHCOOH)_2$	50%	20	0
	50%	boiling	-
Thioglycolic acid HSCH2COOH		20	+
		boiling	0
Toluene $C_6H_5CH_3$		20	+
		boiling	+
Trichlorethylene $CHClCCl_2$		20	+
		boiling	0
Triochloracetic acid CCl_3COOH	every	20	-
Turpentine		20	+
		hot	+
Urea $(NH_2)_2CO$		20	+
Uric acid $C_5H_4N_4O_3$		20	+
Urine		20	+
Vaseline		20	+
		warm	+
vinegar		20	+
		boiling	+

List of resistance stainless steel

material number: 1.4310 [DIN: X12 Cr Ni 17 7]

medium	concentration	temperatute [°C]	resistance
Water distilled		20	+
		boiling	+
Wine		20	+
		warm	+
Wine vinegar, 4-5% acetic acid without H_2SO_4		20	+
Xylene $C_6H_4(CH_3)_2$		20	+
		boiling	+
Zinc chloride, aqueous solution $ZnCl_2$	20%	20	+
	20%	90	+
Zinc chloride, aqueous solution $ZnCl_2$	ca. 68%	20	+
	ca. 68%	boiling	-
Zinc sulfate, aqueous solution $ZnSO_4$	warm saturated	boiling	+

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