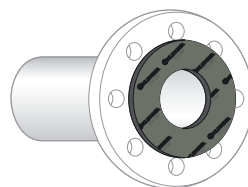


KLINGERmilam PSS

High-Temperature Gasket Material for Temperatures up to 900°C and higher

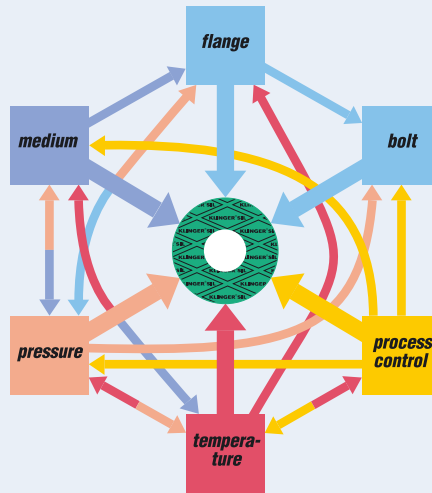


KLINGERmilam PSS is a special high-temperature sealing material for temperatures up to 900 °C and higher. Together with its extreme resistant toward chemical substances such as solvents, aggressive acids, bases and mineral oils interesting application options become available.

KLINGER – The global leader in static sealing

The many, varied demands placed on gaskets

A common perception is that the suitability of a gasket for any given application depends upon the maximum temperature and pressure conditions. This is not the case.



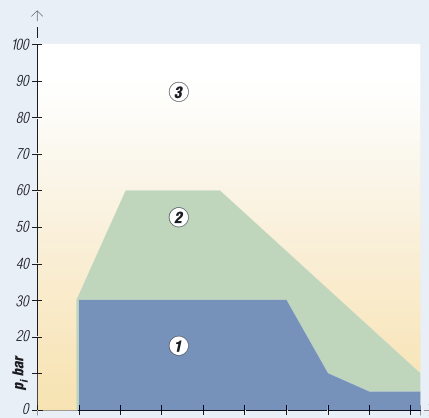
Maximum temperature and pressure values alone can not define a material's suitability for an application. These limits are dependent upon a multiplicity of factors as shown in the diagram opposite. It is always advisable to consider these factors when selecting a material for a given application.

Selecting gaskets with pT diagrams

The Klinger pT diagram provides guidelines for determining the suitability of a particular gasket material for a specific application based on the operating temperature and pressure only.

Additional stresses such as fluctuating load may significantly affect the suitability of a gasket in the application and must be considered separately.

Always refer to the chemical resistance of the gasket to the fluid.



Areas of Application

- ① In area one, the gasket material is normally suitable when a minimum gasket load of 40 MPa is guaranteed.
- ② In area two, the gasket materials may be suitable but a technical evaluation is recommended.
- ③ In area three, do not install the gasket without a technical evaluation.

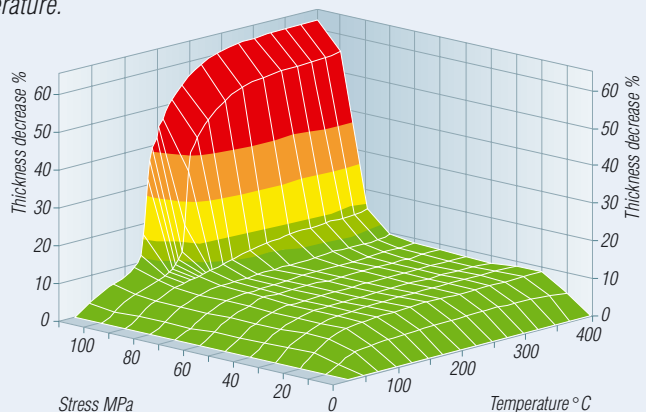
Thickness reduction under pressure and temperature

This diagram shows the thickness reduction of the sealing material under flange compression and simultaneous temperature admission.

Excessive thickness reduction with flange connections leads to unreliable operation since the bolt tension decreases too much. A thickness decrease of approx. 20 – 25% can normally still be tolerated.

The diagram therefore helps to define the max. permissible contact pressure (σ_{BO}) depending on the temperature.

This allows correct dimensioning of the sealing joint.



Tightness at high temperatures

Tightness at high temperatures is measured with the Klinger stability test at different temperatures and internal pressures. Nitrogen is used as test medium. The load and the temperature are kept constant at increasing internal pressure. The holding time for each measured value is two hours. A new gasket is used for each individual load and temperature. Tightness is measured with a mass flow meter.

The pressure is controlled by a pressure regulator.

Important notes:

Growing environmental and safety awareness leads to constantly increasing requirements on the tightness of flange connections. Therefore, it becomes more and more important for the users to choose the most suitable gasket for the respective application and to install it correctly to ensure that the desired tightness is reached.

As a consequence of the high requirements on tightness (e.g. leakage class L 0,01), respectively high surface pressures must often be applied to the gasket as the internal pressures increase. The planned flange connections must therefore be examined for their suitability for such operating conditions whether they are actually suitable to withstand these loads without undue mechanical stress.

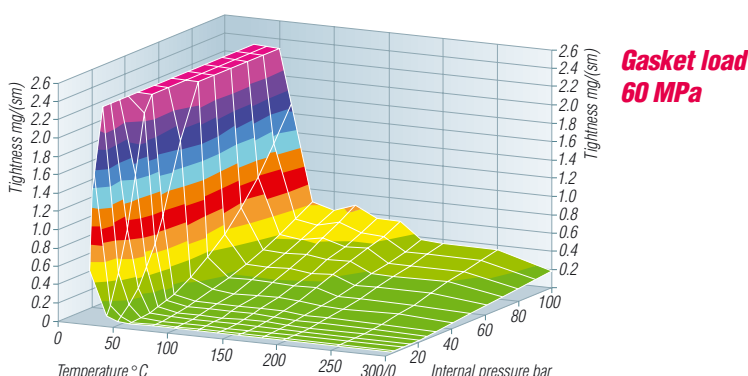
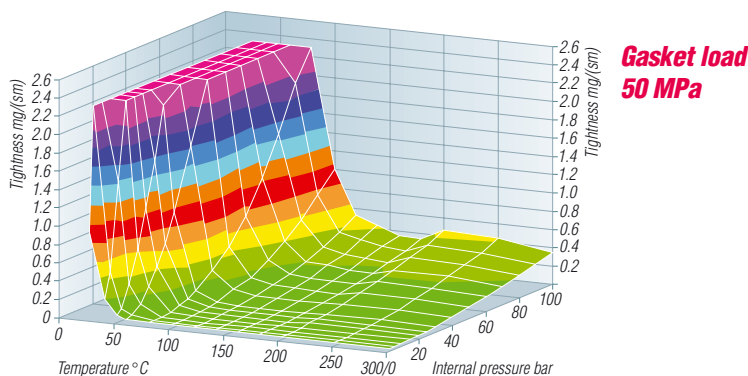
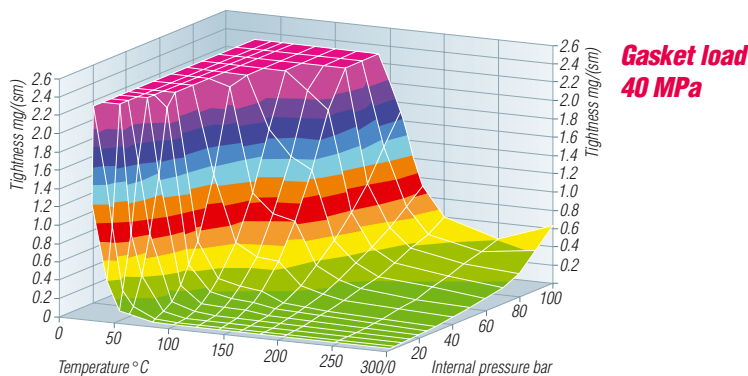
The sealing joint remains tight when the contact pressure encountered during the operation condition is greater than the required minimum contact pressure and the max. permissible contact pressure of the sealing joint is not exceeded during operating conditions.

More densely compressed but not overly compressed gaskets exhibit a longer life than those with smaller pressures.

If an exclusively static load on the installed gasket cannot be guaranteed or if tension variations can be expected during intermittent operation then sealing materials must be used that do not exhibit excessive embrittlement under temperature (e.g. KLINGERgraphit Laminat, KLINGERmilam PSS, KLINGERtop-chem, KLINGERtop-sil).

In such cases, the sealing thickness should be kept as thin as technically possible and useful.

The multiple use of gaskets is generally discouraged for safety reasons.



Medium	Medium	Medium	Medium
Acetaldehyde ■	Chloroform ■	Lead acetate ●	Sodium chloride ●
Acetamide ■	Chromic acid ■	Lead arsenate ●	Sodium cyanide ●
Acetic acid ester ■	Citric acid ●	Linseed oil ●	Sodium hydrogen carbonate ●
Acetic acid 10% ●	Clophen T64 ●	Magnesium sulfate ●	Sodium hydroxide ●
Acetic acid 100% ●	Coagulating baths (up to 10%) ●	M.E.K. Butanone ■	Sodium silicate ●
Acetone ■	Condensed water ●	Methane ■	Sodium sulfate ●
Acetylene ■	Copper acetate ●	Methyl alcohol ■	Sodium sulfide ●
Adipic acid ●	Copper sulfate ●	Methyl chloride ■	Spirit ●
Air ●	Cresol ●	Methylene chloride ■	Starch ●
Alum ●	Cyclohexanol ●	Mineral oil No. 1 ●	Steam ●
Aluminium acetate ●	Decaline ●	Mineral oil No. 3 ●	Stearic acid ●
Aluminium chlorate ●	Dibenzyl ether ■	Monochlormethane ■	Sugar ●
Aluminium chloride ●	Dibutyl phthalate ●	Naphta ●	Sulfuric acid 20% ●
Ammonia ●	Diesel oil ●	Natural gas ■	Sulfuric acid 40% ●
Ammonium carbonate ●	Dimethyl formamide ▲	Nitro benzene ●	Sulfuric acid 96% ●
Ammonium chloride ●	Diphyl ■	Nitrogen ●	Sulfur dioxide ●
Ammonium hydrogenphosphate ●	Diethyl ether ■	Octane ●	Sulfuric acid ▲
Ammonium hydroxide ●	Dye baths (alkaline, neutral, acidic) ●	Oleic acid ●	Sulfurous acid ●
Amyl acetate ●	Ethane ●	Oleum ●	Tannic acid ●
Aniline ■	Ethanol ■	Oxalic acid ●	Tar (asphalt) ●
Anon (Cyclohexanone) ■	Ethyl acetate ■	Oxygen ●	Tartaric acid ●
Arcton 12 ▲	Ethyl alcohol ■	Palmitic acid ●	Tetrachlorethane ■
Arcton 22 ▲	Ethylene ■	Pentane ●	Tetralin ●
Asphalt (tar) ●	Ethylene chloride ■	Petroleum ●	Toluene ●
Barium chloride ●	Ethylenediamine ■	Petroleum ether ■	Transformer oil ●
Benzene ■	Ethylene glykol ●	Perchlorethylene ■	Trichlorethylene ■
Benzoic acid ●	Fluorosilicic acid ●	Phenol ●	Triethanolamine ●
Benzol ■	Formaldehyde ■	Phosphoric acid ●	Turpentine ●
Blast furnace gas ●	Formamide ■	Phthalic acid ●	Urea ●
Bleaching liquor ●	Formic acid 10% ▲	Potassium acetate ●	Vinyl acetate ●
Borax ●	Formic acid 85% ●	Potassium carbonate ●	Water ●
Boric acid ●	Freon 12 ▲	Potassium chlorate ●	Water-glass ●
Brine ●	Freon 22 ▲	Potassium chloride ●	White Spirit ●
Boiler feed water (alkaline) ●	Fuel gases ■	Potassium chromium sulfate ●	Xylo ●
Butane ▲	Generator gas ▲	Potassium cyanide ●	
Butanol ■	Glycerol ●	Potassium dichromate ●	
Butanone ■	Glacial acetic acid ●	Potassium hydroxide ●	
Butyric acid ■	Heating oil ●	Potassium hypochloride ●	
Butyl acetate ■	Heptane ▲	Potassium iodide ●	
Butyl alcohol ■	Hydraulic oil (mineral) ●	Potassium nitrate ●	
Butylamine ■	Hydraulic oil (phosphat ester) ●	Potassium nitrate (salpêtre) ●	
Calcium chloride ●	Hydraulic oil (glycol based) ●	Potassium permanganate ●	
Calcium hydroxide ●	Hydrazine hydrate ●	Propane ▲	
Calcium hypochlorite ●	Hydrochloric acid 20% ●	Pyridrine ■	
Calcium sulfate ●	Hydrochloric acid 37% ●	Rapeseed oil ●	
Castor oil ●	Hydrofluoric acid 10% ●	Salicylic acid ●	
Carbolic acid ●	Hydrofluoric acid 40% ■	Salt (rock salt, common salt) ●	
Carbon disulfide ■	Hydrogen ●	Seawater ●	
Carbon tetrachloride ■	Hydrogen chloride (dry) ●	Silicone oil ●	
Chlorine (wet) ▲	Hydrogen peroxide ●	Skydrol 500 ●	
Chlorine (dry) ■	Isooctane ●	Soap ●	
Chlorine ethyl ■	Isopropyl alcohol ■	Soda ●	
Chlorine methyl ▲	Kerosene ●	Sodium aluminat ●	
Chlorine water ●	Lactic acid 50% ●	Sodium bisulfite ●	

● Resistant
 ■ Condit. recommended
 ▲ Not recommended

■ Material composition

KLINGERmilam PSS is an asbestos-free sealing material on mica base with a perforated 0.1 mm thick stainless steel reinforcement 1.4401 or AISI 316. It is impregnated with high-quality silicon oil.

The phlogopite mica, an aluminosilicate of mineral origin, has a fiber-free lamellar structure.

■ Properties

The special properties of the material are its thermal stability (weight loss at 800°C less than 5%). Together with its extreme resistance toward chemical substances such as solvents, aggressive acids, bases and mineral oils, interesting application options become available.

■ Applications

Because of its specific properties, KLINGERmilam PSS can be used advantageously upward of 100°C. Originally used in the emission area at high temperatures up to 1000°C, often with an inner eyelet, it is now increasingly used with high-temperature processes. If contact pressures of 40 MPa and more can be realized, tightnesses comparable to those of common sealing materials can be reached. Applications such as HNO₃-azeotropic acid systems at 6 bar and 400°C, NO gas at 4 bar and 400°C, salt reactors above 400°C and catalysis processes at over 800°C with dimensions of more than 6 m diameter demonstrate the potential of this material.

Typical values

		PSS 130	PSS 200	PSS 300
Compressibility ASTM F 36 J	%	12 - 16	13 - 19	17 - 25
Recovery ASTM F 36 J	%	35 - 45	35 - 45	30 - 40
Stress relaxation DIN 52913 50 MPa, 16 h/300°C	MPa	40	40	30
Tensile strength DIN 52910	MPa	22	21	20
Tensile strength ASTM F 152	MPa	25	24	21
Ignition loss DIN 52911	%	<5	<5	<15
Sealability for nitrogen at 30 MPa and 6 bar, temperature within 100 to 400°C (Sample size 90 x 50 mm) max.	ml/min	0.20	0.20	a.A.
Thickness increase ASTM F 146 Oil JRM 903: 5 h/150°C	%	12	12	5
Weight increase ASTM F 146 Oil JRM 903: 5 h/150°C	%	26	26	28
Max. gasket load	MPa	100	80	80
Density DIN 3754	g/cm ³	2.1	2.1	1.8
Max. temperature*	°C	900	900	900
Thickness	mm	1.3	2.0	3.2

* depending on installation and service conditions.

■ Dimensions of the standard sheets

Size of the plates:
1,000 mm x 1,200 mm
Standard thicknesses:
PSS 130 = 1.3 mm
PSS 200 = 2.0 mm
PSS 300 = 3.2 mm
Tolerances:
Thickness +/- 10%
Length and width +/- 50 mm

■ Tests and certifications

German Lloyd No. 5062803 HH

■ Function and durability

The performance and service life of KLINGER gaskets depend in large measure on proper storage and fitting, factors beyond the manufacturer's control. We can, however, vouch for the excellent quality of our products.

With this in mind, please also observe our installation instructions.

Special installation notes for KLINGERmilam PSS

Please observe the general installation notes for KLINGER sealing materials. The following special notes represent important information for the correct use of the sealing material.

KLINGERmilam PSS is a special high-temperature sealing material for temperatures up to 900°C and higher. It is laminated from mica and a perforated stainless steel reinforcement. Mica is an aluminosilicate and can consist of different mixed crystals. Because of its lamellar structure, the composition can be pictured as a compilation of small lamina. A small amount of silicone resin serves as bonding agent.

Dry installation

KLINGERmilam PSS must absolutely not be installed moist. If a gasket becomes wet by the sealing surfaces before compression, e.g. because of water residues from a previous pressure test, it must be replaced.

Likewise, greases or pastes may not be used on the sealing surface.

Tightness

Because of its composition, KLINGERmilam PSS requires greater than normal gasket load to become gas-tight. A minimum value of approx. 40 MPa should be aimed at. In the flange area, tongue/groove flanges and possibly also male/female flanges or higher pressure levels from the ANSI range are required for this purpose.

KLINGERmilam PSS is therefore also well suitable for tongue/groove connections.

Appropriate contact pressures should be observed with constructed connections. Lower contact pressures are normally sufficient for exhaust gas systems because the internal pressures are very low.

Please note our diagrams for thickness reduction and tightness in the brochure. Please note also that the mounted connection must be heated to at least 100°C to perform good adaptation of the gasket and achieve good tightnesses. Without this heating process, the sealing connection will exhibit leakages even with highest compressions when performing a leakage test with leak detection spray.

The diagrams printed in this data sheet provide you with guide values regarding compression, leakage and temperature behavior.

Please contact us if larger gasket dimensions need to be made up of several segments. We have already successfully realized segment gaskets with over 6 m in diameter.

**KLINGER
EXPERT®**

Powerful sealing calculation
with online help on
CD-ROM



**Certified according to
DIN EN ISO 9001:2000**

Subject to technical alterations.
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KLINGER GmbH
Rich.-Klinger-Straße 37
D-65510 Idstein
Phone +49 (0) 6126-4016-0
Fax +49 (0) 6126-4016-11/-22
e-mail: mail@klinger.de
<http://www.klinger.de>