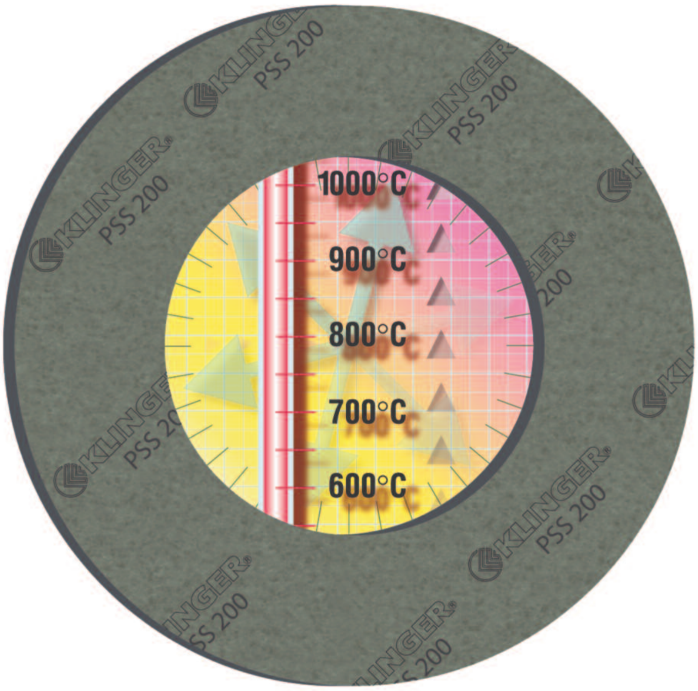
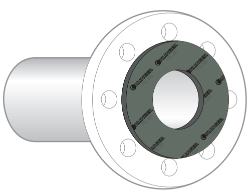


KLINGERmilam® PSS

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

KLINGER®milam 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.

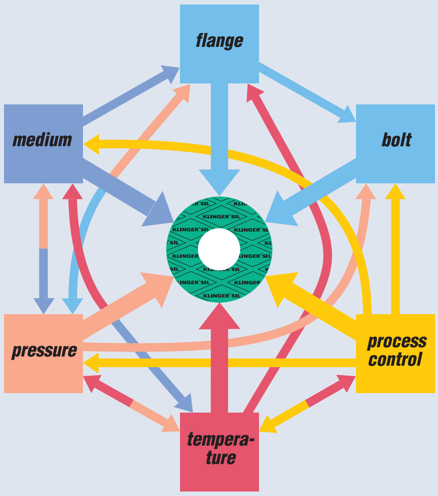


KLINGER – The global leader in static sealing

KLINGERmilam® PSS

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.



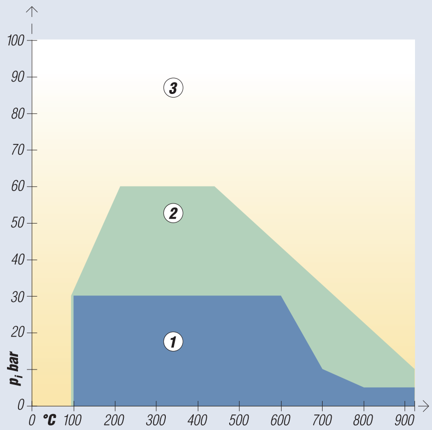
Maximum temperature and pressure values alone can not define a material's suitability for an application. These limits are dependent upon a multiplicity of factors as shown in the diagram opposite. It is always advisable to consider these factors when selecting a material for a given application.

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 guarenteed.

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.

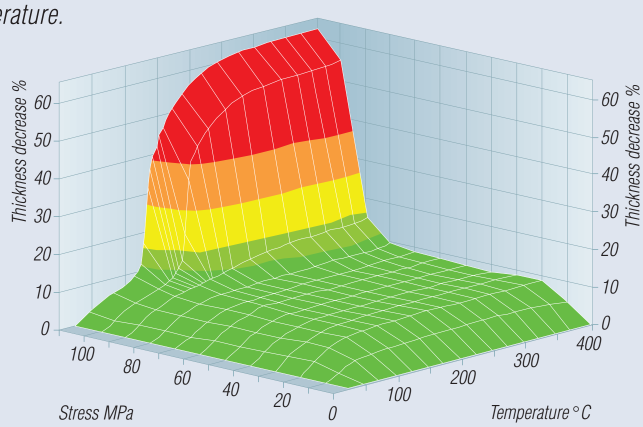
Thickness reduction under pressure and temperature

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.

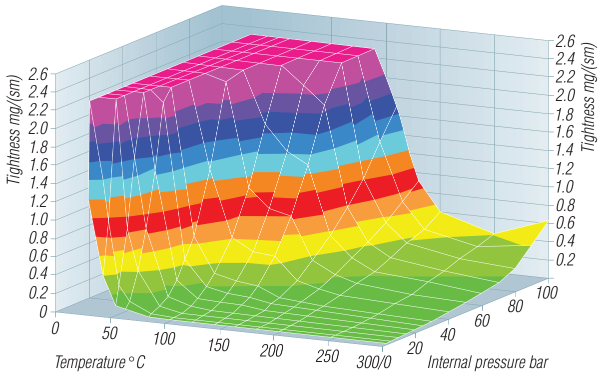
This allows correct dimensioning of the sealing joint.

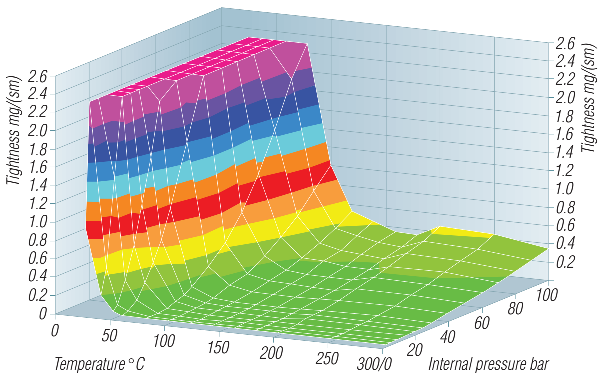


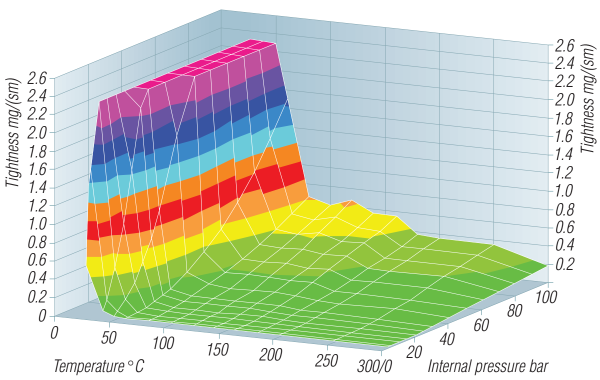
KLINGERmilam® PSS
Information for your safety

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. KLINGER®graphit Laminat, KLINGER®milam PSS, KLINGER®top-chem, KLINGER®top-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.

KLINGERmilam® PSS
Chemical resistance table

Medium	
Acetaldehyde	■
Acetamide	■
Acetic acid ester	■
Acetic acid 10%	●
Acetic acid 100%	●
Acetone	■
Acetylene	■
Adipic acid	●
Air	●
Alum	●
Aluminium acetate	●
Aluminium chlorate	●
Aluminium chloride	●
Ammonia	●
Ammonium carbonate	●
Ammonium chloride	●
Ammonium hydrogenphosphate	●
Ammonium hydroxide	●
Amyl acetate	●
Aniline	■
Anon (Cylohexanone)	■
Arcton 12	▲
Arcton 22	▲
Asphalt (tar)	●
Barium chloride	●
Benzene	■
Benzoic acid	●
Benzol	■
Blast furnace gas	●
Bleaching liquor	●
Borax	●
Boric acid	●
Brine	●
Boiler feed water (alkaline)	●
Butane	▲
Butanol	■
Butanone	■
Butyric acid	■
Butyl acetate	■
Butyl alkohol	■
Butylamine	■
Calcium chloride	●
Calcium hydroxide	●
Calcium hypochlorite	●
Calcium sulfate	●
Castor oil	●
Carbolic acid	●
Carbon disulfide	■
Carbon tetrachloride	■
Chlorine (wet)	▲
Chlorine (dry)	■
Chlorine ethyl	■
Chlorine methyl	▲
Chlorine water	●

Medium	
Chloroform	■
Chromic acid	■
Citric acid	●
Clophen T64	●
Coagulating baths (up to 10%)	●
Condensed water	●
Copper acetate	●
Copper sulfate	●
Cresol	●
Cyclohexanol	●
Decaline	●
Dibenzyl ether	■
Dibutyl phthalate	●
Diesel oil	●
Dimethyl formamide	▲
Diphyl	■
Diethyl ether	■
Dye baths (alkaline, neutral,acidic)	●
Ethane	●
Ethanol	■
Ethyl acetate	■
Ethyl alcohole	■
Ethylene	■
Ethylene chloride	■
Ethylenediamine	■
Ethylene glykol	●
Fluorosilicic acid	●
Formaldehyde	■
Formamide	■
Formic acid 10%	▲
Formic acid 85%	●
Freon 12	▲
Freon 22	▲
Fuel gases	■
Generator gas	▲
Glycerol	●
Glacial acetic acid	●
Heating oil	●
Heptane	▲
Hydraulic oil (mineral)	●
Hydraulic oil (phosphat ester)	●
Hydraulic oil (glycol based)	●
Hydrazine hydrate	●
Hydrochloric acid 20%	●
Hydrochloric acid 37%	●
Hydrofluoric acid 10%	●
Hydrofluoric acid 40%	■
Hydrogen	●
Hydrogen chloride (dry)	●
Hydrogen peroxide	●
Isooctane	●
Isopropyl alcohol	■
Kerosene	●
Lactic acid 50%	●

Medium	
Lead acetate	●
Lead arsenate	●
Linseed oil	●
Magnesium sulfate	●
M.E.K. Butanone	■
Methane	■
Methyl alcohol	■
Methyl chloride	■
Methylene chloride	■
Mineral oil No. 1	●
Mineral oil No. 3	●
Monochlormethane	■
Naphta	●
Natural gas	■
Nitro benzene	●
Nitrogen	●
Octane	●
Oleic acid	●
Oleum	●
Oxalic acid	●
Oxygen	●
Palmitic acid	●
Pentane	●
Petroleum	●
Petroleum ether	■
Perchlorethylene	■
Phenol	●
Phosphoric acid	●
Phthalic acid	●
Potassium acetate	●
Potassium carbonate	●
Potassium chlorate	●
Potassium chloride	●
Potassium chromium sulfate	●
Potassium cyanide	●
Potassium dichromate	●
Potassium hydroxide	●
Potassium hypochloride	●
Potassium iodide	●
Potassium nitrate	●
Potassium nitrate (salpetre)	●
Potassium permanganate	●
Propane	▲
Pyridrine	■
Rapeseed oil	●
Salicylic acid	●
Salt (rock salt, common salt)	●
Seawater	●
Silicone oil	●
Skydrol 500	●
Soap	●
Soda	●
Sodium aluminate	●
Sodium bisulfite	●

Medium	
Sodium chloride	●
Sodium cyanide	●
Sodium hydrogen carbonate	●
Sodium hydroxide	●
Sodium silicate	●
Sodium sulfate	●
Sodium sulfide	●
Spirit	●
Starch	●
Steam	●
Stearic acid	●
Sugar	●
Sulfuric acid 20%	●
Sulfuric acid 40%	●
Sulfuric acid 96%	●
Sulfur dioxide	●
Sulfuric acid	▲
Sulfurous acid	●
Tannic acid	●
Tar (asphalt)	●
Tartaric acid	●
Tetrachlorethane	■
Tetralin	●
Toluene	●
Transformer oil	●
Trichlorethylene	■
Triethanolamine	●
Turpentine	●
Urea	●
Vinyl acetate	●
Water	●
Water-glass	●
White Spirit	●
Xylol	●

● Resistant
■ Condit. recommended
▲ Not recommended

KLINGERmilam® PSS Technical values

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 (two stainless steel reinforcements at KLINGERmilam® PSS 300). 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 HNO_3-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	33	33	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	1.0
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/cm³	2.1	2.1	1.8
Max. temperature*	°C	900	900	900
Thickness	mm	1.3	2.0	3.2
Number of stainless steel reinforcements		1	1	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

Gasket factors

Gasket factors acc. to EN 13555 for flange calculation acc. to EN 1591-1 are available on request.

Function and durability

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

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

Subject to technical alterations.
Issue: February 2013

KLINGER®

KLINGERmilam® PSS Installation notes

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.

Certified according to DIN EN ISO 9001:2008

Subject to technical alterations.
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