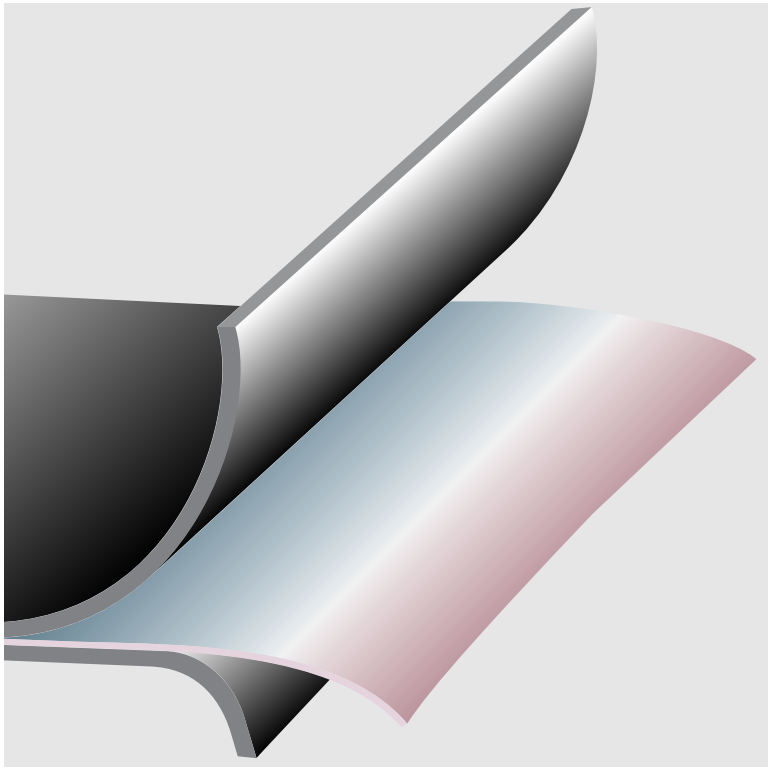
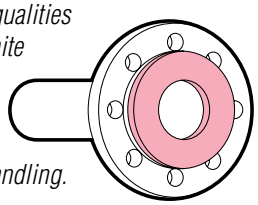
KLINGER®



KLINGERgraphite Gasket and sealing tape

Also available with KLINGERantistick (A/S) or resin impregnation

Forget about all unpleasant properties which you know from laminated graphite. Our qualities KLINGERgraphite -laminate SDS and PDM offer high strength and optimal handling.



KLINGERgraphite-foils, sheets, laminate SLS

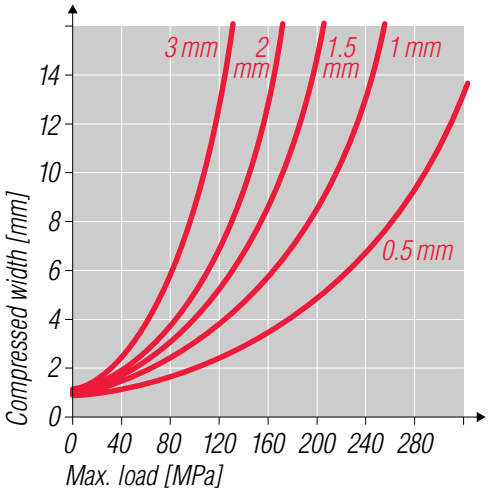
Tests and permits:
DIN-DVGW-permit no. NG-5124AT0417, BAM checked according to UVV28, Oxygen (VBG62) up to 130 bar and 200 °C even for use with liquid oxygen. The components of KLINGERgraphite-laminate are fully compatible with FDA requirements. WRc-approval.

Anti-stick finish:
The foils and sheets indicated at the right-hand side are available with KLINGERantistick (A/S) a finish which keeps its stability even at high temperatures and causes no organic contaminations of the pure graphite.

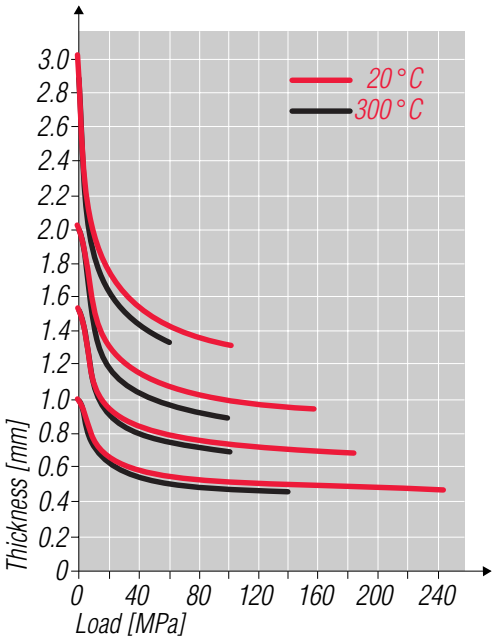
** In case of supply shortfall also 1.4404 may be delivered.*

Technical data		
Stress relaxation DIN 52913	*MPa*	*> 48*
Tightness ASTM F 37 B (Fuel A)	*ml/h*	*0.5*
Tightness according to DIN 3535	*ml/min*	*0.6*
Total content of chloride and fluoride	*ppm*	*≤ 200*
Water-soluble share of chloride	*ppm*	*< 40*
Purity of graphite	*%*	*98*
Purity of graphite for nuclear application	*%*	*99.8*
Total content of chloride and fluoride	*ppm*	*≤ 100*
Water-soluble share of chloride	*ppm*	*≤ 20*
KLINGERantistick (A/S) on request		
KLINGERgraphite foil H		
Thicknesses: 0.25/ 0.38/ 0.50/ 0.63/ 0.76/ 1.00 mm		
Roles: width 1 m, max. length 90 m		
KLINGERgraphite sheets HL *without reinforcement*		
Thicknesses: 1.5/ 2.0/ 3.0 mm		
Sheets: 1,000 x 1,000 mm		
KLINGERgraphite-laminate SLS *with 1.4401* reinforcement, thickness 0.05 mm*		
Several reinforcement layers on request, for higher stiffness.		
Thicknesses: 0.45/ 0.6/ 0.8/ 1.0/ 1.5/ 2.0/ 3.0 mm		
Sheets: 1,000 x 1,000 mm		
Material on roles: Thickness 0.45 - 1.0 mm		
Sheets: 1,500 x 1,500 mm in thickness 1.5/ 3.0 mm		
KLINGERgraphite foil SMB *self-adhesive*		
Thicknesses of graphite foil: 0.38/ 0.50/ 0.70 mm		
Roles: width 1 m , max. length 90 m		

Max. load diagram (MPa) as a function of the compressed width for KLINGERgraphite-laminate SLS with reinforcement of 1.4401/ thickness 0.05 mm. (Typical values)



Load diagram of KLINGERgraphite-laminate SLS with reinforcement, thickness 0.05 mm. Initial density 1.0 g/cm³, several initial thicknesses. (Typical values)



KLINGERgraphite-laminate PSM

Technical data		PSM 10010	PSM 15010	PSM 20010
Density of graphite layer	g/cm³	ca. 1,0	ca. 1,0	ca. 1,0
Max. perm. surface load at 450 °C	MPa	300	180	160
Compressibility ASTM F 36 J	%	28 – 33	33 – 38	35 – 40
Recovery ASTM F 36 J	%	14 – 19	13 – 18	13 – 18
Stress relaxation DIN 52913:				
50 MPa, 16 h/300 °C	MPa	min. 48	min. 48	min. 48
KLINGER cold hot compression:				
Surface load 50 MPa				
Thickness decrease at 23 °C	%	30	40	45
Thickness decrease at 300 °C	%	1.5	1.5	2.0
Tightness according to DIN 3535 part 6	ml/min.	0.6	0.8	1.0
Chloride content of graphite layer	ppm	max. 40	max. 40	max. 40
Thickness	mm	1.0	1.5	2.0
Size of sheets	mm	1,000/1,000	1,000/1,000	1,000/1,000
	mm	1,500/1,500	1,500/1,500	1,500/1,500
Thickneses: 0.8/ 1.0/ 1.5/ 2.0/ 3.0 mm				
KLINGERantistick (A/S) on request				

Suitable for temperatures up to approx. 450 °C.
In an inert atmosphere (no admission of oxygen) even suitable for higher temperatures.

Fields of application:
Particularly suitable under high chemical and thermal loads.

KLINGERgraphite-laminate PSM keeps its physical properties in the entire field of application. Resistance table see back.

Suitable for media used in the food industry. In accordance with Landesgewerbeamt von Baden-Württemberg and the requirements of the German Food Act.

The function and durability of the Klinger gaskets depends largely on the installation conditions which we as manufacturers cannot influence. We therefore only guarantee a perfect condition of our material.

Material structure:
A KLINGERgraphite foil is rolled on a 0.10 mm thick tang stainless steel sheet (1.4401*) without adhesive.

* In case of supply shortfall also 1.4404 may be delivered.

Order example:
1 sheet
KLINGERgraphite-laminate PSM 15010, 1,000 x 1,000 x 1.5 mm.

Other delivery options
Rings and other finished gaskets are also available in any size and corresponding sheet thicknesses.

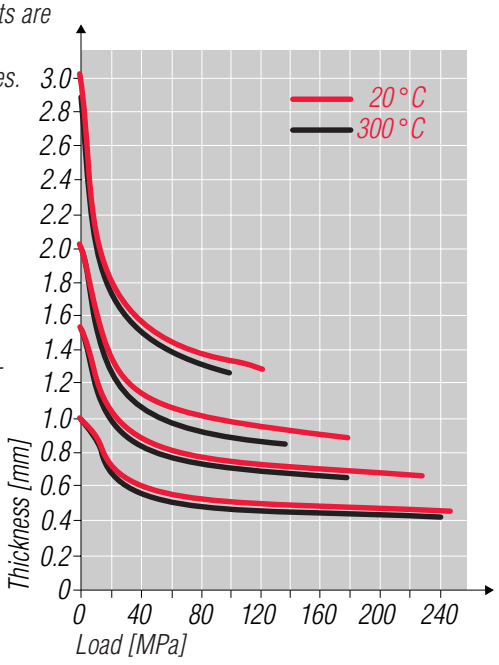
Tests and approvals:
DIN-DVGW approval no. NG-5124AT0417.

BAM approval in accordance with UVV 28, oxygen (VBG 62) tested up to 130 bar and 200 °C, also for use with liquid oxyen. KLINGERgraphite-laminate complies with FDA regulations. WRc approval.

Anti-stick finish:
The KLINGERgraphite-laminate PSM is available with KLINGERantistick (A/S) a finish which keeps its stability even at high temperatures and causes no organic contaminations of the pure graphite.

1.5 mm, 2mm, and 3 mm thick sheets are also available with resin impregnation as an alternative.

Load diagram for KLINGERgraphite-laminate PSM with tang stainless steel sheet reinforcement, thickness 0.1 mm, initial density 1.0 g/cm³, several initial thickneses.
(Typical values).



KLINGERgraphite-laminate PDM

Better handling and a much higher capability

Forget about all unpleasant properties which you know from handling graphite materials. Here are three convincing advantages which are due to the 30% higher density of the new KLINGERgraphite-laminate PDM:

1. Higher stability due to two tang stainless steel sheet reinforcements

Due to the improved connection of the graphite and the two tang stainless steel sheets the new KLINGER-graphite-laminate PDM offers a higher stability and deformation resistance.

2. Optimal handling

Due to of the increase in density we could do without any impregnation.

The new KLINGERgraphite-laminate PDM has a purity of 98% and is free of resins, impregnations, or other organic substances and therefore free of possibly toxic residual risks.

3. Clearly more safety

Gaskets made of the new KLINGERgraphite-laminate PDM offer clearly more safety during fitting and under operation.

Important:

Due to the higher compression, the KLINGERgraphite-laminate PDM has a thickness of 1.5 mm, even where 2.0 mm-graphite gaskets were previously used.

The final thicknesses are the same in compressed condition.

Anti-stick finish:

The KLINGERgraphite-laminate PDM is available with KLINGERantistick (A/S) a finish which keeps its stability even at high temperatures and causes no organic contaminations of the pure graphite.

Technical data			
Compressibility ASTM F 36 J		%	19–23
Final thickness at a surface load of 35 MPa		mm	1.18–1.23
Density of the graphite layer		g/cm³	1.3
Graphite purity		%	min. 98
Chloride content		ppm	max. 40
Tang stainless steel sheets:	Material		1.4401*
	Thickness	mm	0.075
	Number of sheets		2
Tightness according to DIN 3535/6		ml/min.	0.5
Stress relaxation DIN 52913		MPa	48
Max. surface load at 300 °C		MPa	200
Permanent operating temperature		°C	ca. 450
Size of sheets		mm	1,000 x 1,000
Thickness		mm	1.5
Other sizes on request			
KLINGERantistick (A/S) on request.			
DIN-DVGW approval no. NG-5124AT0417			

** In case of supply shortfall also 1.4404 may be delivered.*

KLINGERgraphite sealing tape

KLINGERgraphite consists of pure graphite expanded by a special process that produces a flexible material which fits perfectly to the unevennesses of the sealing face.

Chemical resistance:
to almost all fluids such as acids, alkalis, solvents, greases, oils, gas, steam and water.
Exceptions: high-oxidizing fluids such as concentrated nitric acid, potassium chlorate, permanganate solutions and chloric acid.
Details are given in the resistance table.

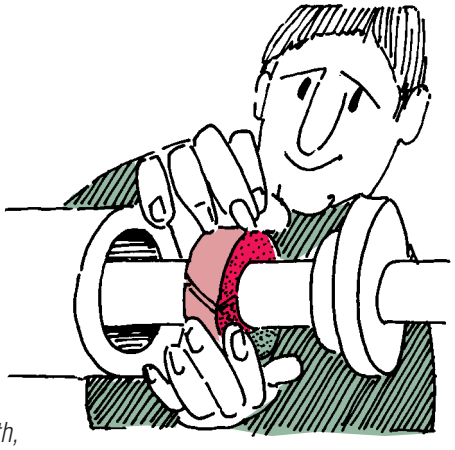
Temperature resistance:
- *in oxidizing atmospheres from - 200 °C to +450 °C*
- *in reduction or inert atmospheres up to +300 °C*
- *excellent resistance to temperature fluctuations*
- *high thermal conductivity*
- *no hot or cold flows, even at high temperatures and surface loads*
- *flexibility over the whole temperature range*

Other features:
- *excellent sliding properties, max. 40m/s*
- *no adhesion of the sealing area*
- *self-lubricating, therefore no wear on moving parts*
- *high corrosion resistance*
- *no swelling or shrinkage under influence of media*
- *no ageing*
- *easy to work with*
- *not detrimental to health*

Type 1:
KLINGERgraphite sealing tape, corrugated
Fields of application:
Universal packing for use in pumps and fittings. The tape is wound around the shaft or spindle on the spot and compressed to a packing with the help of the gland.

All spindles and shafts can be reliably sealed with only a few tape widths. Ask for our mounting instructions for packings.

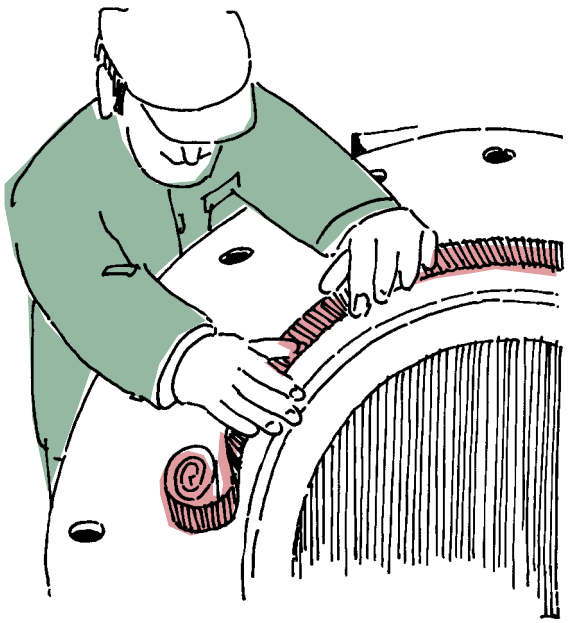
Available in roles of 12 m length, packed in boxes, together with the mounting instructions.
Material thickness: 0.5 mm
Tape width: 6, 10, 15, 20, 25 mm



Type 2:
KLINGERgraphite sealing tape, corrugated, self-adhesive
Fields of applications:
The self-adhesive tape is ideal for sealing big flanges and sealing surfaces. The self-adhesive back fixes the tape on the sealing surface during mounting.

The required amount of adhesive is very small. It carbonises at higher temperatures.

Available in roles of 12 m length, packed in boxes, together with the mounting instructions.
Material thickness: 0.5 mm
Tape width: 6, 10, 15, 20, 25 mm



Resistance table for all KLINGERgraphite products

Medium	Concentration [%]	Temperature up to °C
Acetic acid	●	N.I.
Acetic acid anhydride	●	N.I.
Acetone	●	N.I.
Air	●	450
Alum	●	N.I.
Aluminium chloride	●	N.I.
Amino acid	●	N.I.
Ammonia	●	N.I.
Ammonium hydroxide	●	N.I.
Ammonium sulfate	●	N.I.
Amyl acetate	●	N.I.
Amyl alcohol	●	N.I.
Aniline	●	N.I.
Aqua regia	■	N.I.
Arsenic acid	●	N.I.
Benzenesulfonic acid	< 60	N.I.
Benzol and derivates	●	N.I.
Bitumen	●	N.I.
Boric acid	●	N.I.
Bromine	■	N.I.
Bromine water	●	N.I.
Butane	●	N.I.
Butanone	●	N.I.
Butyl acetate	●	N.I.
Butyl alcohol	●	N.I.
Calcium chlorate	< 10	60
Calcium chloride	< 15	N.I.
Calcium hydroxide	●	N.I.
Calcium hypochlorite	●	N.I.
Carbon tetrachloride	●	N.I.
Carbonic acid	●	N.I.
Cellosolve	●	N.I.
Chlorine (dry)	●	N.I.
Chlorine dioxide	■	N.I.
Chlorine water	●	25
Chloroacetic acid	●	25
Chloroform	●	N.I.
Chromic acid	< 10	25
Citric acid	●	N.I.
Condensate	●	N.I.
Copper sulfate	●	N.I.
Cyclohexane	●	N.I.

Medium	Concentration [%]	Temperature up to °C
Diethanolamine	●	N.I.
Ethyl alcohol	●	N.I.
Ethyl chloride	●	N.I.
Ethyl dichloride	●	N.I.
Ethylamine	●	N.I.
Ethylene chlorohydrine	< 10	N.I.
Fatty acids	●	N.I.
Fluorine	●	N.I.
Formic acids	●	N.I.
Frigen (Freon)	●	N.I.
Hydrazine	●	N.I.
Hydro sulfide	●	N.I.
Hydrobromic acid	●	N.I.
Hydrocarbones	●	N.I.
Hydrochloric acid	●	N.I.
Hydrofluoric acid	●	140
Iodine	●	N.I.
Iron chlorides	●	N.I.
Iron sulfates	●	N.I.
Isopropanole	●	N.I.
Isopropyl acetates	●	N.I.
Isopropyl ether	●	N.I.
Kerosene	●	N.I.
Lactic acid	●	N.I.
M.E.K. (2-butanone)	●	N.I.
Manganese sulfates	●	N.I.
Mercaptoethylene	< 50	N.I.
Methanol	●	N.I.
Methylen chloride	●	N.I.
Methylpentanone peroxide	●	N.I.
Mineral oil	●	N.I.
Monochlorbenzene	●	N.I.
Nickel chloride	●	N.I.
Nickel sulfate	●	N.I.
Nitrating acid	■	N.I.
Nitric acid	< 65	N.I.
Oils	●	N.I.
Oleum	■	N.I.
Oleic acid	●	N.I.
Oxalic acid	●	N.I.
Oxygen	●	200
Oxygen liquid	●	N.I.

Medium	Concentration [%]	Temperature up to °C
Paraldehyde	●	N.I.
Perchlorethylene	●	N.I.
Petrol (Fuel)	●	N.I.
Petroleumether	●	N.I.
Petroleum/-products	●	N.I.
Phosphoric acid	●	N.I.
Phosphorus trichloride	●	N.I.
Potassium chlorate (melt)	■	N.I.
Potassium nitrate (melt)	■	N.I.
Propane	●	N.I.
Sodium carbonate	●	N.I.
Sodium chloride	●	N.I.
Sodium hydroxide	●	N.I.
Sodium hypochloride	< 20	30
Sodium peroxide	■	N.I.
Steam	●	N.I.
Stearic acid	●	N.I.
Sulfur dioxide	●	N.I.
Sulfur trioxide	■	N.I.
Sulfuric acid	< 70	N.I.
Sulfurous acid	●	N.I.
Synthetic resins	●	N.I.
Tartaric acid	●	N.I.
Terpentine	●	N.I.
Trichlor ethylene	●	N.I.
Vinyl chloride	●	N.I.
Water	●	N.I.
Zinc chloride	●	N.I.

● = suitable for any concentration

■ = unsuitable

N.I. = no influence

Subject to technical alterations.

Properties

Please note the resistance table in the margin

The given concentrations and temperatures might be exceeded if the medium is not or only in restricted contact with the graphite. This case arises when edged and spiralwound gaskets are used.

KLINGERgraphite is not resistant to mixtures of nitric acid and other stronger acids (e.g. nitrating acid, aqua regia etc.), chromium VI and permanganate solutions as well as melts af alkali or alkaline earth metals.The given recommendations are supposed to be a help for the use of KLINGERgraphite.

We cannot give a guarantee as function and durability depend on a variety of factors which we as manufacturers cannot influence. If there are particular conditions of admission these have to be observed.

For information on other media or operating conditions we are at your disposal.

KLINGERgraphite–laminate

KLINGERgraphite-laminate SDS consists of expanded-graphite layers bonded to steel foil with adhesive or rolled on tang stainless steel reinforcement.

The adhesive layer is applied in an exactly controlled process so as to ensure

- *that the amount of adhesive is always less than 1% of the graphite*
- *a uniform distribution of the adhesive.*

The advantage of this method is that the excellent characteristics of the flexible graphite are kept.

Since only small amounts of adhesive (less than 0.005 mm thickness, no chlorides) are used, the excellent chemical and thermal resistances of the flexible graphite are not affected.

Range of application

Sealing material for:

- *high and low temperatures*
- *high corrosive and aggressive medias*
- *sensitive flanges (enamel, glass, graphite)*
- *gas and steam applications*

Properties of flexible KLINGERgraphite

– No flowing under pressure and temperature loads

– temperature-resistant from -200 °C to +450 °C (in inert atmosphere even higher)

– reliable sealing of gases and liquids

– excellent micro-sealing

– chemically resistant to nearly all medias

– excellent resistance to temperature fluctuations

– high flat heat conductivity

– no health hazard

– unlimited shelf live

– no combination with glass and ceramics

Subject to technical alterations.
October 2002