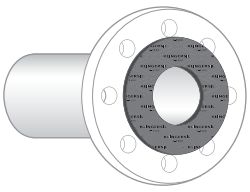
KLINGER®

KLINGERSIL® C-4500

A Hightech Fibre Material – ideal for strong alkali media and steam



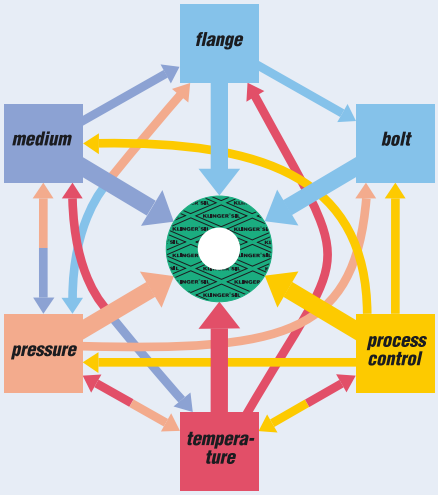
KLINGERSIL® C-4500
Carbon fibres and special heat resistant additives bonded with NBR.
A superior performance product designed for use with strongly alkaline media and steam in the chemical industry.

KLINGER – The global leader in static sealing

KLINGERSIL® C-4500

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.

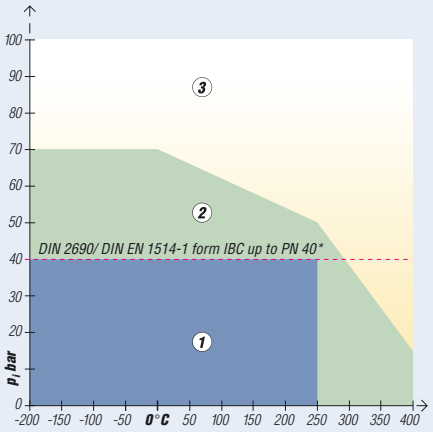


Maximum temperature and pressure values alone can not define a material's suitability for an application. These limits are dependent upon a multiplicity of factors as shown in the diagram opposite. It is always advisable to consider these factors when selecting a material for a given application.

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.



*Gaskets according to DIN 2690 are only standardised up to PN 40 and gasket thickness 2 mm.

Areas of Application

(1) In area one, the gasket material is normally suitable subject to chemical compatibility.

(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.

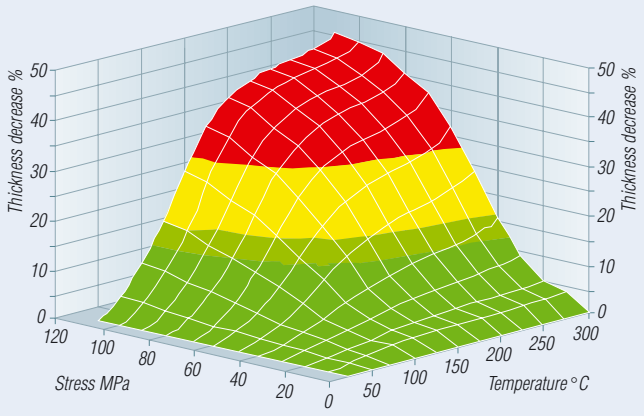
Klinger Hot and Cold Compression Test Method

The Klinger Hot Compression Test was developed by Klinger as a method to test the load bearing capabilities of gasket materials under hot and cold conditions.

In contrast to the BS 7531 and DIN 52913 tests, the Klinger Compression test maintains a constant gasket stress throughout the entire test. This subjects the gasket to more severe conditions.

The thickness decrease is measured at an ambient temperature of 23°C after applying the gasket load.
This simulates assembly.

Temperatures up to 300°C are then applied and the additional thickness decrease is measured. This simulates the first start up phase.



The diagram shows additional thickness decrease at temperature

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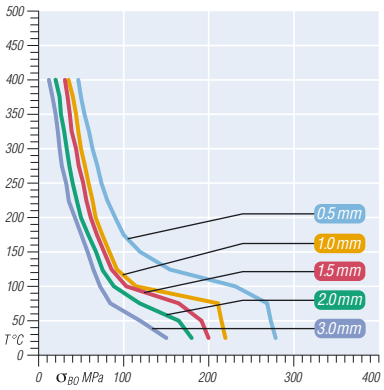
Maximum permissible surface pressure σ_{B0} under operating conditions acc. DIN 28090 – 1

The maximum surface pressure under operating conditions is the maximum allowable surface pressure on the effective gasket area under service conditions that can be applied to the gasket before unacceptable relaxation of the flanged joint occurs and/or the gaskets are destroyed.



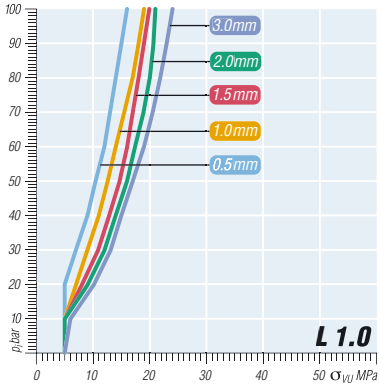
The diagram above shows this values for different gasket thicknesses.

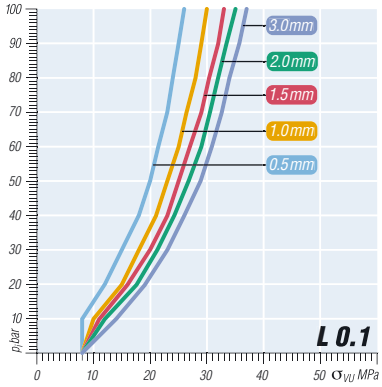
Min. surface pressure σ_{VU} for tightness classes L = 1.0, L = 0.1 and L = 0.01 in accordance to DIN 28090

The minimum surface pressure is the minimum surface pressure that should be applied to the gasket to achieve the necessary tightness requirements.

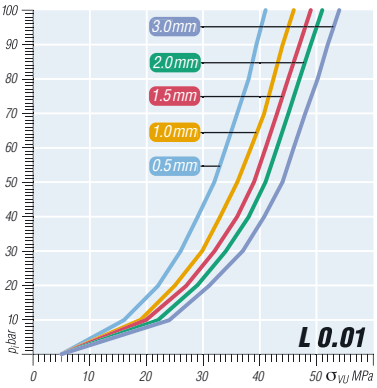
The value must be sufficient to compress the material into the flange imperfections, reduce the materials porosity and also counteract the release of load due to the internal pressure.

The diagrams below show the minimum gasket stress required to achieve the relevant tightness classes as a function of thickness.



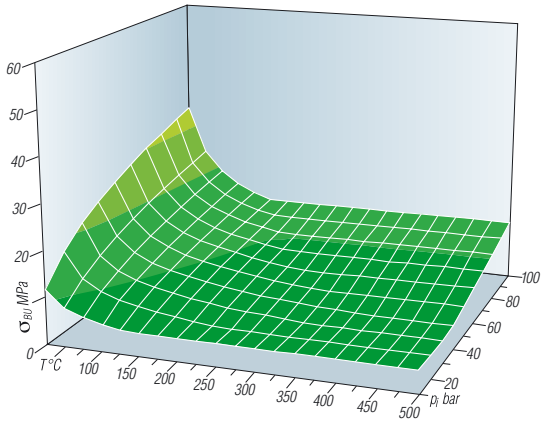


Tightness class L= 0.1 allows a maximum leakage of 0.1 mg nitrogen per second per meter of gasket length (mg/s x m)



Minimum surface pressure σ_{BU} for tightness class L = 0.1

The three dimensional diagram below describes the behaviour of 2 mm gasket material with respect to the minimum surface pressure to achieve a tightness class of L = 0.1 under a wide range of temperatures and internal pressures. It clearly shows that the minimum surface pressure decreases at elevated temperatures – the gasket will seal at lower loads under these conditions.



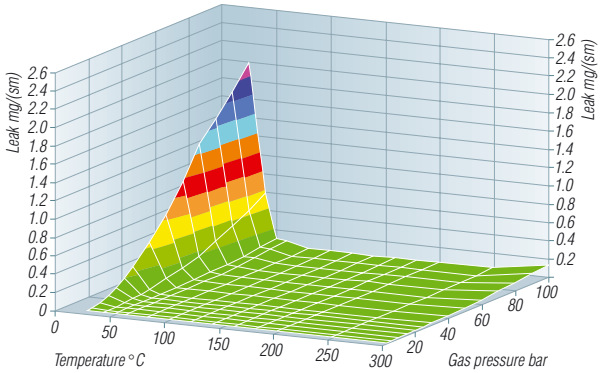
KLINGERSIL® C-4500
Flanged joint integrity

High temperature tightness

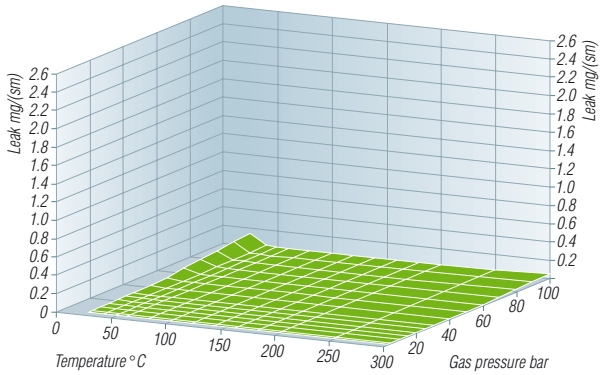
High temperature tightness is measured by means of the Klinger Hot Compression test under defined constant gasket load and temperature with increasing internal pressures using nitrogen as test fluid.

Stabilisation time for each reading is two hours and a new test specimen is used for every gasket load and temperature.

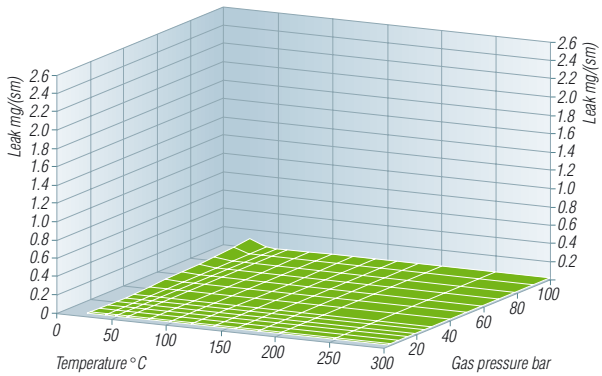
The tightness is analysed with a massflow meter. The pressure is controlled by pressure controller.



Gasket load 15 MPa



Gasket load 20 MPa



Gasket load 35 MPa

Important points to be observed

With heightened awareness of safety and environmental issues, reducing leaks from flanged assemblies has become a major priority for industry. It is therefore important for companies who use gaskets to choose the correct material for the job and install and maintain it correctly to ensure optimum performance.

A flanged joint will remain tight as long as the surface pressure in service is higher than the minimum surface pressure required to achieve the necessary levels of tightness but is lower than the maximum permissible surface pressure.But increasingly high demands on the tightness requirements for flanged joints (e.g. Tightness class L 0.1 in accordance with DIN 28090) necessitate the application of high loads on the gasket material in order to meet these stringent requirements.

If the gasket is to be subjected to non-static loading and stress fluctuations due to temperature and pressure cycling, it is advisable to select a gasket material which is less prone to embrittlement with increasing temperatures (e.g. KLINGERgraphite laminate, KLINGERtop-chem or KLINGERtop-sil). In cyclic loading conditions we recommend a minimum surface stress of 30 MPa and that the gasket should be as thin as is practicable.

For safety reasons never re-use gaskets.

KLINGERSIL® C-4500
Installation instructions

The following guidelines are designed to ensure the optimum performance of our gasket materials:

1. Choosing the gasket

There are many factors which must be taken into account when choosing a gasket material for a given application including temperature, pressure and chemical compatibility. Please refer to the information given in our brochure or, for advice to our software program KLINGER®expert. If you have any questions regarding the suitability of material for a given application please contact Klinger Technical Department.

2. Gasket thickness

The gasket should be as thin as technically practical. To ensure optimum performance a minimum thickness/width ratio of 1/5 is required (ideally 1/10).

3. Flange condition

Ensure all remains of old gasket materials are removed and the flanges are clean, in good condition and parallel.

4. Gasket compounds

Ensure all gaskets are installed in a dry state, the use of gasket compounds is not recommended as this has a detrimental effect on the stability and load bearing characteristics of the material. In its uncompressed form the gasket can absorb liquid, and this may lead to failure of the gasket in service. To aid gasket removal Klinger materials are furnished with a non sticking finish.

In difficult installation conditions, seperating agents such as dry sprays based on molybdenum sulphide or PTFE e.g. KLINGERflon spray, may be used, but only in minimal quantities. Make sure that the solvents and propellants are completely evaporated.

5. Gasket Dimensions

Ensure gasket dimensions are correct. The gasket should not intrude into the bore of the pipework and should be installed centrally.

6. Bolting

Wire brush stud/bolts and nuts (if necessary) to remove any dirt on the threads. Ensure that the nuts can run freely down the thread before use.

Apply lubricant to the bolt and to the nut threads as well as to the face of the nut to reduce friction when tightening. We recommend the use of a bolt lubricant which ensures a friction coefficient of between 0.10 to 0.14.

7. Joint Assembly

It is recommended that the bolts are tightened using a controlled method such as torque or tension, this will lead to greater accuracy and consistency than using conventional methods of tightening. If using a torque wrench, ensure that it is accurately calibrated.

For torque settings please refer to the KLINGER®expert or contact our Technical Department which will be happy to assist you

Carefully fit the gasket into position taking care not to damage the gasket surface.

When torquing, tighten bolts in three stages to the required torque as follows:

Finger tighten nuts. Carry out tightening, making at least three complete diagonal tightening sequences i.e. 30%, 60% and 100% of final torque value. Continue with one final pass – torquing the bolts/studs in a clockwise sequence.

8. Retightening

Provided that the above guidelines are followed retightening of the gasket after joint assembly should not be necessary.

If retightening is considered necessary, then this should only be performed at ambient temperature before or during the first start-up phase of the pipeline or plant. Retightening of compressed fibre gaskets at higher operating temperatures and longer operating times may lead to a failure of the gasket connection and possible blow out.

9. Re-use

For safety reasons never re-use a gasket.

KLINGER EXPERT®

Powerful sealing calculation with online help on CD-ROM

KLINGERSIL® C-4500
Technical data

Uses
High pressure gasket for special applications. Suitable for use with strong alkali medias and steam at higher temperatures as well as to oils, gases, salt solutions, fuels, alcohols, organic and inorganic acids, hydrocarbons, lubricants and refrigerants. Premium material grade with very high stress retention.

Dimensions of the standard sheets
Sizes:
1000 x 1500 mm, 2000 x 1500 mm.
Thicknesses:
0.5 mm, 1.0 mm, 1.5 mm,
2.0 mm, 3.0 mm;
other thicknesses and sizes on request.
Tolerances:
thickness ± 10%, length ± 50 mm,
width ± 50 mm.

Surfaces
KLINGERSIL® gasket materials are generally furnished with surfaces of low adhesion. On request, graphite facings and other surface finishes on one or both sides are also available.

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.

Tests and approvals
Fire safe according API SPEC 6 FA.
BAM approval in accordance with UVV 28, oxygen(VGB 62)
tested up to 100 bar and 85° C.
Approved for gas supply in accordance with DIN 3535/6.
DIN - DVGW permit NG 5123AN0539.
ÖVGW permit, KTW recommended
Lab. National d`Essais 105.097
Germanischer Lloyd.
Meets the technical requirements of BS 7531:2006 Grade AX.
TA Luft (Clean air) approval, tested in accordance with VDI 2440 at 250° C.

Typical values				
Compressibility ASTM F 36 J			%	12
Recovery ASTM F 36 J	min		%	60
Stress relaxation DIN 52913	50 MPa, 16h/ 175°C		MPa	35
	50 MPa, 16h/ 300°C		MPa	32
Stress relaxation BS 7531	40 MPa, 16h/ 300°C		MPa	30
Klinger cold/hot compression	thickness decrease at 23°C		%	10
50 MPa	thickness decrease at 300°C		%	15
Tightness according DIN 3535/6			mg/s x m	< 0.1
Tightness class L	DIN 28090-1			0.1
Specific leakrate λ	VDI 2440		mbar x l/s x m	4.94E-06
Cold compression	DIN 28091-2		%	7 - 11
Cold recovery	DIN 28091-2		%	3 - 5
Hot compression	DIN 28091-2		%	9
Hot recovery	DIN 28091-2		%	1
Spring back R	DIN 28091-2		mm	0.019
Thickness increase after fluid	oil JRM 903: 5 h/150 °C		%	3
immersion ASTM F 146	fuel B: 5 h/23 °C		%	5
Density			g/cm³	1.6
Average surface resistance	R_{OA}		Ω	5.7x10E4
Average specific volume resistance	ρ_D		Ω cm	7.5x10E4
Average dielectric strength			kV/mm	< 0.1
Average power factor	1 kHz, ca.3 mm thickness		tan δ	0.147
Average dielectric coefficient	1 kHz, ca.3 mm thickness		εr	9.7
Thermal conductivity			W/mK	0.2
ASME-Code sealing factors				
for gasket thickness 2,0 mm	tightness class 0.1 mg/s x m		MPa	y 25
				m 4

KLINGER EXPERT®
Powerful sealing calculation with online help on CD-ROM

Certified according to DIN EN ISO 9001:2000

Subject to technical alterations.
Issue: December 2007

http://www.klinger.com.au