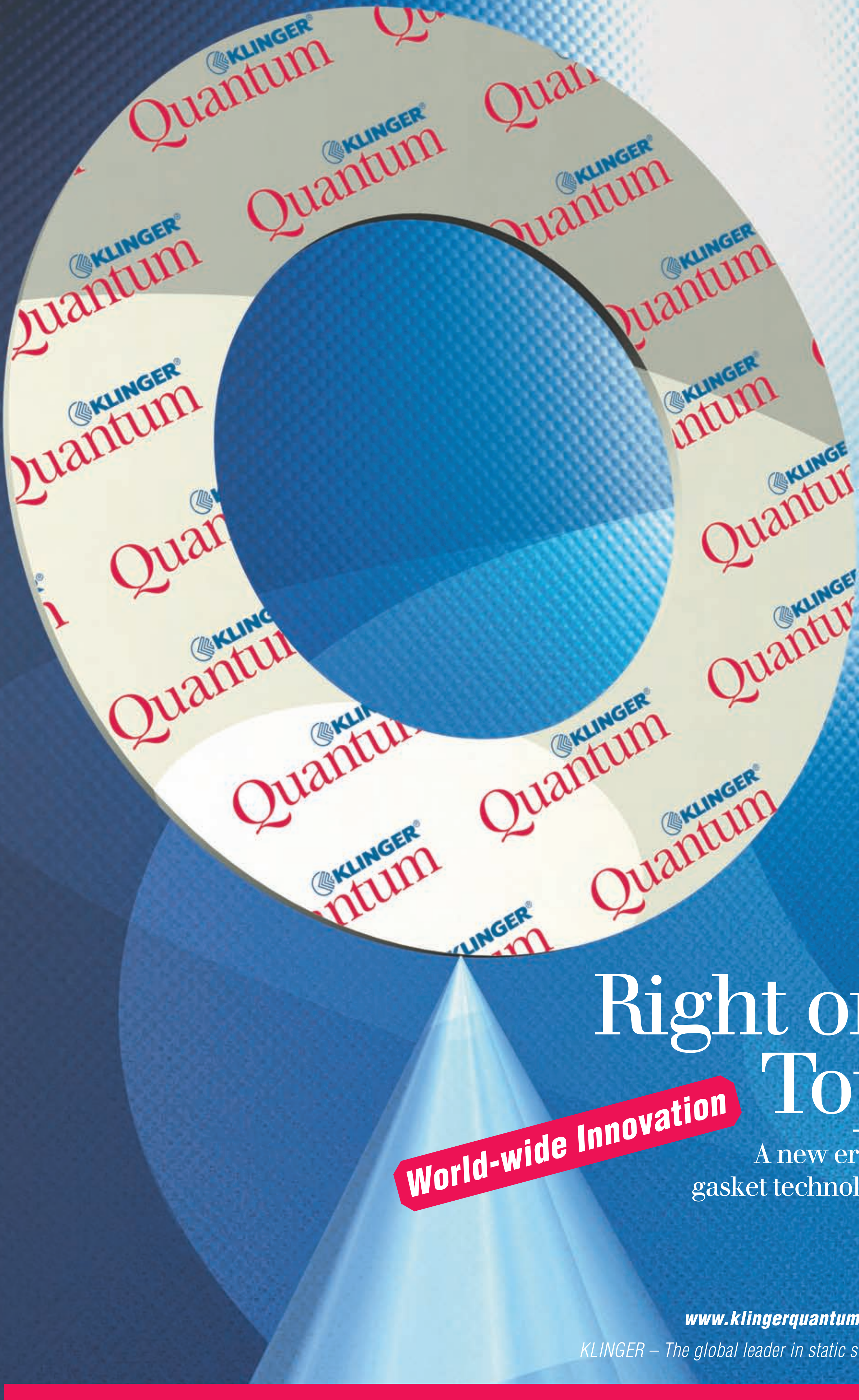
KLINGER®

KLINGER® Quantum



Right on Top

A new era in gasket technology

World-wide Innovation

www.klingerquantum.com

KLINGER – The global leader in static sealing

Since the change-over to asbestos-free fibre gaskets, many users have been on the look-out for a gasket material with the outstanding high-temperature properties of the asbestos-containing material KLINGERit.

As the leading manufacturer of static gasket materials, Klinger was the pioneer in the development of asbestos-free fibre reinforced gaskets.

The best achieved so far was the market launch of KLINGER®top-sil-ML1, which, although it was a large step forward, did not reach the really challenging ultimate goal.

With the development of KLINGER®Quantum, Klinger is now heralding a new era in the world of gasket technology.

A Vision Becomes Reality

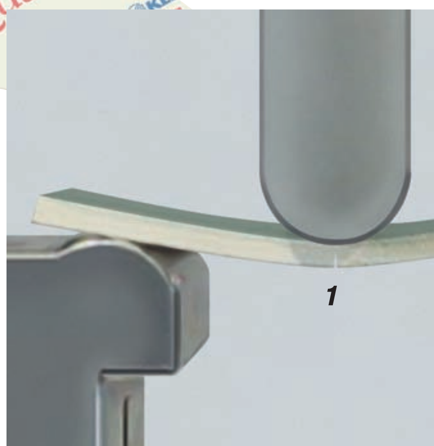
The development of KLINGER®Quantum germinated from the vision of developing an asbestos-free, fibre-reinforced gasket material that would behave in a similar, problem-free manner at high temperatures to the earlier KLINGERit. Moreover, this material would fulfil the contemporary, trendsetting requirements for tightness and environmental compatibility.

The first groundbreaking step in the development of an asbestos-free fibre gasket was the presentation and market launch of KLINGERSIL® in 1982. Since then, KLINGERSIL® materials have established themselves in the market and proven themselves a million times over. Many applications are today simply not conceivable without these materials.

Nonetheless, so far, fibre-reinforced materials generally have not been able to fulfil the expectations of many users with regard to flexibility at higher temperatures

KLINGER®Quantum is the first fibre-reinforced gasket material in the world that is exclusively HNBR-bound.

Together with a unique production process developed specially for the purpose, this material can be used at higher temperatures and with a much wider range of media than any other fibre-reinforced gasket material that is currently available.



A new era in gasket technology

Being a world-wide market leader, KLINGER was therefore continuously involved in finding a solution to this problem and in 2004, exactly 111 years after the invention of KLINGERit, presented the groundbreaking material KLINGER®top-sil-ML1.

The patented, futuristic multilayer concept resulted in an extension of service life at high temperatures.

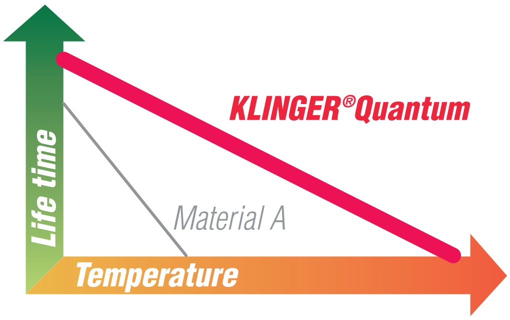
HNBR was used for the first time as the binding agent in fibre-reinforced gasket materials in combination with NBR.

From the experience gained in this development and a focused, consistent further development of the production process came the breakthrough: in 2009, KLINGER revolutionized the capability of fibre gaskets with the launch of the unique sealant material KLINGER®Quantum.

The Outstanding Properties

KLINGER®Quantum offers a formerly unknown level of flexibility for fibre-reinforced gasket materials at high continuous temperatures, with a simultaneously improved chemical resistance and a broader range of applications than all known fibre-reinforced gasket materials.

Of course, KLINGER®Quantum fulfils all the present-day requirements for tightness and safety.



Flexibility at High Temperatures

The 3-point bending test is often used as an evaluation method for the flexibility of fibre-reinforced gasket materials. Special tests on conditioned specimens provide an indication of the brittleness and hence of the aging behaviour of the elastomers used.

Before the test, the specimens are first conditioned and subsequently tested.

The results of the tests on these artificially aged test specimens provide information on the aging resistance of the different material concepts.

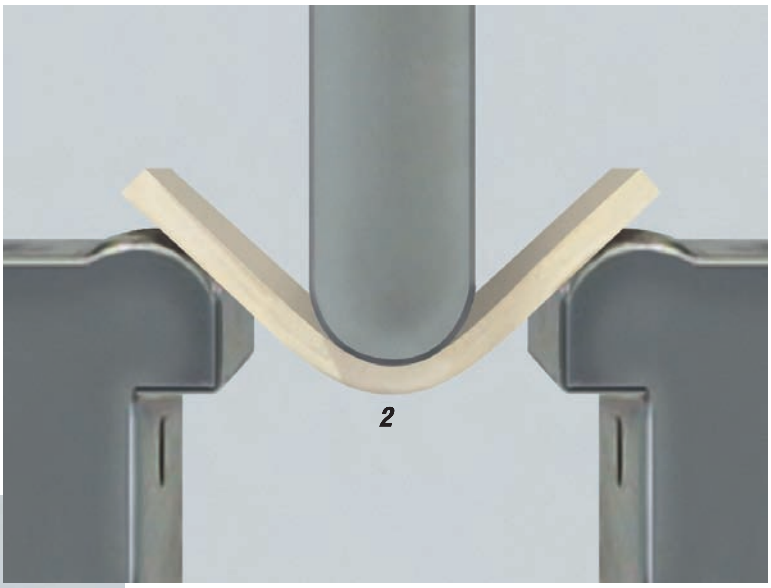
Particularly in steam applications, pressure shocks frequently occur, which result in damage to the gasket material.

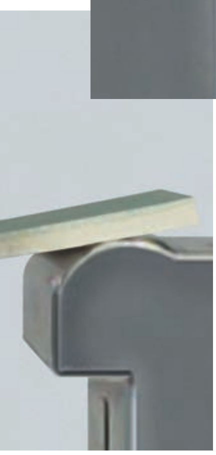
A more flexible gasket that can overcome extensive expansion without fracture is a decisive factor in obtaining a more reliable gasket joint.

In this test, KLINGER®Quantum shows its uniqueness and outstanding position as compared to all other available fibre-reinforced gasket materials. The flexibility of KLINGER®Quantum at higher temperatures is several times higher than that of traditional fibre-reinforced gasket materials.

All the negative aspects of flat gaskets such as embrittlement, crack formation and increased leakage can be reduced significantly by the use of KLINGER®Quantum.

The handling of the material is similar to that of the known fibre-reinforced materials and is therefore familiarly simple.





Treatment of the samples:
48 h at 200°C

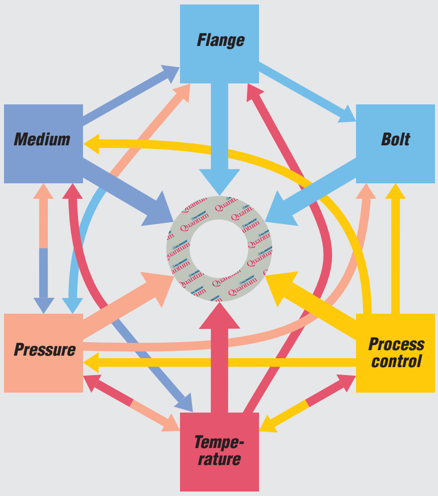
1. Standard fibre reinforced material
2. KLINGER®Quantum

KLINGER®

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.



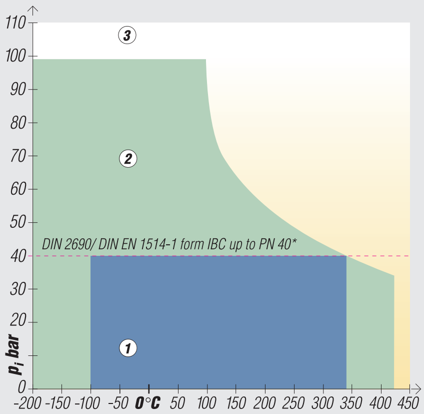
Maximum temperature and pressure values alone can not define a material's suitability for an application. These limits are dependent upon a multiplicity of factors as shown in the diagram opposite.

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.

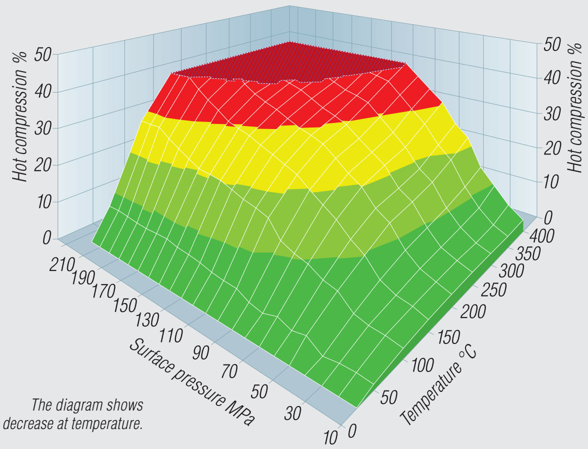
Klinger Hot and Cold Compression Test Method

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 400°C are then applied and the additional thickness decrease is measured. This simulates the first start up phase.



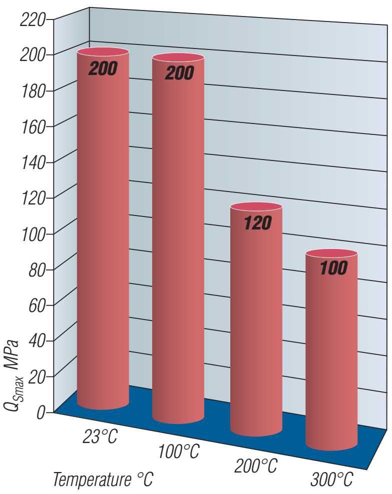
The diagram shows additional thickness decrease at temperature.

KLINGER® Quantum
Flanged joint integrity

Gasket factor Q_{Smax} according to EN13555

Q_{Smax} is the maximum surface pressure that may be imposed on the gasket at the indicated temperatures without collapse or compressive failure of the gasket.

The determination of Q_{Smax} may for sheet materials result in an overestimation of the capability of the gasket sheet and it is important that all values of Q_{Smax} for sheets are verified by conducting a test for P_{QR} at the same temperature and surface pressure as for the Q_{Smax}-value.

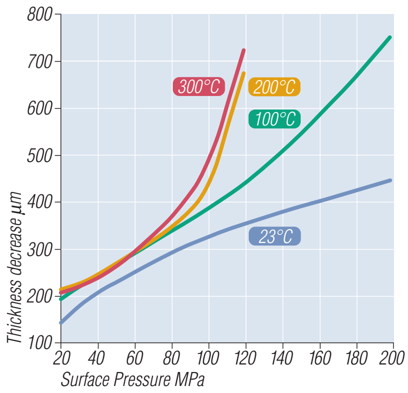


Temp. °C	Q_{Smax}	P_{QR} 500k N/mm	40 MPa	60 MPa
23	200	0,99	>0,99	>0,99
100	200	0,77	0,85	0,88
200	120	0,72	0,83	0,82
300	100	0,64	0,82	0,72

Thickness Reduction at Q_{Smax}

The specification of the thickness reduction of the tested gasket material results in a better evaluation of whether the material is suitable for the given application or not.

The thickness reduction of the gasket material is measured at the end of every load cycle of the Q_{Smax} test and results in the following diagram:

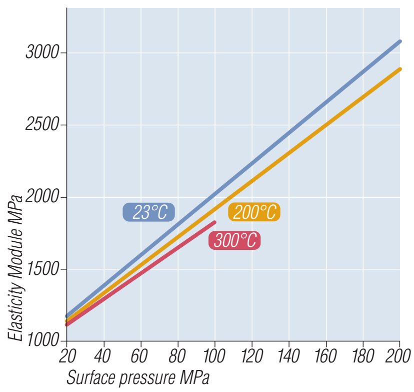


Elasticity Module E_G according to EN 13555

This gasket characteristic is determined from the thickness recovery of the gasket between the initial compression surface pressure and unloading to a third of the initial surface pressure.

The determination is made from the unloading cycles of the Q_{Smax} test. The value for E_G changes with the surface pressure on the gasket.

A high E_G value means a small recovery, and a low E_G value means a higher recovery and is thus an indication of a lesser embrittlement of the material.



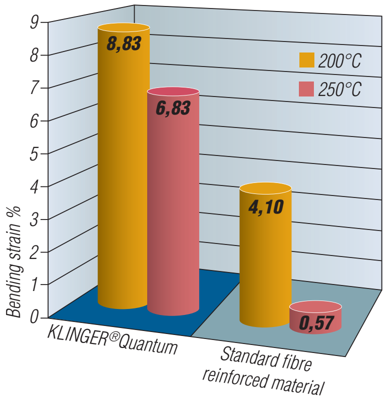
Bending Test according to ISO 178

To evaluate flexibility potentials of sealing materials the three point bending test is often used to assess the flexibility of compressed fibre materials.

In this test, the test specimen is deformed in the middle between the contact faces with a constant testing speed until it breaks, or until the deformation has reached a specified value.

For the flexibility test, specimens of a fibre-reinforced reference material and of KLINGER®Quantum were treated for 48h at 200°C and at 250°C.

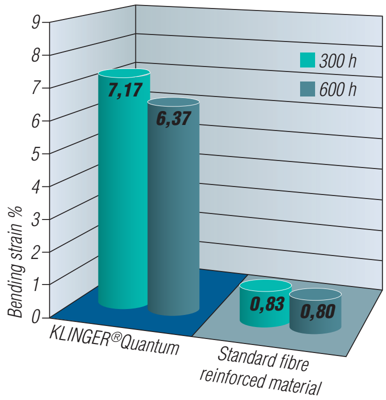
The results of the test on these artificially aged samples provide information on the aging resistance of the two different materials and underscore the high performance of KLINGER®Quantum.



The unique behaviour of KLINGER®Quantum manifests itself even more impressively in long-term tests. For this purpose, a fibre-reinforced reference material, together with KLINGER®Quantum was again treated at a temperature of 200°C for 300 h and 600 h.

After 600 hours at a temperature of 200°C KLINGER®Quantum shows a flexibility that is **8 times higher** than known fibre-reinforced gasket materials!

Particularly in steam applications, there are often strong pressure shocks that result in damage to the gasket material. A more flexible gasket that withstands greater expansions without rupture is thus a factor that contributes to a safer, more reliable gasket joint.



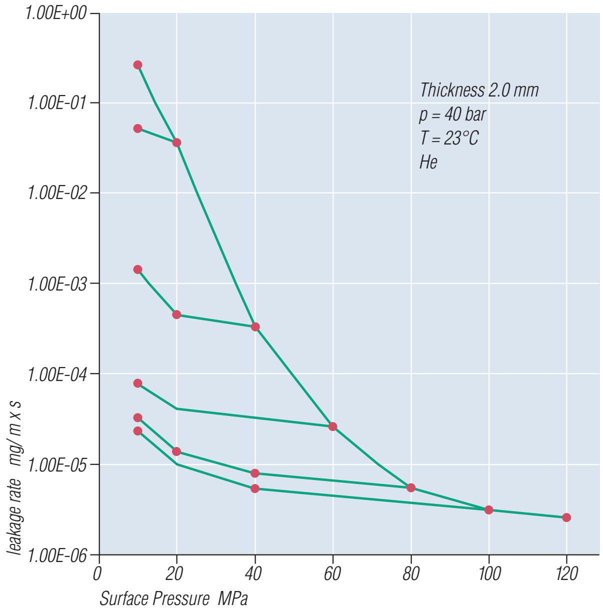
KLINGER® Quantum Flanged joint integrity

Gasket factor Q_{Smin} according to EN13555 (Tightness at high temperatures)

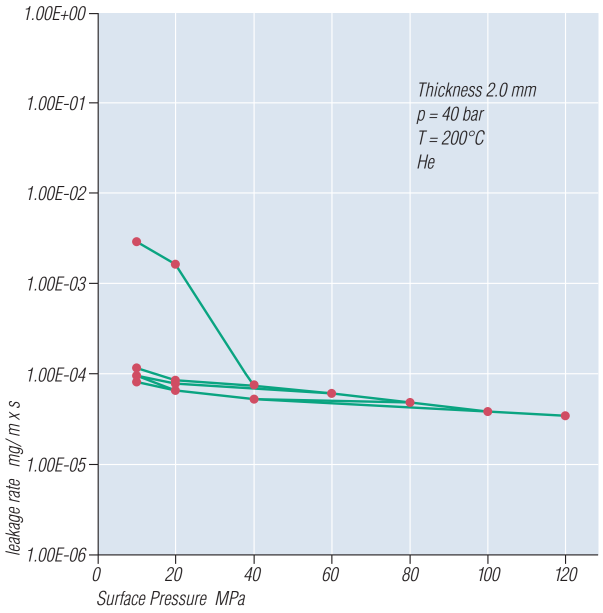
Q_{Smin} describes the required minimum surface pressure on the gasket under operating conditions, i.e. upon relief during operation at operating temperature, so that the necessary leakage class L is maintained for the given internal pressure.

During the test, the gasket must be cyclically strained and relieved, with the leakage rate being measured at a surface pressure defined in the standard at an internal pressure of 40 bar.

Helium has to be used as testing gas for this test.



Leakage curve of KLINGER® Quantum at a temperature of 23°C and an internal pressure of 40 bar



Leakage curve of KLINGER® Quantum at a temperature of 200°C and an internal pressure of 40 bar

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 0.01) 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. KLINGER®graphit Laminat, KLINGER®top-chem, KLINGER®top-sil, KLINGER®Quantum).

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.

KLINGER® Quantum 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, separating agents such as dry sprays based on molybdenum sulphide or PTFE e.g. KLINGER®flon 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® Quantum
Technical data

Application
Unique gasket material with the highest flexibility at high temperatures, manufactured from a high-quality fibre and filler compound.

A high temperature-resistant HNBR matrix is used as the binding agent. Suitable for use in oils, water, steam, gases, salt solutions, fuels, alcohols, weak organic and inorganic acids, hydrocarbons, lubricants and refrigerants.

Dimensions of the standard sheets
Sizes:
1,000 x 1,500 mm, 2,000 x 1,500 mm
Thicknesses: 0.8 mm, 1.0 mm, 1.5 mm, 2.0 mm, 3.0 mm
other thicknesses and sizes on request.
Tolerances:
thicknes ±10%, length ± 50 mm, widt ± 50 mm

Surfaces
The 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
BAM, DIN-DVGW, TA-Luft, DVGW VP401, FireSafe.
Other approvals in preparation.

Patent pending.

Typical values for a thickness of 2.0 mm			
Compressibility ASTM F 36 J		%	10
Recovery ASTM F 36 J		%	60
Stress relaxation DIN 52913	50 MPa, 16h/ 300°C	MPa	28
	50 MPa, 16h/ 175°C	MPa	32
Stress relaxation BS 7531 1,5 mm	40 MPa, 16h/ 300°C	MPa	27
KLINGER cold/hot compression 50 MPa	Thickness decrease at 23°C	%	10
	Thickness decrease at 300°C	%	14
	Thickness decrease at 400°C	%	20
Tightness	DIN 28090-2	mg/s x m	< 0.02
Specific leakrate VDI 2440	300°C/30 MPa	mbar x l/s x m	4.4 10E-8
Cold compression	DIN 28090-2	%	6 - 9
Cold recovery	DIN 28090-2	%	3 - 5
Hot compression	DIN 28090-2	%	< 18
Hot recovery	DIN 28090-2	%	2
Thickness increase after fluid immersion ASTM F 146	Oil IRM 903: 5 h/150 °C	%	3
	Fuel B: 5 h/23 °C	%	5
Density	DIN 28090-2	g/cm³	1.7
Designation DIN 28091-2	FA-GAZ		
ASTM F104 line call-out	F712122B3E22M5		
Classification acc BS 7531	Grade AX		

KLINGER EXPERT®
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Rich. Klinger Dichtungstechnik GmbH & Co KG
Am Kanal 8-10
A-2352 Gumpoldskirchen, Austria
Tel ++43 (0) 2252/62599-137
Fax ++43 (0) 2252/62599-296
e-mail: marketing@klinger.co.at
http://www.klinger.co.at

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