KLINGER®

KLINGERexpert® 5.2.1 Powerful Sealing Calculation

The KLINGERexpert® 5.2.1 gasket design program is a versatile piece of software to assist users in the selection of non-metallic gasket materials.

KLINGER – The global leader in static sealing

KLINGERexpert® 5.2.1 Powerful Sealing Calculation

The KLINGERexpert® 5.2.1 gasket design program is a versatile piece of software to assist users in the selection of non-metallic gasket materials.

The program uses European industry standard calculations to generate all information involved with selection of suitable materials.

Among the range of functions that can be performed are:

Identification of the best gasket material for specific applications

Design of gasket assemblies

Checks of chemical and temperature suitability

Calculation of bolt torque requirements

The program keeps itself (Application and Database) updated automatically (Internet connection required).

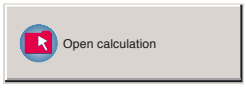
Installation

After inserting the CD into the CD-ROM drive it is possible to choose either to start the KLINGER® product catalogue or to install KLINGERexpert® 5.2.1.

An installation wizard will guide through the set-up process and install KLINGERexpert® 5.2.1 on the computer.

After starting KLINGERexpert® 5.2.1 an information window will appear.

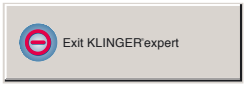
If this message is confirmed with 'Accept' a new window will appear in which the following possibilities can be chosen:



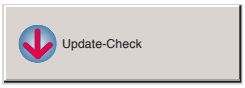
Will open an existing calculation file

Here you can change the default values (i.e. language)

Starts a new gasket calculation



Exits KLINGERexpert® 5.2.1



Search for an update manually

1. New Calculation

1.1 Menu and Toolbar

The following Icons will guide clearly through the many possibilities which KLINGERexpert® 5.2.1 offers:

File

New
Create a new gasket calculation

Open
Opens an existing calculation file

Close Analysis
Closes the actual calculation

Save
Saves the actual calculation

Save as
Will save the actual calculation under a defined name

Print Preview
Displays a preview of the print out

Print
Prints the actual calculation

Create a PDF
Creates a pdf out of the analysis screen

Print settings
Changes the settings for the printout

Exit
Exit the program

Options

Preferences
Opens the settings

Manual Update
Search manually for an update

Help

KLINGERexpert® Help
Opens the KLINGERexpert® 5.2.1 Help

About
Shows information to the program

Read Disclaimer
Shows the disclaimer

Other Toolbar Icon's

Info
Opens the Info dialogue

Gasket catalogue
Shows the corresponding product datasheet to the chosen Gasket

Select flange
Shows the flange selection dialogue

Select gasket dimension
Shows the gasket dimension selection dialogue

Restore initial calc.
Will restore the initial calculation

Quick Help
Opens the KLINGERexpert® 5.2.1 Quick Help

1.2 Flanges

KLINGERexpert® 5.2.1 contains the gasket dimensions and bolting information for a range of standard flanges, including DIN, EN, JIS and ANSI standards.
KLINGERexpert® 5.2.1 can also be used to calculate variables for non standard user defined flanges.

1.3 Gaskets

The dimensions screen can be used to confirm the dimensions of the gasket. When using standard designs most of these values are fixed, with the only variable being the material thickness. The diagram shows the inner and outer diameters of the gasket and also includes the dimensions of the raised face area where applicable. At user-defined flanges the type of gasket has to be chosen.

The first six options for non standard flanges require relatively straightforward variables such as inner and outer diameters, bolt hole sizes and lengths and widths for rectangular gaskets.

The final option "Complex Dimension" requires the area of the gasket to be entered for more complex shapes.

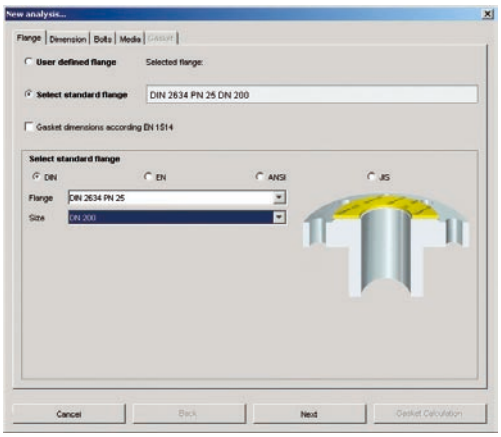


Figure 2 – Flange selection

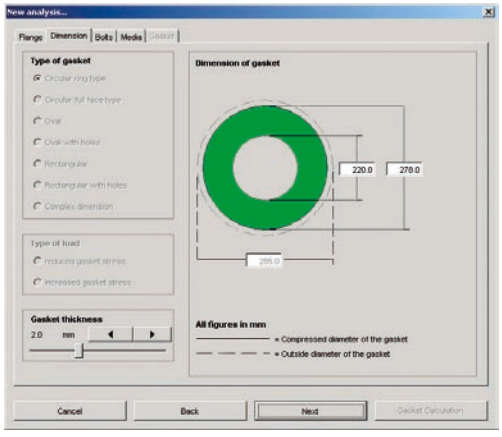


Figure 3 – Gasket dimensions

The calculation goes out from a permanent allocation of the bolts. The areas required are the "Stressed gasket area" and the "Total area" to be entered.

Stressed gasket area
Area of the gasket which will be subjected to compressive load.

Total area
Area subjected to compressive load with the addition of the enclosed pressurised area.

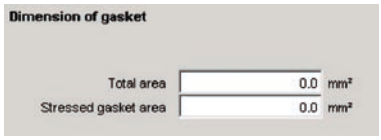


Figure 4 – Complex shape

The type of pressure loading is selected from this screen:

Internal pressure relieved
The most common type of application, when the internal pressure is applied it has the effect of reducing the compressive load on the gasket.

Internal pressure loaded
The option is sometimes required for boiler man way joints for which the lid of the flange is on the inside of the vessel and the internal pressure increases the compressive load on the gasket.

1.4 Bolts

Again, like the "Dimensions" screen most of the bolt details are entered according to the standard and do not need to be altered. The two values that can be changed are the bolt lubrication co-efficient and the bolt material.

For non-standard flanges the type of bolt can first be selected from the option box, this will then alter the available options in the dimension combo box in the "Bolt characteristics" area of the screen.

The number, size and quality of bolt can be identified in their appropriate boxes; the friction coefficient can also be entered.

1.5 Medium

The specification of the medium is the same for both standard and non-standard flanges.The medium can be selected from the drop-down list as shown in figure 5. It is also possible to choose the medium via the chemical formula.

The temperature, pressure and concentration of the application can be typed into the relevant boxes. The aggregate state can be selected from the option box. The required leak rate can be selected; the selection of a medium will select a standard leak rate classification according to the DIN standard.

1.6 Gasket material selection

On the material selection screen there are two main options, "Automatic choice" and "Material input":

Automatic choice

The program selects the correct gasket based on the given application and the pre adjusted values.

Afterwards please carry out the gasket calculation.

Material Input

Selecting of the gasket material suitable for the given application from the material table. The chemical resistance and the maximum permissible temperature of the selected gasket material gives a first indication for the suitability of the gasket material.

Afterwards please carry out the gasket calculation.

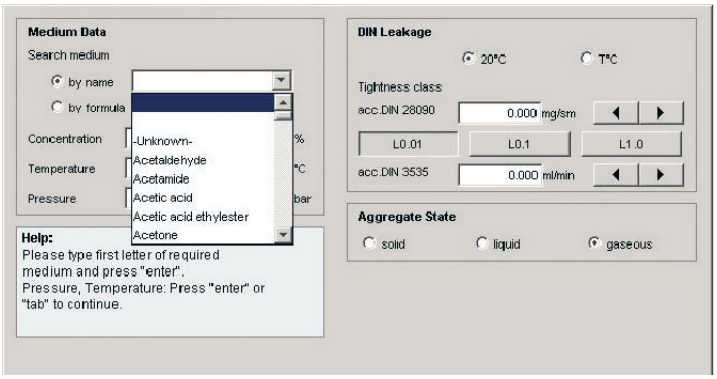


Figure 5 – Medium selection

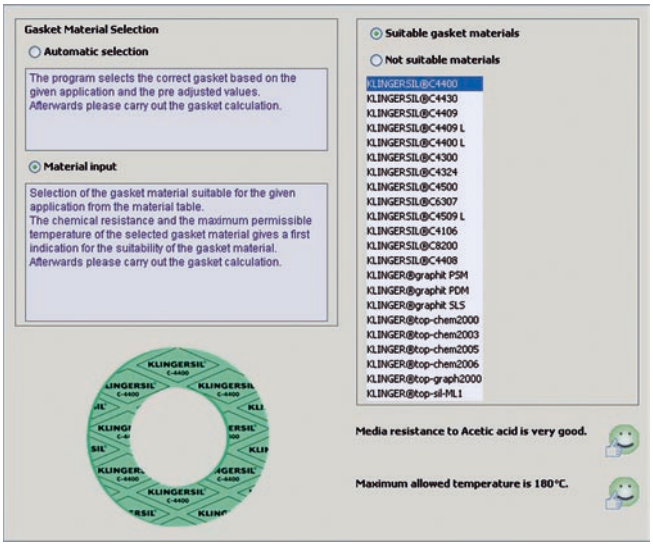


Figure 6 – Gasket material selection

1.7 Calculation results – The analysis screen

The analysis screen is split into a number of areas:

- **Bolt characteristics**
- **Bolt Forces**
- **Gasket conditions**
- **Gasket stresses**
- **Service conditions**
- **Leakage**
- **DIN Leakage**

1.7.1 Bolt characteristics

This area displays information concerning the bolts of the flange:

Bolt number
The number of bolts. This number will be set in calculations involving standard size flanges.

Bolt quality
A range of bolt materials are available for selection.

0.2% creep limit
The stress applied to the bolt material to attain a permanent deformation of 0.2%. This value is a property of the selected material and cannot be independently edited. This value is used in the calculation of the percentage of bolt yield.

Size
The size of bolts. This will be set for applications involving standard size flanges.

Friction
The friction co-efficient of the currently selected bolt material, the lower the value the greater the amount of energy transferred into stretching the bolt and not "wasted" in overcoming the friction of the bolt thread.

Torque
The level of torque currently selected.

1.7.2 Bolt forces

The maximum bolt load is calculated as a function of the material and the bolt material. The yield is a product of the torque applied to the current bolt with the given friction co-efficient.The total bolt force is the sum of the bolt force for the number of bolts given.

1.7.3 Gasket conditions

The current gasket material, thickness, compressed area and total area is displayed and can also be edited.

1.7.4 Gasket surface pressures

The primary information for checking the assembly is calculated and displayed. The definitions of the terms are as follows:

- **Maximum surface pressure under operating conditions σ_{BO}**

The maximum permissible surface stress, given in N/mm², refers to the gasket material and the stated operating conditions. This value may not be exceeded by the effective surface stress.

- **Maximum surface pressure under installing conditions σ_{VO}**

σ_{VO} in accordance with DIN 28090 amounts to the value of σ_{BO} at room temperature. It is always equal to or larger then σ_{BO} and thereby does not represent an additional restrictive limitation in the calculation of the gasket.

- **Minimum surface pressure under operating conditions $\sigma_{BU/L}$**

The minimum surface pressure $\sigma_{BU/L}$ is the surface pressure which must be exercised on the effective gasket area in the operating condition to achieve the desired leakage class with the given medium, internal pressure, temperature and previous value of σ_V of the surface pressure, especially if it is higher. The actual value may not be less than this value in operation in any case.

- **Minimum surface pressure under installing conditions $\sigma_{VU/L}$**

At least this surface stress must be reached on the sealing area through the bolt forces during assembly to guarantee the leakage requirements selected (DIN leakage) under the defined operating conditions.

Because there are limiting influences not covered by the calculation one has to take care that the real installation surface stress will be selected safe above $\sigma_{VU/L}$ as a rule. This applies especially for lower $\sigma_{VU/L}$ values (<10 N/mm²).

$\sigma_{VU/L}$ is a material-specific index and does not yet take account of a possible higher necessary minimum installation surface pressure which will be required because of the relief of the gasket through the internal pressure (cf. $\sigma_{e\,min}$)

- **Minimum installing surface pressure $\sigma_{e\,min}$**

The minimum installed surface pressure $\sigma_{e\,min}$ is the surface pressure which should be reached with the installation of the gasket. It ensures that adequate pressure/ adaptation of the gasket material is achieved (cf. $\sigma_{VU/L}$), and that possible dynamic changes of the surface pressure through the internal operating pressure are taken into account (cf. $\Delta\sigma_p$).

This surface pressure should be reached by the effective pressure in view of the necessary tightness. If this is not the case, meaning that the expected tightness is less than desired, the installation surface pressure can nevertheless still be adequate under certain circumstances.Take account of the DIN Leakage.

- **Hydrostatic end thrust $\Delta\sigma_p$**

This value represents the maximum possible arithmetical reduction or raise of the gasket stress as the result of the operating pressure during operation by this value. The inner pressure can raise (+) or lower (-) the surface pressure during operation. (Additional reducing of the installation surface stress through the real operation conditions e.g. settling of the gasket and reducing of the bolt forces due to temperature influences can not be covered by the calculation and therefore not be taken into consideration in this software).

- **Effective surface stress σ_{eff}**

(Important: Value for the installation) The effective surface stress named here was determined through the calculation. It depends upon the entire bolt load which is made available and the gasket area. Equal surface stress is required over the whole gasket. Using inner pressure loaded gaskets, the effective surface stress here determined by the inner pressure and bolt forces too.

This value is an approximated value, because there are some not considerable parameters which have an influence on it. Also we presume, that the bolts will be tighten up after applying the inner pressure. But you should pay attention, that the bolts receive no overload, when decreasing the pressure.

1.7.5 Service conditions

The currently selected service conditions can be viewed and altered, the results of any changes will automatically be calculated and displayed.

1.7.6 Leak Rates

The effective leak rate represents the equivalent nitrogen leakage for the current gasket arrangement by taking into account bolt forces, internal pressure and the gasket dimensions. The leak rate is calculated at room temperature λ_{20} and the operating temperature λ_T.

1.7.7 DIN leakage

The leak rate is calculated in accordance with DIN 28090 and DIN 3535 and the currently selected tightness class (L= 0.01; L= 0.1; L=1.0).

KLINGERexpert® 5.2.1 program automatically defines a leakage rate based on the media currently selected. The value is calculated for a gasket of dimensions 90 x 50 mm with the current internal pressure, material and thickness.

1.8 Manipulating results

Possibly the most important factor in correct operation of a gasket is the stress exerted on the gasket material, this must be sufficient to counteract the internal pressure and also retain enough stress to compress the material to effect a reliable seal and also must be less than the maximum stress of the material σ_{BO}.

1.8.1 Creating a seal

Materials such as compressed fibre, expanded graphite, modified PTFE and some of the harder rubber materials all require a certain degree of stress to reduce the porosity of the material matrix and deform the surfaces to accommodate imperfections in the flange. The stress required to create a seal varies from material to material.

1.8.2 Maximum permissible stress

The maximum stress capability of a gasket is dependant on a number of factors such as the temperature, material, thickness and with graphite based materials in particular the widththickness ratio. Materials designed for higher pressure duties have a much greater maximum stress than other materials.

The higher the maximum stress capability of the material the higher the internal pressure the gasket can withstand. Sufficient load has to be applied to the gasket to compress the material and also counteract the force due to the internal pressure, generally as the internal pressure increases, the amount of stress released also increases and the initial stress on the gasket must be greater to cater for the releasing effect of the internal pressure.

Once the material is subjected to a load greater than its maximum, the gasket is unlikely to maintain a reliable seal, as the gasket could undergo a large decrease in thickness known as "crashing".

1.8.3 Attaining sufficient gasket stress

The compressive load due to the bolts must be sufficient to compress the material and also counteract the release of load due to the internal pressure. The torque of the bolts must be selected to ensure the effective gasket stress $\sigma_{E\,ff}$ is greater than $\sigma_{E\,min}$ and less than σ_{BO}.

Typically the bolts should be torqued to equate to a utilisation figure of 60-80%. (DIN) ensuring the bolt operates within its elastic region and will not over-stress the bolt.

Figure 7 – Analysis screen

2. Settings

The "settings" screen can be accessed through the "Options" menu and selecting "settings".

Figure 8 – Preferences menu

2.1 Language

The current language used to display information can be altered by selecting it via the pulldown menu.

2.2 Price index

The price index in KLINGERexpert® 5.2.1 is formed as a ratio of the relative prices on one side and on the application frequency of the chosen material on the other side.

The price index is variable and influences the position table of the suitable materials at the automatic choice.

2.3 Weighting

Materials can be selected in two main ways; Manual and Automatic. The Automatic option uses the figures entered in this screen to identify a material. The program can evaluate materials according to 3 factors; Function, Price and Handling. A balance can be struck according to the operators requirements. The function variable must be in the range of 10 to 100%, the example in figure 11 shows 100% function and hence will now select the technically best solution.

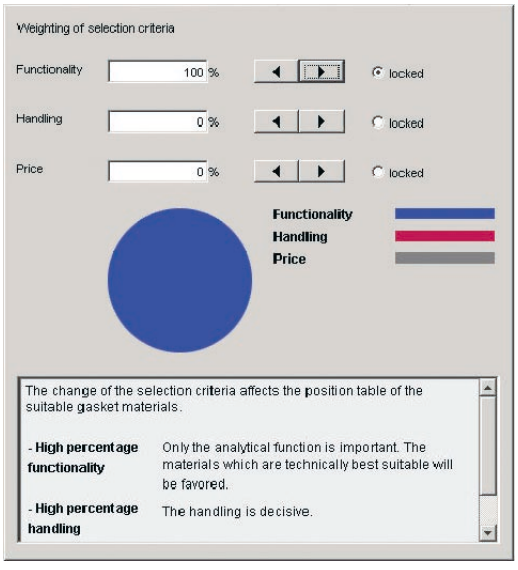


Figure 9 – Weighting

2.4 Standard values

The "Presetting" screen is used to select the preferred or most common start-up requirements for the following variables; bolt quality, co-efficient of friction, bolt utilisation, gasket thickness.

2.5 Display

The units for any calculations can be altered from the "Screen" menu by selecting either SI-Norm or US-Norm (imperial).

2.6 Print Settings

2 fields can be found here:

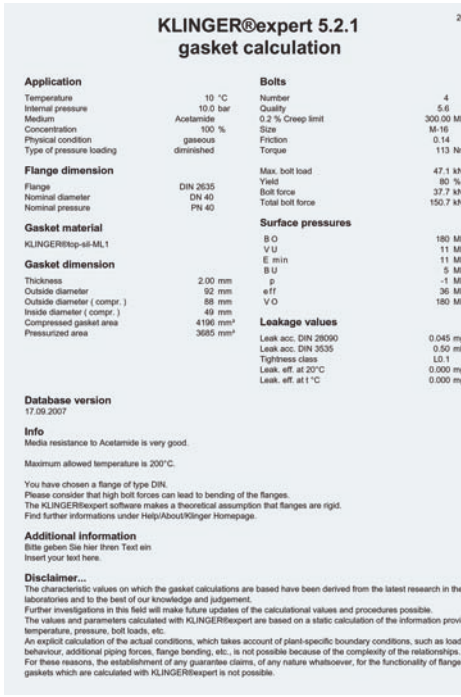
1. Info
In this field a additional permanent text can be entered which then will be shown on every print-out.

2. Info (only for the next print job)
The text entered in this field stays just for the next print-out and will then be resetted.

3. Printout

The calculation results as well as some additional information concerning the gasket materials and the flange connection will be printed on the hard copy.

There is also the possibility to print out an additional text.


KLINGER®expert 5.2.1
gasket calculation

Application
Temperature 10 °C
Internal pressure 10.0 bar
Medium Acetamide
Concentration 100 %
Physical condition gaseous
Type of pressure loading diminished

Flange dimension
Flange DIN 2635
Nominal diameter DN 40
Nominal pressure PN 40

Gasket material
KLINGERtop-sil-ML1

Gasket dimension
Thickness 2.00 mm
Outside diameter 92 mm
Outside diameter (compr.) 88 mm
Inside diameter (compr.) 49 mm
Compressed gasket area 4196 mm²
Pressurized area 3685 mm²

Bolts
Number 4
Quality 5.6
0.2 % Creep limit 300.00 M
Size M-16
Friction 0.14
Torque 113 N
Max. bolt load 47.1 kN
Yield 80 %
Bolt force 37.7 kN
Total bolt force 150.7 kN

Surface pressures
B O 180 M
V U 11 M
E min 11 M
B U 5 M
p -1 M
eff 36 M
V O 180 M

Leakage values
Leak acc. DIN 28090 0.045 m
Leak acc. DIN 3535 0.50 m
Tightness class L0.1
Leak. eff. at 20°C 0.000 m
Leak. eff. at t °C 0.000 m

Database version
17.09.2007

Info
Media resistance to Acetamide is very good.
Maximum allowed temperature is 200°C.
You have chosen a flange of type DIN.
Please consider that high bolt forces can lead to bending of the flanges.
The KLINGERexpert software makes a theoretical assumption that flanges are rigid.
Find further informations under Help/About/Klinger Homepage.

Additional information
Bitte geben Sie hier Ihren Text ein
Insert your text here.

Disclaimer...
The characteristic values on which the gasket calculations are based have been derived from the latest research in the laboratories and to the best of our knowledge and judgement.
Further investigations in this field will make future updates of the calculational values and procedures possible.
The values and parameters calculated with KLINGERexpert are based on a static calculation of the information provi temperature, pressure, bolt loads, etc.
An explicit calculation of the actual conditions, which takes account of plant-specific boundary conditions, such as load behaviour, additional piping forces, flange bending, etc., is not possible because of the complexity of the relationships. For these reasons, the establishment of any guarantee claims, of any nature whatsoever, for the functionality of flange gaskets which are calculated with KLINGERexpert is not possible.

KLINGER®

We have devised
a tried and tested method,
to guide you step by step to the right gasket
for your needs.

1. Applications overview:
The gasket characteristics compared with the criteria to be met in typical application.

2. Product documentation:
A separate data sheet is supplied for each gasket in our range.
The pT diagrams are an invaluable aid to selecting the gasket most suitable for a particular application.

3. Data on chemical resistance:
This section indicates the resistance of the individual Klinger gaskets to over 200 chemicals in common use.

4. Technical information by Fax:
Let us have the details of your particular gasket requirements and you will receive a prompt reply, in some cases within 24 hours.

5. Sealing calculations on your PC:
For the experienced specialist we have developed a powerful program which will answer all your questions on gasket construction, design and maintenance. We supply the software with on-line help.

6. Ideally you should run your own tests:
We will supply the materials you need to carry out tests under your own operating conditions.

7. On-sit advice:
With particularly difficult problems we shall be glad to advice you on-site. We can supply products adapted from our existing range or custom-formulated products.

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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