

User Guide

FreqCalc



Legal notice

1. edition

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Table of Contents

Legal notice	3
1. About this document.....	4
1.1 Layout	4
1.2 What does FreqCalc do? Appropriate usage	5
2. Requirements and safety	6
2.1 General safety notes.....	6
2.2 Web browser recommendations	6
2.2.1 Configuring trusted sites	7
2.2.2 Configuring the pop-up blocker	8
2.3 PDF reader	9
2.4 User account	9
2.4.1 Creating a user account.....	10
2.4.2 Changing your user settings and password	13
2.4.3 Logging out.....	14
3. How it works	16
4. Starting the program.....	17
4.1 Customising your profile.....	18
5. User interface	20
5.1 Project area.....	21
5.2 Input area	22
5.3 Results area	24
5.4 Archive	26
5.4.1 Saving a calculation	27
5.4.2 Opening a saved calculation	27
5.4.3 Deleting a saved calculation	27
5.5 Graphs	28
5.5.1 Deflection curve.....	28
5.5.2 Graph of isolation	30
5.6 Table	32
5.7 Additional option for pre-stressed bearing calculation.....	34
5.7.1 Input bushing area	34
5.7.2 Bushing results area	36
5.7.3 Graph of pre-stressed bearing.....	38
6. Case studies	40
6.1 Case study 1: Simple bearing calculation	40
6.2 Case study 2: Pre-stressed bearing calculation	42
7. Frequently asked questions	45
8. Glossary	46

1. About this document

This user guide has been produced for users of the FreqCalc online calculation program developed by Getzner Werkstoffe GmbH. Users are assumed to be familiar with the use of the internet and to have a basic technical knowledge of the field.

1.1 Layout

Sidebar

The sidebar contains general safety notes on avoiding errors, particularly operating errors, together with background information on the physical principles and important information about vibration isolation.

Symbols



This user guide explains how to use FreqCalc in the appropriate way. The following symbols are used:



This safety note warns of the risk of serious errors in operating the program. Operating errors can lead to serious design faults and hence to damage to installed machines or components. At these points always check that you have entered your data correctly. If you need help with technical questions, consult a trustworthy source with technical expertise or contact Getzner Werkstoffe GmbH.



This safety note warns of the risk of errors in operating the program that could lead to a misinterpretation of the results or to a loss of data and indicates safety-related aspects of data management. At these points double-check the data you have entered.

This note offers tips to simplify the use of the program or provides background information on calculating or interpreting results.

Styles

Any data that can be entered via your computer keyboard is printed in italics in this guide. *Italic*

This data may be either text (e.g. *project XY*) or numbers e.g. *12,345*).

All inputs that can be made with your mouse are printed in bold in this guide. **Bold**

Sequences of steps are linked by means of a ▶ symbol.

Example: Select **File▶Print**

This symbol indicates a required action. It instructs you to carry out an action. ▶

This symbol indicates the results of an action. In order to obtain the results, you must first carry out the preceding action. -

Screenshots

Screenshots illustrate individual steps or results and are designed to help you carry out the actions. The relevant areas are framed by a red line.

1.2 What does FreqCalc do? Appropriate usage

FreqCalc is used for calculating elastic polyurethane materials from Getzner Werkstoffe GmbH.

The calculations are based on the physical model of an SDOF oscillator with a weightless spring on a solid, smooth foundation. The calculation program FreqCalc makes calculations based on the assumption of loading with a rigid mass in the centre of gravity. The calculated values are relevant for the degree of freedom in the vertical direction (1st degree of freedom), taking into consideration the non-linear behaviour of the material. The latest material data is always applied, taking shape factor dependence into account. Calculations that do not fall within this model cannot be performed with FreqCalc.

2. Requirements and safety

FreqCalc is a web-based solution and operates in a web browser. All values for the calculation are entered in an input screen. The calculation is performed on the server. Then the results are returned to the program. FreqCalc operates independently of any operating system. No installation on your computer is required. You do not need administrator rights. All you need is internet access and a standard web browser.

2.1 General safety notes

In order to use FreqCalc, you need a basic technical understanding of the field. Only use the program if you are able to interpret the results correctly.

2.2 Web browser recommendations

You can use any web browser, provided it supports the following functions:

- Cookies
- JavaScript



Use the recommended web browsers to ensure error-free operation.

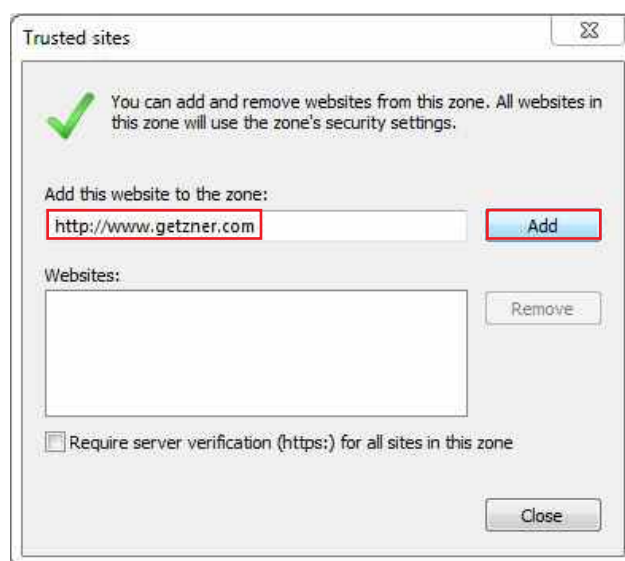
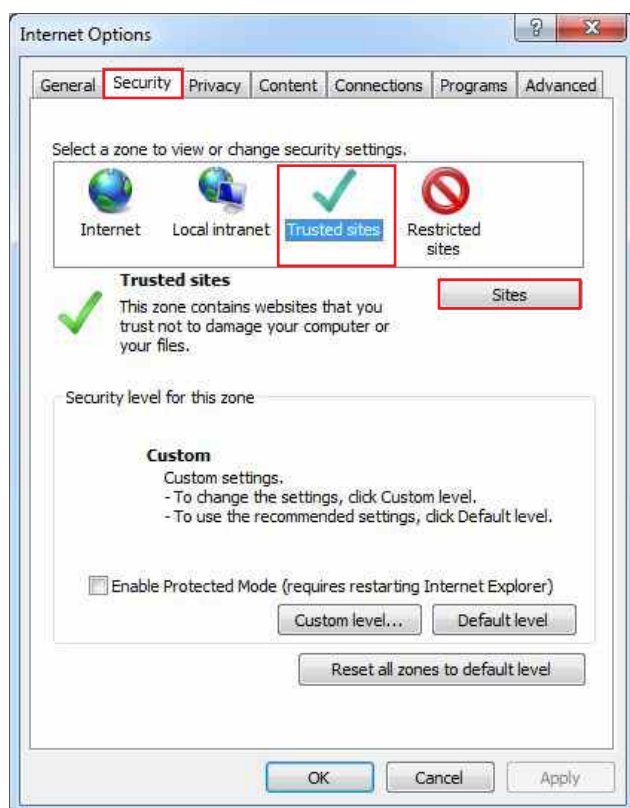
Optimum results for error-free operation are obtained with the following web browsers:

- Microsoft® Internet Explorer® Version 7 or higher - <http://www.microsoft.com>
- Mozilla Firefox® Version 3 or higher - <http://www.mozilla-europe.org>

2.2.1 Configuring trusted sites

FreqCalc operates with JavaScript. The default security level in Microsoft® Internet Explorer® can prevent pages containing ActiveX or Script elements and plug-ins from displaying correctly. If you use Microsoft® Internet Explorer®, add <http://www.getzner.com> to your list of trusted sites.

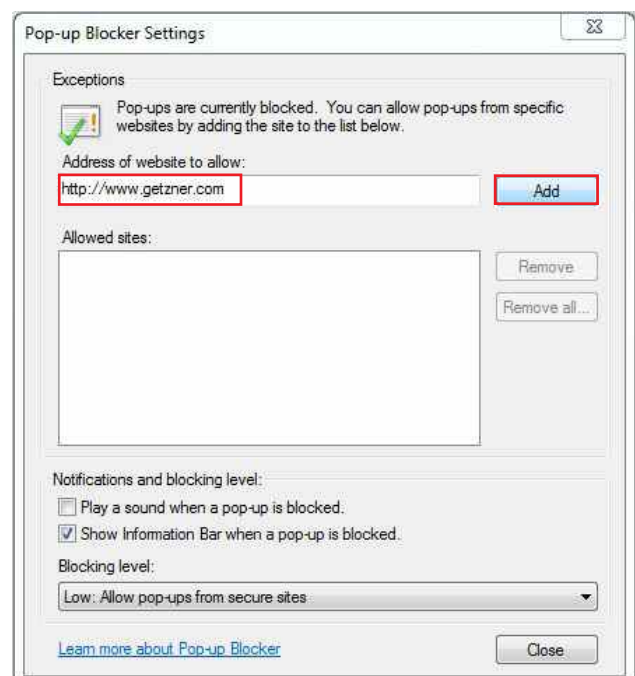
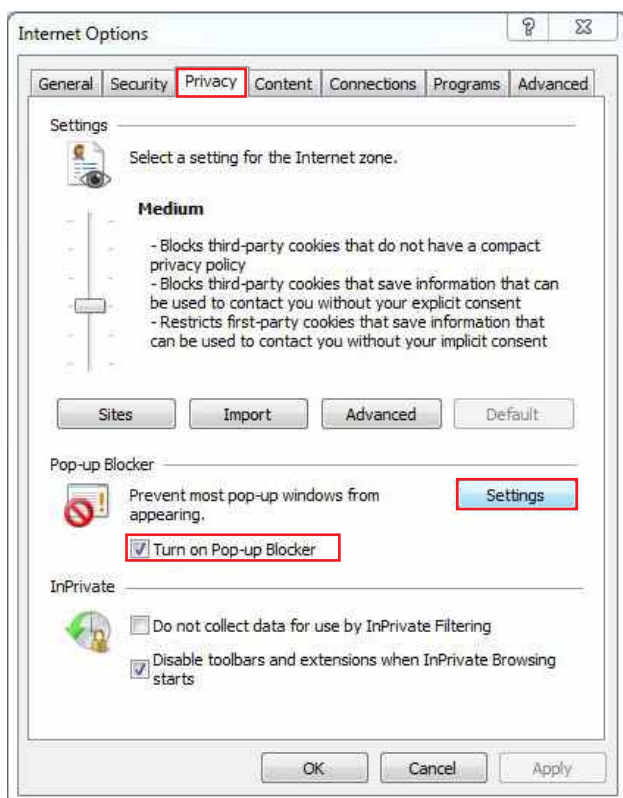
- › Start Microsoft® Internet Explorer®.
- › Select **Tools >Internet** options.
 - The Internet options dialog opens.
- › Select the **Security**.
- › Select the **Trusted sites** zone and then click **Sites**.
 - The Trusted sites dialog opens.
- › Enter *http://www.getzner.com* in the input field and click **Add**.
 - The site now appears under Websites.



2.2.2 Configuring the pop-up blocker

FreqCalc allows you to export calculations in PDF format. The export function uses pop-ups. If you use Microsoft® Internet Explorer® it is advisable to configure the pop-up blocker to allow pop-ups from <http://www.getzner.com>. To configure the pop-up blocker, proceed as follows.

- › Start Microsoft® Internet Explorer®.
- › Select **Tools>Internet options**.
- The Internet options dialog opens.
- › Select the **Privacy**
- › Tick the Turn on **Pop-up Blocker checkbox** and then click **Settings**.
- › Enter <http://www.getzner.com> in the input field and click **Add**.
- The site now appears under Allowed sites.
- Pop-ups from this website are allowed.



2.3 PDF reader

You can export calculations in PDF format and save them on your computer or print them. This allows you to display the input values and calculated results in an organised fashion. In order to read or print the PDF files you need a standard PDF reader. These are available on the internet for download from the manufacturers' websites and are normally free of charge.

Standard PDF readers:

- Adobe® Reader®: <http://www.adobe.com>
- Foxit® Reader: <http://www.foxitsoftware.com>
- PDF-XChange Viewer: <http://www.tracker-software.com>

2.4 User account

FreqCalc can only be used if you have an active user account on the Getzner Werkstoffe homepage. This user account gives you access to the closed website area, with specific information about materials and products. This information includes:

- General material data
- Background information about material properties and vibration isolation
- Chemical resistance of materials
- Material data sheets for the Sylomer® and Sylodyn® product ranges
- Product data sheets from the railway and construction sectors
- FreqCalc calculation program

2.4.1 Creating a user account

To create a user account on the Getzner Werkstoffe homepage, proceed as follows.

- > In the address line of your web browser type the address *http://www.getzner.com*.
- > In the menu at the bottom left of the screen select **Login**.
- > In the text underneath the input fields select the word **>Register now**.

The screenshot shows a web browser window at the URL `apps.getzner.com`. The page is titled "User login". The main content area contains the following elements:

- A heading "User login".
- A sub-heading "Enter your username and password here in order to log in on the website:".
- An input field labeled "YOUR EMAIL ADDRESS" with the placeholder text "Your email address".
- An input field labeled "PASSWORD" with the placeholder text "Password".
- A link "Forgot your password?" and a "Login" button.
- A message: "Not yet registered? Use our calculation apps Typematch and FreqCalc. It's quick and free."
- A "Register now" button, which is highlighted with a red rectangular box.

The top navigation bar includes "DOWNLOADS", "SUBJECT AREAS", "CASE STUDIES", "REFERENCES", "LOGIN" (highlighted with a red box), and "EN". The main navigation bar includes "PRODUCTS", "APPLICATIONS", "LATEST NEWS", "CAREERS", "SERVICE", and a search icon.

Registration form

Gender *
 Mr
 Ms

Title

First name *

Last name *

Password *

Confirm password *

Company *

Address *

Postal code *

City *

Country *

Preferred language *

Number format *

Use angloamerican system for calculations

Telephone *

Fax

Email *

By sending us your data, you agree that we are allowed to store the data on our server for marketing purposes. *



By sending us your data you agree to your data being stored on our server and possibly to being contacted by a member of the Getzner Werkstoffe team. We will not pass on your data to third parties.

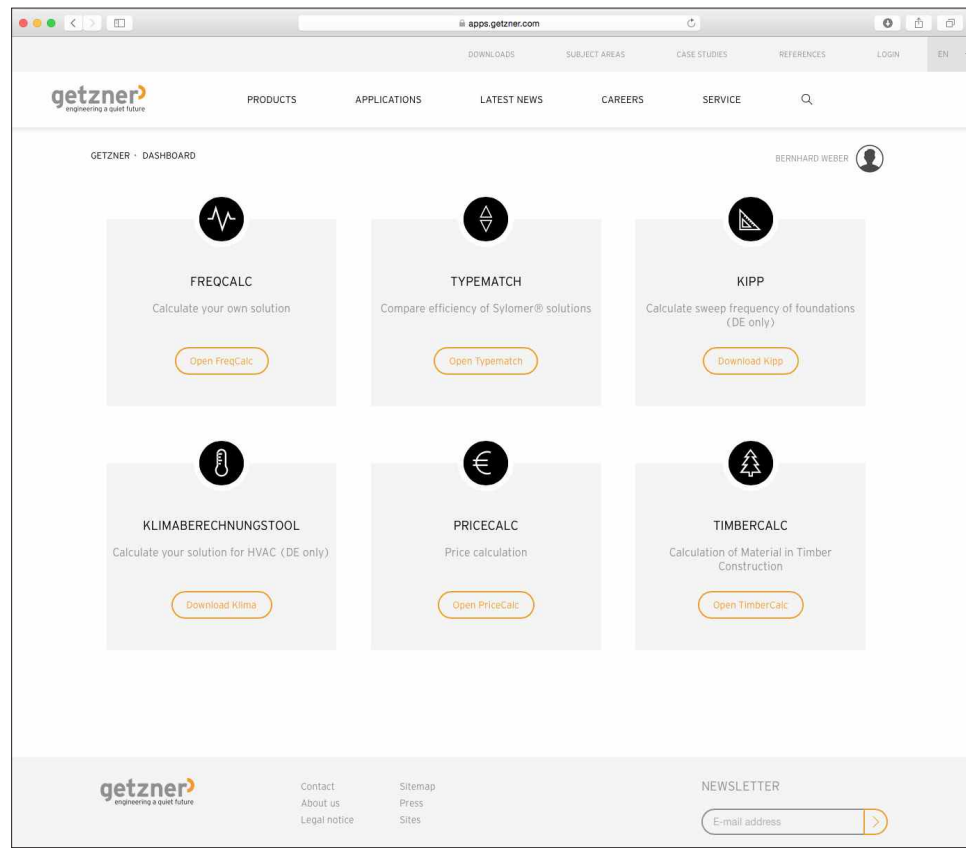


Your password is sent to the server in encrypted form. For that reason the string of characters displayed in the input field is longer than your password.



Store your password separately from your email address. Choose a location which nobody else can access. Getzner Werkstoffe will never ask you for your user details over the telephone or by email. If you receive a suspicious email, do not reply to it. Instead please notify us immediately by calling us on +43-5552-201-0.

- This will take you to the registration page.
- › Enter your *personal details* in the required fields and read the note in the right-hand column.
- › Tick the **checkbox** to confirm that you have read the note in the right-hand column.
- › To complete the registration process click **Submit**.



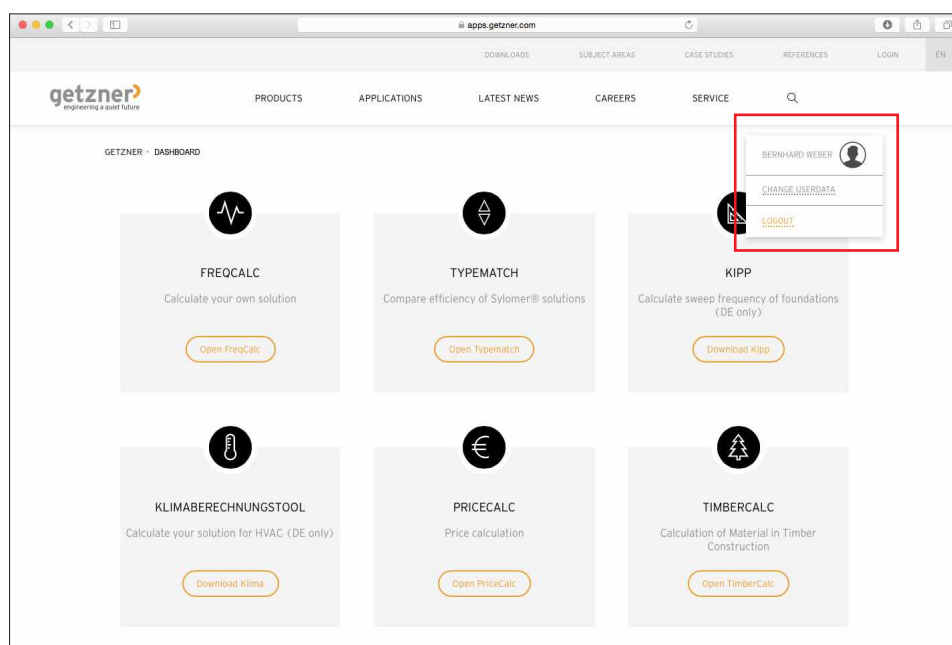
It can take up to 24 hours to process an application. Getzner Werkstoffe reserves the right to deny access to the calculation program.

- You will shortly receive an email sent to your nominated email address.
- > Click on the **confirmation link** in the email to confirm your registration.
- This will take you to the Getzner Werkstoffe homepage.
- Three selection fields appear in the web browser: FreqCalc, Typematch and TimberCalc
- > Before you can use the FreqCalc or TimberCalc programs, you will need to request authorisation by clicking **Request authorisation**
- Once your request has been verified, you will receive an email confirming successful activation and containing a link to the relevant calculation program (FreqCalc or TimberCalc).
- > You only need to activate the program once. You can now access the desired calculation program via the login field on the Getzner Website.
- > You can use the Typematch program without requesting authorisation by clicking on **>Open Typematch.**

2.4.2 Changing your user settings and password

You can change your details in the closed user area at any time.

- › In the address line of your web browser type the address *http://www.getzner.com*.
- › In the menu at the top right of the screen select ›**Login**.
- › In the Login screen enter your *email address* and your *password*.
- › Click ›**Login**.
 - This takes you to the closed user area.
 - The user symbol is displayed with your name at the top right.
- › Move the cursor over the user symbol and click ›**Change userdata**.

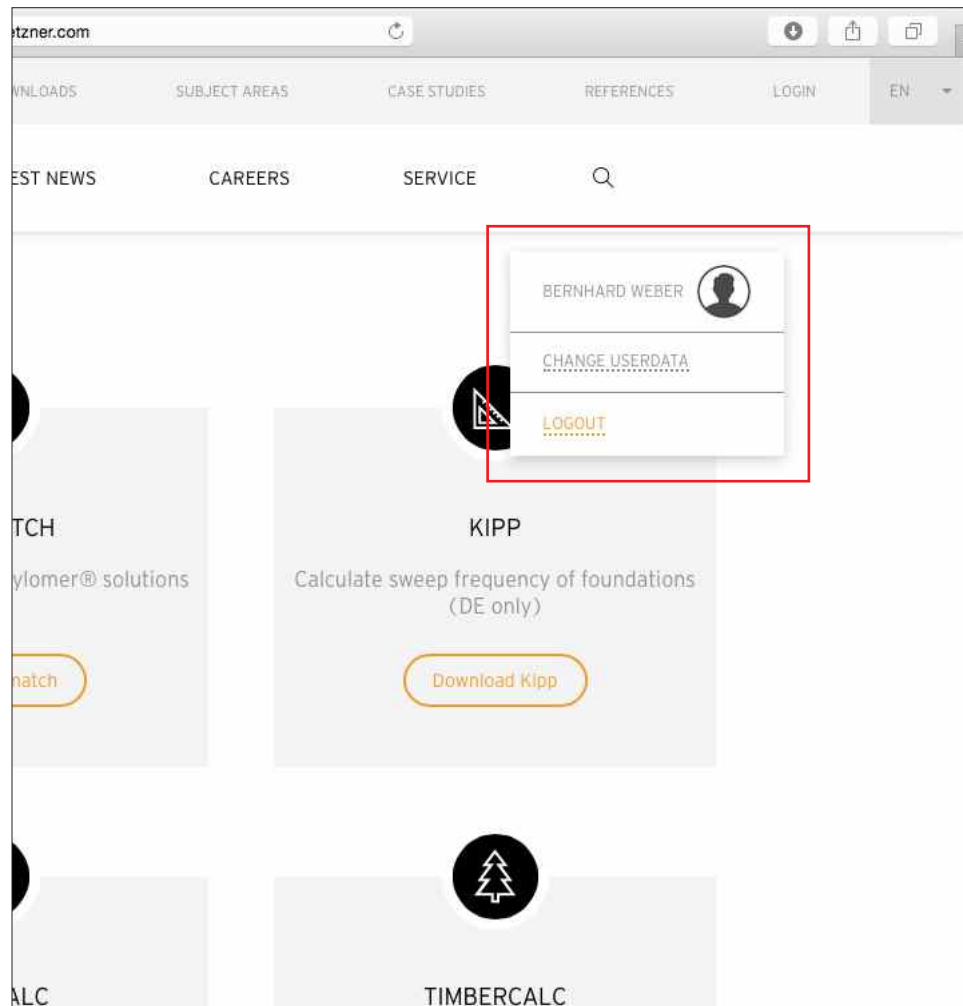


- › Enter any changes in the corresponding input field and confirm by clicking › **Submit**.
 - The text will confirm that your details have been updated.

2.4.3 Logging out

You can leave the closed user area at any time.

- › Move the cursor over the user symbol and select **Logout**.
- You will be logged out and returned to the login screen.



You can reset your password at any time.

- > In the address line of your web browser type the address
- > *http://www.getzner.com*.
- > In the menu at the top right of the screen select **Login**.
- > Select **>Forgot your password?** under the password input field.
- Type your *email address* in the input field and click **>Reset password**.
- You will shortly receive a new password sent to your nominated email address.



Remember to change your password again once it has been reset.

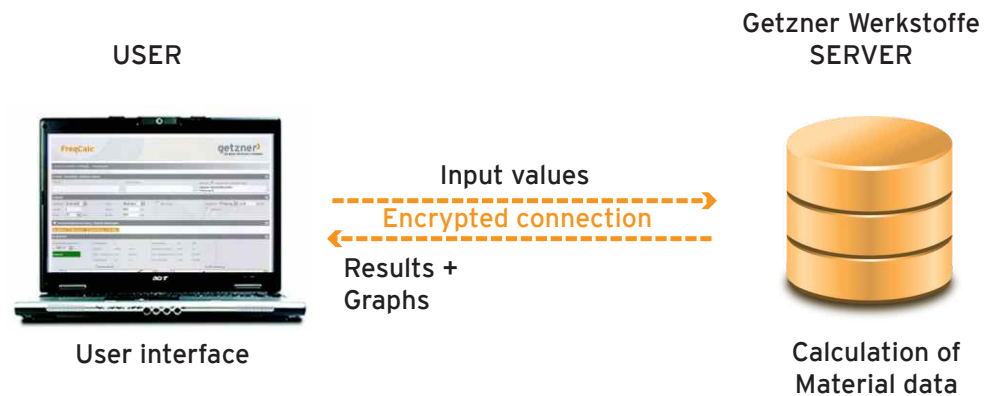
3. How it works

FreqCalc is an online solution. This means that you do not have to install the program on your computer in order to use it. So no program data or material values are stored on your computer, and the program does not access your computer to perform a calculation.

All the input values needed for a calculation are entered in an input screen (the user interface). There are a number of different functions and input options.

Once you have finished entering your data, clicking the Calculation button in the user interface sends all values to the Getzner Werkstoffe server. The calculation is then performed on the server. The results are returned to the user interface and displayed as numerical values and graphs.

All connections are encrypted and ensure the highest security standards.



4. Starting FreqCalc

The first time you start the calculation program you will see the conditions for using FreqCalc. Read them through carefully and accept them. You can also download and store the conditions for use in PDF format. To start the program, proceed as follows.

- › Log in to the closed user area on the Getzner Werkstoffe website.
- › Select **Open FreqCalc** on the overview screen for the different calculation programs.
- The conditions for use will appear.
- › Read through the conditions for use carefully.
- › Tick the **I accept the conditions** checkbox and then click **›Continue to FreqCalc**.
- The FreqCalc calculation program starts.



You can also download and store the conditions for use in PDF format. To do so, under the conditions for use select **›Download as PDF**.

If you do not want the conditions for use to be displayed each time you open the program, tick **›Don't ask me again**.

GETZNER · USER AREA · FREQCALC MAX MUSTERMANN

CONDITIONS FOR USE OF THE ONLINE CALCULATION PROGRAM FREQCALC

Use of the calculation program FreqCalc is permitted under the following conditions. Upon beginning to use the calculation program FreqCalc, the User fully and irrevocably accepts the following conditions of Getzner Werkstoffe GmbH (hereinafter: "Getzner"):

The calculation program FreqCalc was developed by Getzner. The copyright and all other rights belong to Getzner. Getzner reserves the right to alter the calculation program FreqCalc at any time. In the event of alteration, registered users will receive notification to this effect, whereby Getzner accepts no liability that all registered users will be notified nor that such notification will take place in due time.

The calculation program FreqCalc is provided only to the User and is restricted to personal use by said User. Any other use, in particular creation and dissemination of copies of the calculation program FreqCalc, by the User is forbidden.

Getzner provides the calculation program FreqCalc to the User free of charge and independently of the purchase of Getzner products. A pre-requisite for this is the prior registration of the User with the required User data. Said data are stored on our server and are used to contact the User. If the User desires, the calculations which are prepared can be saved on Getzner's server and can be deleted. The User hereby grants its express permission for Getzner to save the User data and calculations.

The calculation program FreqCalc is based on the experience and expertise of Getzner. To the extent allowed by law, in relation to the calculation program FreqCalc Getzner assumes no warranty or liability for the contents, freedom from errors, modes of use or suitability for the specific needs of the User. Use of the calculation program FreqCalc or the results of the program's calculations shall not form the basis of any claims by the User against Getzner. The User shall be solely responsible for use of the calculation program FreqCalc and the results of such. The User shall bear sole responsibility for its entry of data into the program and the assessment of the correctness and suitability of the calculation results.

The calculation program FreqCalc is calibrated to the technical parameters from the data sheets of Getzner. The parameters in the data sheets are based on the experience and expertise of Getzner. Generally speaking, they can be taken as guidelines and calculation values with due consideration of the

4.1 Customising your profile



The Getzner Werkstoffe logo is included as standard in PDF exports. You can customise your PDF exports if you wish, by adding your company logo for example. If you do not want to include a customised logo, leave this box empty.

Make sure that your logo complies with the following criteria:

File format: JPG / GIF / PNG

File size: max. 500 kB

Aspect ratio: 7:3

You can personalise your settings and user data at any time. To do so, proceed as follows.

- › Move the cursor over the user symbol and select ›**Change userdata**.
 - The settings dialogue opens.
- › Enter the corresponding details into the required fields.
- › Logo: If you would like to customise your PDF exports to include a logo (e. g. company logo) click ›**Browse** under the **Logo menu item** and **select** the appropriate logo from your data file structure.
- › Click **Open**.
 - The path to your logo on your computer appears in the input field.
- › Choose the **language** in the dropdown menu. The following languages are available:
 - **German**
 - **English**
 - **French**
 - **Spanish**
 - **Danish**
 - **Italian**
 - **Polish**
 - **Russian**
 - **Czech**
- › Choose your preferred number format in the dropdown menu.
- › If desired, you can select the Anglo-American system for your calculation.
- › Address: If you want to customise your PDF exports to show your address, enter the details in the **Default address for FreqCalc projects** input field.
- › To apply these settings, click ›**Submit**
 - The text will confirm that your details have been updated.
- › To return to the FreqCalc user interface, select ›**Dashboard** and ›**Open FreqCalc** via the selection window.

Gender *

- Mr
 Ms

Title

Enter your title

First name *

John

Last name *

Doe

Company *

Samplefirm

Address *

Sampleway

Postal code *

123456

City *

Midtown

Country *

United Kingdom

Telephone *

+43 5572 394904

Fax

Enter your business fax number

Logo

Keine Datei ausgewählt

Preferred language *

English

Number format *

English

Use angloamerican system for calculations

Default address for FreqCalc projects

Sampleway 245548 MidtownCrazy country

Submit

5. User interface

Project area

Input area (Input main bearing)

Calculation of pre-stressed bearing | Input bushing

Results area (Bushing results)

Results area (Main bearing results)

Graphs (Deflection curve and graph of isolation)

Table

Graph of pre-stressed bearing

Download buttons

Basis of calculation

Project | by:
Project: Remark: Address: Load saved address

Input Main bearing
Material: Sylomer® Shape: Rectangle Holes: Load Type: Load 0,08 N/mm²
Quantity: 1 Length: 300 mm Width: 300 mm Secant
Thickness: 25 mm

Calculation of pre-stressed bearing | Input bushing
Material: Sylomer® SR110 Shape: Rectangle Holes per bushing: Deflection under: 1 mm
Bushings per main bearing: 1 Length: 100 mm Quantity: 1 preload:
Thickness: 25 mm Width: 100 mm Diameter: 10 mm
Calculate Reset Save Archive Manual License

Results Bushing
Shape factor: 0,9 Load of bushing: 0,053 N/mm² Preload force (*): 0,53 kN (* refers to all bushings per main bearing
Surface (*): 9921 mm² Capacity: 52 % Dyn. Stiffness (*): 0,67 kN/mm bearing

Results Main bearing considering the influence of the bushing
Choose material: SR110 Best
Shape factor: 3 Deflection: 1,5 mm
Surface: 90000 mm² Natural frequency: 15,3 Hz
Static load limit: 0,11 N/mm² Dynamic bedding modulus: 0,068 N/mm³
Capacity: 78 % Dyn. Modulus of elasticity: 1,71 N/mm²

Deflection curve
Load [N/mm²] vs Deflection [mm]

Graph of isolation
Isolation [dB] vs Frequency [Hz]

Frequency [Hz]	Isolation [dB]	Degree of isolation [%]
4,0	0,6	-7
5,0	1,0	-12
6,3	1,6	-20
8,0	2,7	-37
10,0	4,7	-72
12,5	9,0	-183
15,3	17,2	-621
16,0	15,5	-495
20,0	3,0	-41
25,0	-4,3	39
31,5	-9,9	68
40,0	-14,9	82
50,0	-19,1	89
63,0	-23,3	93
80,0	-27,3	96
100,0	-30,9	97
125,0	-34,3	98
160,0	-37,9	99
200,0	-41,0	99

Legend Deflection curve
blue line Static load limit
green or red (overload) line Load Type

Pre-stressed bearing
Force [kN] vs Deflection [mm]

Legend Pre-stressed bearing
Main bearing: Sylomer® SR110
F1 = 7,2 kN (Load), x1 = 1,5 mm (Deflection)
Bushing: Sylomer® SR110
F2 = 0,53 kN (Load of bushing), x2 = 1 mm (Deflection under preload)

Download: English Calculation Product datasheet
E-Mail: English Calculation Product datasheet

Base of calculation:
The calculations are based on the physical model of a harmonic oscillator with a mass-less spring on a solid and plane foundation. The calculation program FreqCalc makes calculations based on the assumption of a rigid mass in the centre of gravity. The calculated values are relevant for the degree of freedom in the vertical direction (1st degree of freedom), taking into consideration the non-linear behavior of the material. The material data takes into account shape factor dependency and was last updated on 11/3/2014 | SW-Version 150610

5.1 Project area

The screenshot shows a form titled "Project by:" with three input fields: "Project:", "Remark:", and "Address:". The "Address:" field includes a checked checkbox and the text "Load saved address". A red line connects the "Project:" field to its description, the "Remark:" field to its description, and the "Address:" field to its description. A "NOTE" icon is also present.

Project:

Input field for the name of your project.

Remark:

Input field for additional comments about the project.

Address:

Ticking the checkbox loads the specified address. You can also enter an alternative address in the input field.



If you do not want an address to be included in the printed output, leave this field blank.

Author:

Shows the name under which you registered.



5.2 Input area

If you ticked the checkbox for the pre-stressed bearing calculation function, the title changes to „Input main bearing“.

Material:

Dropdown menu for selecting different product ranges. The product ranges available to you will depend on your user rights.

Quantity:

Defines the number of bearings used.

Thickness:

Dropdown menu for selecting a standard material thickness. You can also enter a custom material thickness in the field.

Shape:

Dropdown menu for selecting a bearing shape. The following shapes are available: **Rectangle** and **Cylinder**.

Length:

[Condition: **Shape = Rectangle**]: Defines the length of your bearing.

Width:

[Condition: **Shape = Rectangle**]: Defines the width of your bearing.

Diameter:

[Condition: **Shape = Cylinder**]: Defines the diameter of your bearing.

Holes:

Checkbox to activate the Holes function. The centre point of a hole is aligned centrally with the bearing.

Quantity:

[Condition: **Holes** checkbox ticked]: Defines the number of holes in the bearing.

Diameter:

[Condition: **Holes** checkbox ticked]: Defines the diameter of the holes.



The specified thicknesses are standard material production thicknesses. Custom thicknesses may give rise to additional production costs, with implications for delivery time and price.



Units

Disregarding the units can have serious consequences for the calculation. Always check the unit when you enter the load value.

Load type:

Dropdown menu for selecting the load type. The available load types are Load, Mass and Force. The input field determines the value of the specified load.

Secant:

Checkbox to activate the Secant stiffness function. The input fields determine the lower and higher limits.

The screenshot shows the FreqCalc software interface. At the top, there is a 'Project | by:' section with fields for 'Project:', 'Remark:', and 'Address:'. The 'Address:' field has a checked checkbox labeled 'Load saved address'. Below this is the 'Input' section with various parameters: 'Material:' (Sylomer®), 'Shape:' (Rectangle), 'Holes' (checkbox), 'Load Type:' (Load), '0.08 N/mm²', 'Quantity:' (1), 'Length:' (300 mm), 'Width:' (300 mm), and 'Thickness:' (25 mm). At the bottom of the input section, there is a 'Secant' checkbox. Below the input section are four buttons: 'Calculate', 'Reset', 'Save', and 'Archive'. To the right of these buttons are two more buttons: 'Manual' and 'License'.

Reset button: Restores the input fields and dropdown boxes to their original status.

Save button: Saves the current calculation under the specified project name.

Calculation button: Starts the calculation using your specified values.

Archive button: Opens the calculation archive, in which up to ten calculations can be stored.

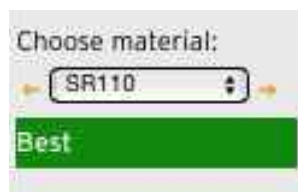
FreqCalc User Guide for download

Conditions for use for download

Load saved address: If the box is checked, the program automatically uses the address specified during customisation (see 4.1). If the box is not checked, an individual project address can be entered.

5.3 Results area

Results Main bearing considering the influence of the bushing					
Choose material:	Shape factor:	3	Deflection:	1.5	mm
SR110	Surface:	90000 mm ²	Natural frequency:	15.3	Hz
Best	Static load limit:	0.11 N/mm ²	Dynamic bedding modulus:	0.068	N/mm ³
	Capacity:	78 %	Dyn. Modulus of elasticity:	1.71	N/mm ²



Choose material:

Shows the material calculated on the basis of your inputs. Use the orange arrows to the left and right of the dropdown menu to select the next softest or stiffest material. The results are refreshed each time you change the material type.

If a material is the best one based on your inputs, the word „Best“ is displayed below the dropdown menu, against a green background.



Cellular materials such as Sylomer® SR 11, SR 18 and SR 28 are volume-compressible, so the influence of shape factor on stiffness can be disregarded. As the elastomer compactness increases, however, the shape factor becomes increasingly important.

Shape factor:	3
Surface:	90000
Static load limit:	0.11
Capacity:	78

Shape factor:

The shape factor is a geometric measure of the shape of an elastomer bearing and is defined as the quotient of the surface area under load and the curved surface area of the bearing. The deflection curve for elastomers is dependent on the shape factor (already taken into account in the calculation).

Surface:

The surface area under load of the (main) bearing.

Shape factor:	3
Surface:	90000
Static load limit:	0.11
Capacity:	78

Static load limit:

Indicates the value up to which the material can be used under a permanent static load. This value is dependent on the shape factor.

Capacity:

The capacity of the material under the specified load.

Deflection:	1.5	mm
Natural frequency:	15.3	Hz
Dynamic bedding modulus:	0.068	N/mm ³
Dyn. Modulus of elasticity:	1.71	N/mm ²

Deflection:

Distance by which the material is compressed when the specified load is applied.

Natural frequency:

Lowest vertical natural frequency of the elastically supported system. The lower the natural frequency, the higher the vibration isolation.

Dynamic bedding modulus:

Ratio of the dynamic stiffness to the surface area under load. This is also known as stiffness per unit area.



Different load values

The values for dynamic loads or peak loads are different from those for static loads. Please refer to the individual product data sheets for exact values.



Overload

The calculated material overload is given as a percentage. The field is shown with a red background. Check your inputs and choose the next highest material type from the dropdown menu. In case of doubt please contact Getzner Werkstoffe.

Deflection:	1.5	mm
Natural frequency:	15.3	Hz
Dynamic bedding modulus:	0.068	N/mm ³
Dyn. Modulus of elasticity:	1.71	N/mm ²

Dyn. modulus of elasticity:

The result shows the dynamic modulus of elasticity under the specified load for the defined material type.

Secant stiffness:

This result is only displayed if the Secant checkbox is ticked in the Input (or Input main bearing) area and the lower and upper limits have been entered. Secant stiffness is an additional value that is not absolutely necessary for a load rating. Experience shows that this value is mainly used in the railway sector.

5.4 Archive

The archive can be used for storing, opening and deleting calculations.

Archive			
Project	Date		
Number 2	25.06.2012	Open	Delete
	15:13		

Number 1	25.06.2012	Open	Delete
	15:13		

Project: Shows the name under which the calculation was saved.

Date: Shows when the calculation was saved.

Open button: Inserts the stored values in the input fields in the user interface.

Delete button: Deletes the stored calculation from the archive.

X: Closes the Archive dialog.

5.4.1 Saving a calculation

You can save calculations in the archive. To do so, proceed as follows.

- › Enter your *details* in the input fields.
- › Click the **Save** button.
- The calculation is saved in the archive under the specified project name.



You can store up to ten calculations in the archive.

5.4.2 Opening a saved calculation

To open a saved calculation from the archive, proceed as follows.

- › Click the **Archive** button.
- The Archive dialog opens. The saved calculations are listed as a table in date order. Each record shows the project name, date and time.
- › Next to the record you wish to open, click the **Open** button.
- The input values are inserted in the input fields.

5.4.3 Deleting a saved calculation

To delete a saved calculation from the archive, proceed as follows.

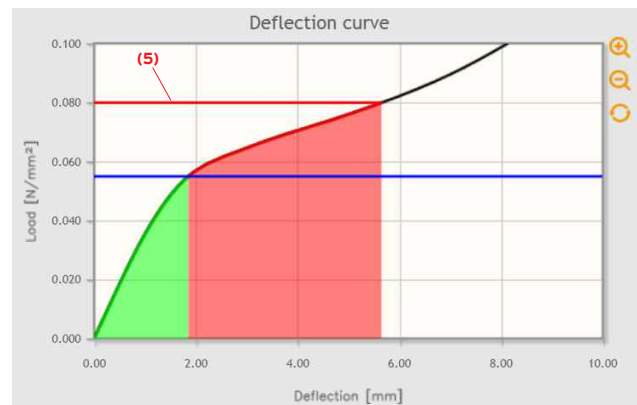
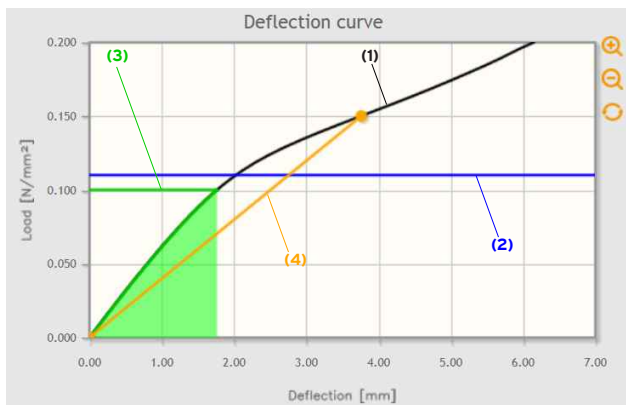
- › Click the **Archive** button.
- The Archive dialog opens. The saved calculations are listed as a table in date order. Each record shows the project name, date and time.
- › Next to the record you wish to delete, click the **Delete** button.
- The record is deleted from the archive.
- › To close the Archive dialog, click **X**.

5.5 Graphs

5.5.1 Deflection curve

The deflection curve (1) maps the relation between load and deflection for the material type. The horizontal blue line (2) shows the static load limit for the selected material type. The horizontal green line (3) shows the specified load. The area below is shown in green. A material overload occurs at the point at which the specified load exceeds the static load limit. An overload is indicated in the chart by a red line (5). The area below is shown in red.

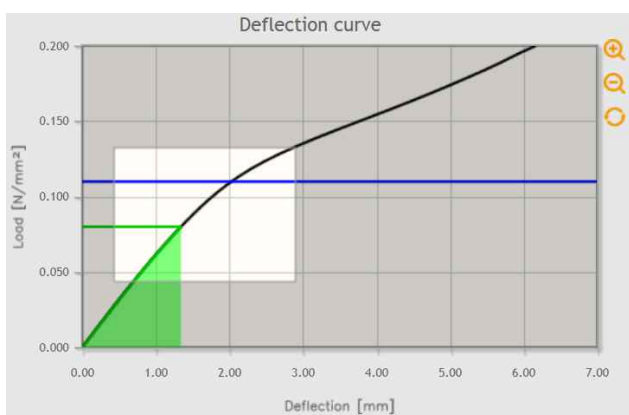
If a secant is specified, this is shown as a straight orange line (4) from the defined lower limit to the defined upper limit.



Expanding areas of the deflection curve

You can expand the view of areas of the deflection curve. To do so, proceed as follows.

- › Move your mouse pointer over the chart.
- The mouse pointer turns into a cross.
- › Position the centre point of the **cross at the top left corner** of the area you wish to expand.
- › Hold down the left mouse button and drag the centre point of the **cross to the bottom right corner** of the area you wish to expand.
- › Release the left mouse button.
- An expanded view of the selected area is displayed.



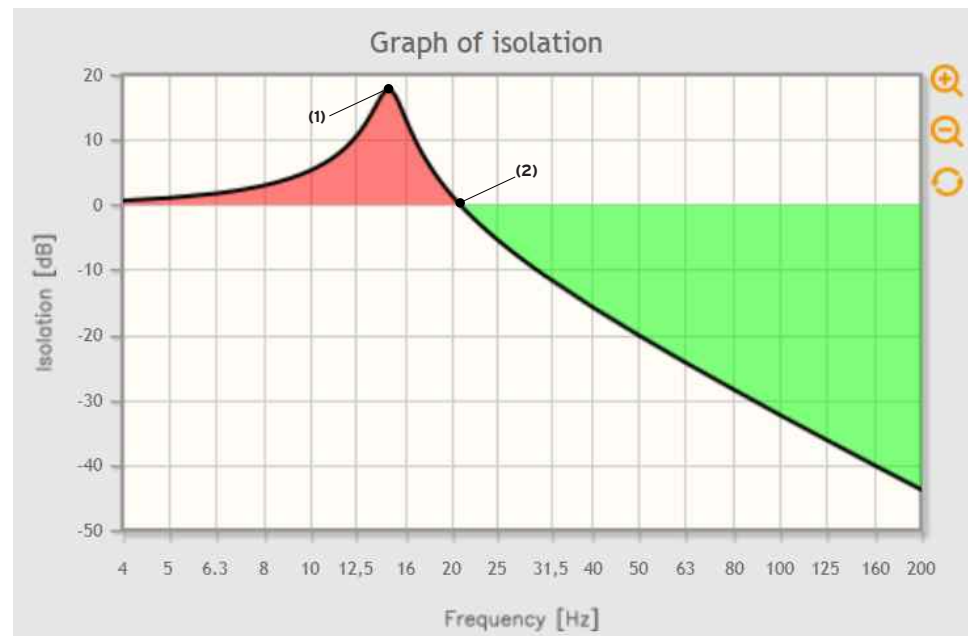
Alternative: Centred zoom

You can expand or reduce the size of the chart view using the zoom icons on the right-hand edge of the chart.

- › To zoom in, select 
- › To zoom out, select 
- › To restore the chart to its original size, select 

5.5.2 Graph of isolation

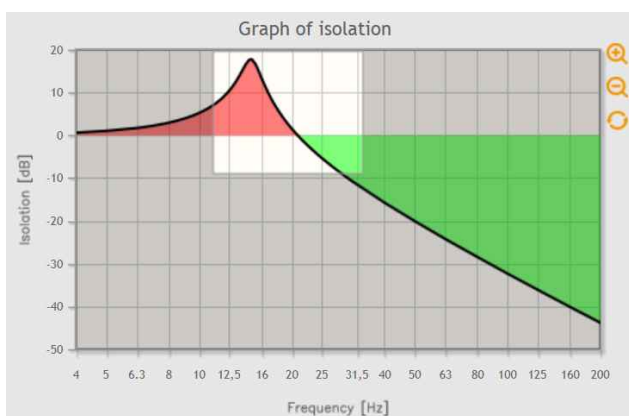
The isolation curve maps the relation between isolation (in dB) and frequency (in Hz) of the vibrating system. The calculated natural frequency is located at the highest point of the curve (1). The vibrating system is at resonant frequency here. At the point of natural frequency $\times\sqrt{2}$ the isolation curve intersects with the horizontal zero line (2). Up to this point an elastic mounting intensifies the vibration rather than improving it (area shown in red). Beyond this point of intersection vibration isolation is effective. The greater the difference between the excitation frequency and the natural frequency of the system, the more effective the vibration isolation (degree of isolation).



Expanding areas of the graph of isolation

You can expand the view of areas of the graph of isolation. To do so, proceed as follows.

- › Move your mouse pointer over the chart.
 - The mouse pointer turns into a cross.
- › Position the centre point of the **cross at the top left corner** of the area you wish to expand.
- › Hold down the left mouse button and drag the centre point of the **cross to the bottom right corner** of the area you wish to expand.
- › Release the left mouse button.
 - An expanded view of the selected area is displayed.



Alternative: Centred zoom

You can expand or reduce the size of the chart view using the zoom icons on the right-hand edge of the chart.

- › To zoom in, select 
- › To zoom out, select 
- › To restore the chart to its original size, select 

5.6 Table



In vibration isolation the degree of isolation characterises the isolation effect as the ratio between the input and output forces or the input and output amplitudes.

The table under the graph of isolation shows the frequency spectrum, isolation and degree of isolation for the calculation. A negative degree of isolation denotes a worsening of the situation, a positive degree of isolation an improvement.

Example:

At an excitation frequency of 40 Hz the system isolation is -15.8 dB. This corresponds to a degree of isolation of +84%.

Frequency [Hz]	Isolation [dB]	Degree of isolation [%]
4,0	0,7	-8
5,0	1,1	-13
6,3	1,8	-23
8,0	3,1	-42
10,0	5,4	-85
12,5	10,6	-240
14,7	17,8	-680
16,0	12,7	-334
20,0	1,3	-17
25,0	-5,4	46
31,5	-10,9	71
40,0	-15,8	84
50,0	-20,1	90
63,0	-24,3	94
80,0	-28,5	96
100,0	-32,4	98
125,0	-36,1	98
160,0	-40,2	99
200,0	-43,8	99

Download buttons:

Download: English Calculation Product datasheet

Language selection:

Dropdown menu for choosing the language in which the calculations are to be downloaded. This allows you to create a PDF of the calculation in a different language from the input language.

Calculation button:

Creates a PDF file of the entire calculation and starts the download process. The file includes the Project, Input and Results areas and the basis of calculation.

Product datasheet button:

Starts downloading the calculated product datasheet.



In the case of a pre-stressed bearing calculation the data-sheet relates to the main bearing.

Basis of calculation:

Basis of calculation:

The calculations are based on the physical model of a SDOF oscillator with a mass-less spring on a solid, smooth foundation. The calculation program FreqCalc makes calculations based on the assumption of loading with a rigid mass in the centre of gravity. The calculated value are relevant for the degree of freedom in the vertical direction (1st degree of freedom), taking into consideration the non-linear behavior of the material.

The material data taking into account form factor dependence was last updated: 12/21/2010 | SW-Version 120228

The basis of calculation describes the exact assumptions on which the FreqCalc calculation is based (see also Appropriate usage). It also includes the date on which the material data was last updated and the software version number.



Material data

The date on which the material data was last updated may vary depending on the material type. Users are not notified if the material data is changed. Check the date of the material data at regular intervals, especially if you have saved calculations in the archive. Changes to the material data may cause the calculation results to vary.

Material:

Dropdown menu for selecting a material type. The material types available to you will depend on your user rights.

Bushings per main bearing:

Defines the number of bushings per main bearing.

Thickness:

Dropdown menu for selecting a standard material thickness. You can also enter a custom material thickness in the field.

Shape:

Dropdown menu for selecting a bearing shape. The following shapes are available: **Rectangle** and **Cylinder**.

Length:

[Condition: **Shape = Rectangle**]: Defines the length of your bearing

Width:

[Condition: **Shape = Rectangle**]: Defines the width of your bearing

Diameter:

[Condition: **Shape = Cylinder**]: Defines the diameter of your bearing

Holes per bushing:

Checkbox to activate the Holes function.

Quantity:

[Condition: **Holes per bushing** checkbox ticked]: Defines the number of holes in the bushing.

Diameter:

[Condition: **Holes per bushing** checkbox ticked]: Defines the diameter of the holes.

Deflection under preload:

Defines the desired deflection under preload.



Owing to the differing loads, the material type used for the bushing is not dependent on the material type used for the main bearing. The choice of material type is governed by the required preload force.



The specified thicknesses are standard material production thicknesses. Custom thicknesses may give rise to additional production costs, with implications for delivery time and price.

5.7.2 Bushing results area

Results Bushing				
Shape factor: 0,9	Load of bushing: 0,034	N/mm ²	Preload force (*): 0,33	kN
Surface (*): 9921 mm ²	Capacity: 52	%	Dyn. Stiffness (*): 0,37	kN/mm



Overload

The calculated material overload is given as a percentage. The field is shown with a red background. Check your inputs and choose the next highest material type from the dropdown menu. In case of doubt please contact Getzner Werkstoffe.

Results Bushing	
Shape factor: 0,9	
Surface (*): 9921	mm ²

Shape factor:

The shape factor is a geometric measure of the shape of an elastomer bearing and is defined as the quotient of the surface area under load and the curved surface area of the bearing.

Surface (*):

The surface area under load of the pre-stressed bearing.

Load of bushing:

Calculated from the preload force and the surface area.

Capacity:

The material capacity with the calculated preload force.

Preload force (*):

The force acting on the bushing.

Dyn. Stiffness (*):

Determined from the selected material and the calculated preload.

(*) refers to all bushings per main bearing.

Load of bushing: 0,034	N/mm ²
Capacity: 52	%



The necessary preload force is determined by the specific installation situation. In case of doubt please contact Getzner Werkstoffe.

Preload force (*): 0,33	kN
Dyn. Stiffness (*): 0,37	kN/mm

Additional results in the main bearing area

Additional load on	0,006	N/mm ²
main bearing:		
Total load:	0,086	N/mm ²

Additional load on main bearing:

Additional load acting on the main bearing if a bushing is used.

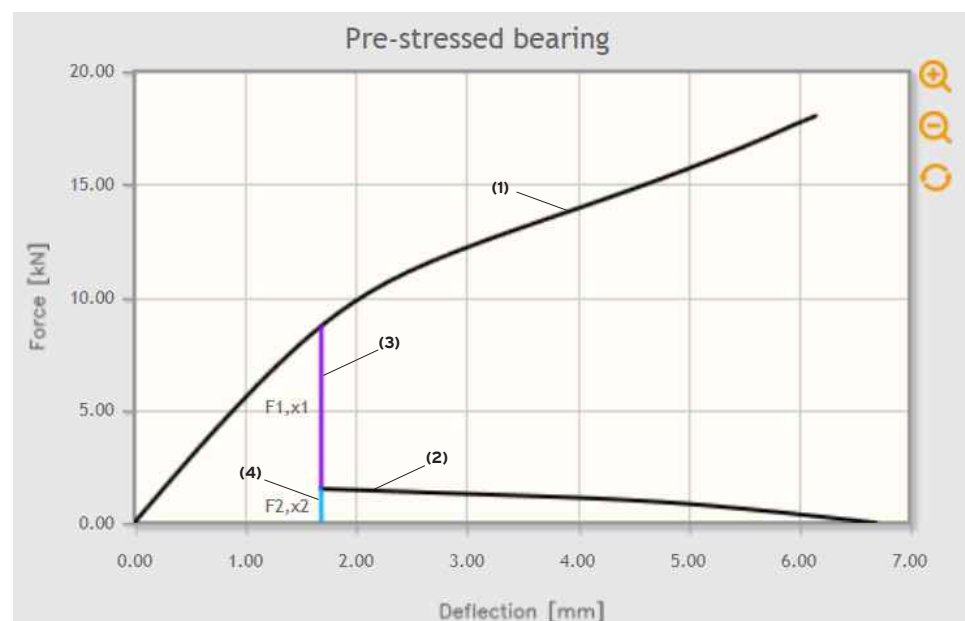
Total load:

Sum of the additional load on the main bearing and the load.

5.7.3 Graph of pre-stressed bearing

This graph only appears if the Calculation of pre-stressed bearing checkbox is activated.

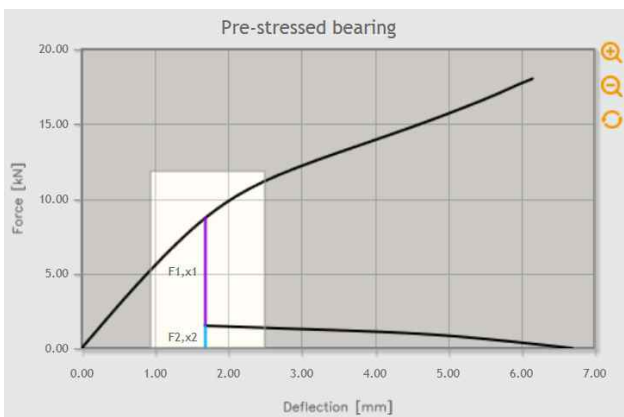
The graph shows the deflection curve for the main bearing (1) and bushing (2). The purple line (3) indicates the load on the main bearing as a force. The turquoise line (4) represents the preload force arising from the deflection under preload.



Expanding areas of the pre-stressed bearing graph

You can expand the view of areas of the pre-stressed bearing graph. To do so, proceed as follows.

- › Move your mouse pointer over the chart.
- The mouse pointer turns into a cross.
- › Position the centre point of the **cross at the top left corner** of the area you wish to expand.
- › Hold down the left mouse button and drag the centre point of the **cross to the bottom right corner** of the area you wish to expand.
- › Release the left mouse button.
- An expanded view of the selected area is displayed.



Alternative: Centred zoom

You can expand or reduce the size of the chart view using the zoom icons on the right-hand edge of the chart.

- › To zoom in, select 
- › To zoom out, select 
- › To restore the chart to its original size, select 

6. Case studies

6.1 Case study 1: Simple bearing calculation

Scenario:

A machine with a dead weight of 9 tonnes is to be elastically supported. The machine stands on four feet, each with a bearing surface of 250 x 250 mm. The disruptive vibrations start at an excitation frequency of 50 Hz. Isolation of at least -15 dB is required.

Step 1: Enter data

- > In the Quantity field in the Input area enter 4.
- > In the Length and Breadth fields enter 250.
- > In the Load type dropdown menu select Mass and in the input field enter 9000.
- > Click the **Calculation** button.

Input

Material: Sylomer® Shape: Rectangle Load Type: Mass 9000 kg

Quantity: 4 Length: 250 mm Width: 250 mm Thickness: 25 mm

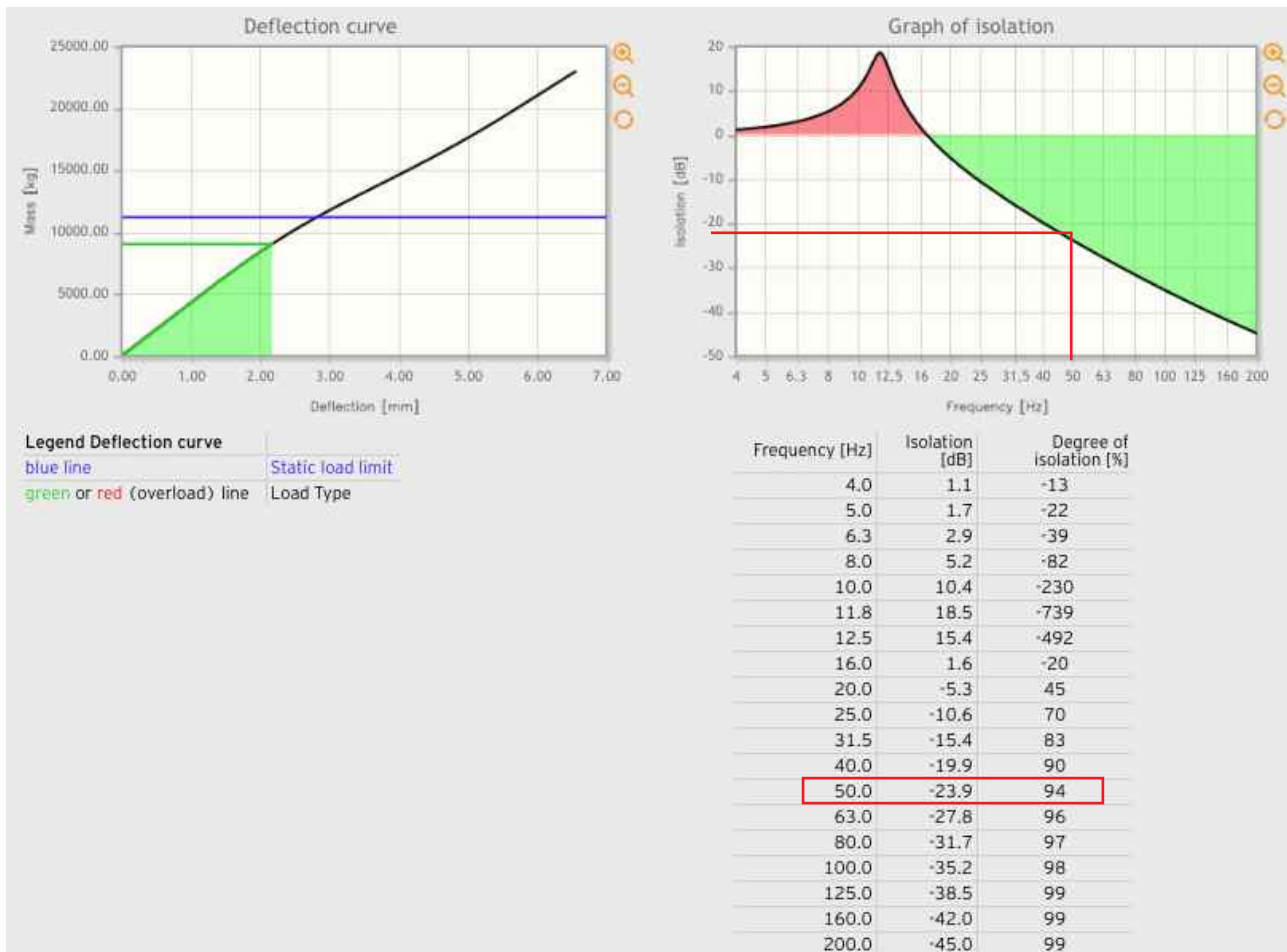
Calculation of pre-stressed bearing | Input bushing

Calculate Reset Save Archive Manual License

Step 2: Results

- Sylomer® SR 450 was calculated to be the best material.
- The material capacity is 81%.
- The natural frequency was calculated at 11,8 Hz.
- The graph of isolation shows the degree of isolation at an excitation frequency of 50 Hz.
- The table indicates an isolation of -24,2 dB at an excitation frequency of 50 Hz. The degree of isolation is 94%.
This satisfies the minimum required value.

Results Main bearing considering the influence of the bushing			
Choose material:	Shape factor:	3	Deflection:
SR110	Surface:	90000 mm ²	1.5 mm
Best	Static load limit:	0.11 N/mm ²	Natural frequency:
	Capacity:	78 %	15.3 Hz
			Dynamic bedding modulus:
			0.068 N/mm ³
			Dyn. Modulus of elasticity:
			1.71 N/mm ²



6.2 Case study 2: Pre-stressed bearing calculation



Lifting force

This causes the structure to „lift“ in the support area unless it is anchored down or a corresponding load is applied in the support area.

Holes

An M20 bolt has a diameter of 20 mm. To make it easier to pass the bolt through the hole on assembly, it is advisable for the hole to be larger than the bolt. In this case an empirical value of +2 mm is chosen.

Scenario:

A machine with a dead weight of 9 tonnes is to be elastically supported. The machine stands on four feet, each with a bearing surface of 250 x 250 mm. The disruptive vibrations start at an excitation frequency of 50 Hz. An isolation value of at least -15 dB is required.

Owing to a lifting force of 3 kN, the machine must be anchored to the foundation. This is to be achieved by means of one preload element per machine foot (120 x 70 mm) and two bolts (M20).

Step 1 - Step 2: Use values from case study 1

Step 3: Enter bushing data

- > Tick the Calculation of **pre-stressed bearing | Input bushing**
- > In the Thickness dropdown menu select **12,5**.
- > In the Length field enter *120* and in the Width field enter *70*.
- > Tick the **Holes per bushing**
- > In the Quantity field enter *2*.
- > In the Diameter field enter *22*.
- > In the Deflection under preload field enter *1*.

Step 4: Adjust the main bearing input

- > In the Input main bearing area tick the **Holes per pre-stressed element**
- > In the Quantity field enter *2*.
- > In the Diameter field enter *22*.
- > Click the **Calculation** button.

Input Main bearing

Material: Sylomer® Shape: Rectangle Holes Load Type: Mass 9000 kg
 Quantity: 4 Length: 250 mm Quantity: 2 Secant
 Thickness: 25 mm Width: 250 mm Diameter: 22 mm

Calculation of pre-stressed bearing | Input bushing

Material: Sylomer® SR450 Shape: Rectangle Holes per bushing Deflection under 1 mm
 Bushings per main bearing: 1 Length: 120 mm Quantity: 2 preload:
 Thickness: 12,5 mm Width: 70 mm Diameter: 22 mm

Calculate Reset Save Archive

Step 5: Main bearing results

- The natural frequency has changed and is now 11,7 Hz.
- The capacity is 91%.

Step 6: Bushing results

- The bushing capacity is 72 %.
- The preload force was calculated at 2,15 kN. Given the lifting force of 3 kN, the preload force is too low.

Results Bushing					
Shape factor: 1,2	Load of bushing: 0,282	N/mm ²	Preload force (*): 2,15	kN	(* refers to all bushings per main bearing)
Surface (*): 7640	mm ²	Capacity: 72	%	Dyn. Stiffness (*): 2,57	kN/mm
Results Main bearing considering the influence of the bushing					
Choose material: ← SR450 →	Shape factor: 2,2	Deflection: 2,6	mm	Additional load on main bearing: 0,035	N/mm ²
Best	Surface: 246959	mm ²	Natural frequency: 11,7	Hz	Total load: 0,392
	Static load limit: 10814	kg	Dyn. Stiffness: 46,06	kN/mm	N/mm ²
	Capacity: 91	%	Dyn. Modulus of elasticity: 4,66	N/mm ²	

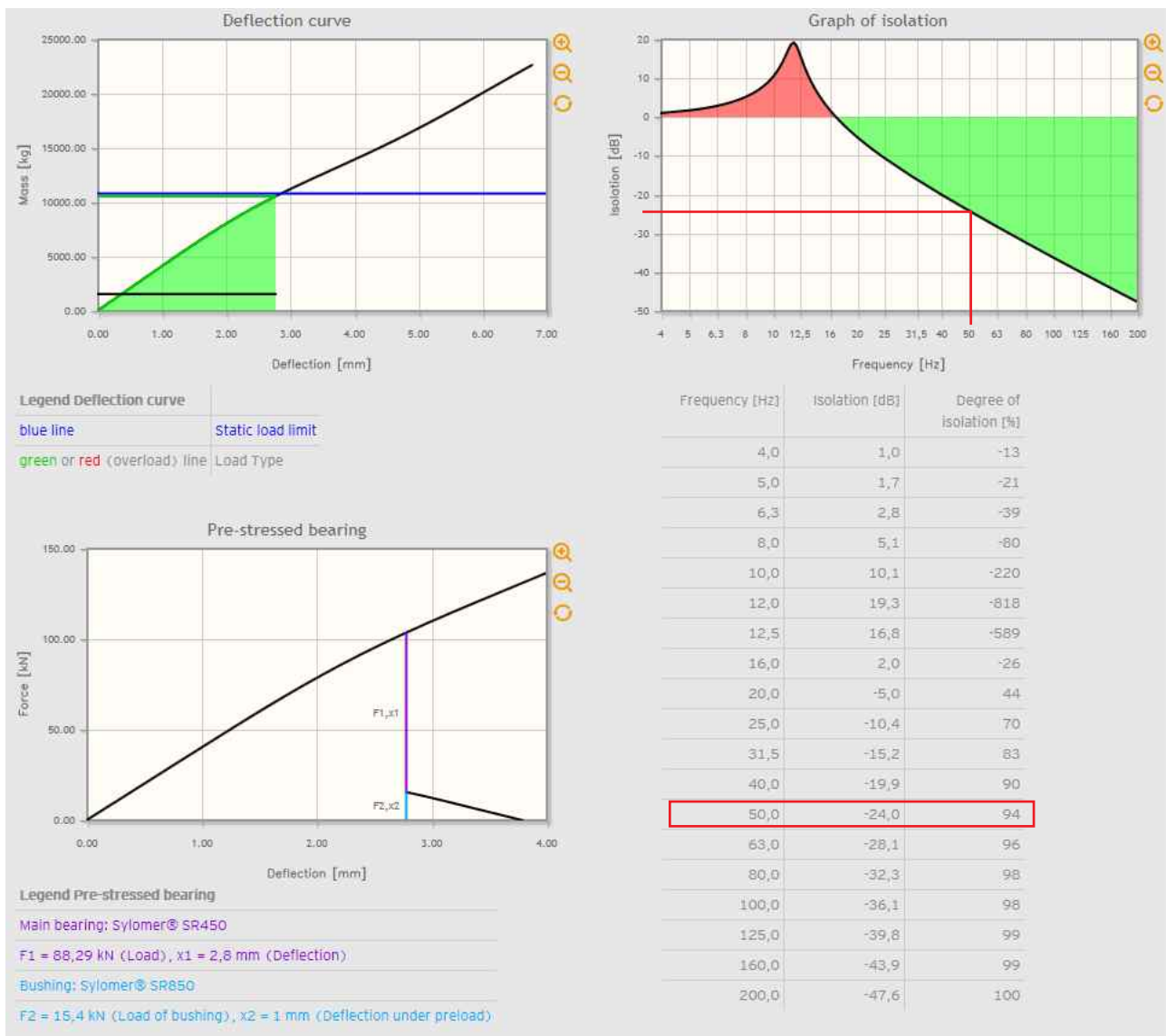
Step 7: Adjust the bushing input

- > In the Material area select the next stiffest material, in this case **Sylomer® SR 850**.
- > Alternative 1: Enter a different value in the Deflection under preload field.
- > Alternative 2: Adjust the bushing dimensions.
- > Click the **Calculation** button.

Calculation of pre-stressed bearing Input bushing					
Material: Sylomer® SR850	Shape: Rectangle	<input checked="" type="checkbox"/> Holes per bushing	Deflection under preload: 1	mm	
Bushings per main bearing: 1	Length: 120	Quantity: 2			
Thickness: 12,5	mm	Width: 70	mm		
Diameter: 22		mm			
Calculate	Reset	Save	Archive		

Step 8: Results

- The main bearing capacity is 98%.
- The natural frequency was calculated at 12.0 Hz.
- The bushing capacity is 77%.
- The preload force was calculated at 3.85 kN. This is high enough to counteract the lifting force.
- The graph of isolation shows the isolation effect at a disruptive frequency of 50 Hz.
- The table indicates an isolation of -24.0 dB at an excitation frequency of 50 Hz. The degree of isolation is 94%.
- This satisfies the minimum required value.
- The pre-stressed bearing graph shows the deflection curves for the main bearing and bushing. The purple line represents the dead weight of the machine as a force. The turquoise line represents the preload force.



7. Frequently asked questions

Is there an offline version of FreqCalc?

No. FreqCalc is only available online via the Getzner Werkstoffe homepage.

Do I have to register in order to use FreqCalc?

Yes. You need to set up a user account on the Getzner Werkstoffe homepage in order to use FreqCalc.

I have registered for FreqCalc but I still can't use FreqCalc. Why not?

The registration process may not be complete yet.

Is FreqCalc available in other languages too?

Yes. FreqCalc is available in German, English, French, Spanish and Danish. Other language versions are being developed.

Do I need to change the program language in order to print out a PDF file in another language?

No. In the footer of the Results area you can choose the download language.

Will I be notified of changes to the material data?

No. You will not be notified. The current date of the material data appears in the basis of calculation in the footer of the calculation program and of the PDF exports.

I have added a logo to customise my user profile. Why does the logo look distorted?

Check that the aspect ratio is correct. Your logo must have an aspect ratio of 7:3.

How many calculations can I store in the archive?

You can store up to ten calculations in the archive. To store new calculations, delete those that you no longer need.

I've forgotten my password! How can I request a new one?

Please refer to Resetting a password.

FreqCalc does not display correctly!

Check which version of your web browser you are using and update it if necessary. If you still experience problems, please contact online support. Email: onlinesupport.buers@getzner.com

8. Glossary

Natural frequency

Frequency at which an oscillating system oscillates freely after a single excitation; the attenuation time is dependent on the isolation.

Vibration isolation

Reduction in the transfer of mechanical vibrations by the installation of elastic intermediate components; a distinction should be made between reducing the transfer of vibrations from a vibration exciter to the environment (emission control, isolation of the exciter) and shielding an object against the effects of vibration from the environment (environmental control, shielding of an object).

Polyurethane

Abbreviation PUR or PU; polyurethanes are prepared by the polyaddition of isocyanates and polyalcohols and can range from cellular through to compact structures. A distinction should be made between polyether urethanes and polyester urethanes.

Single degree-of-freedom (SDOF) oscillator

Vibration isolation applications are often idealised on the basis of an oscillating system with a single degree of freedom, consisting of a mass and a spring.

Deflection curve

Describes the relation between load and deflection in graphical form; depending on the rate of loading it may be a quasi-static or a dynamic deflection curve.

Degree of isolation

In vibration isolation characterises the isolation effect as the ratio between the input and output forces or the input and output amplitudes.

Pre-stressed bearing

A pre-stressed bearing is a bearing designed to prevent transmission of structure-borne noise in mountings. Each pre-stressed bearing consists of a main bearing and a bushing.

Additional terms can be found in the Getzner Werkstoffe glossary at <http://www.getzner.com>

Downloads>Brochures>Glossary

