

# Vibration Reduction in Mechanical and Plant Engineering



» Elastically mounted devices are more cost-effective and efficient in the long term

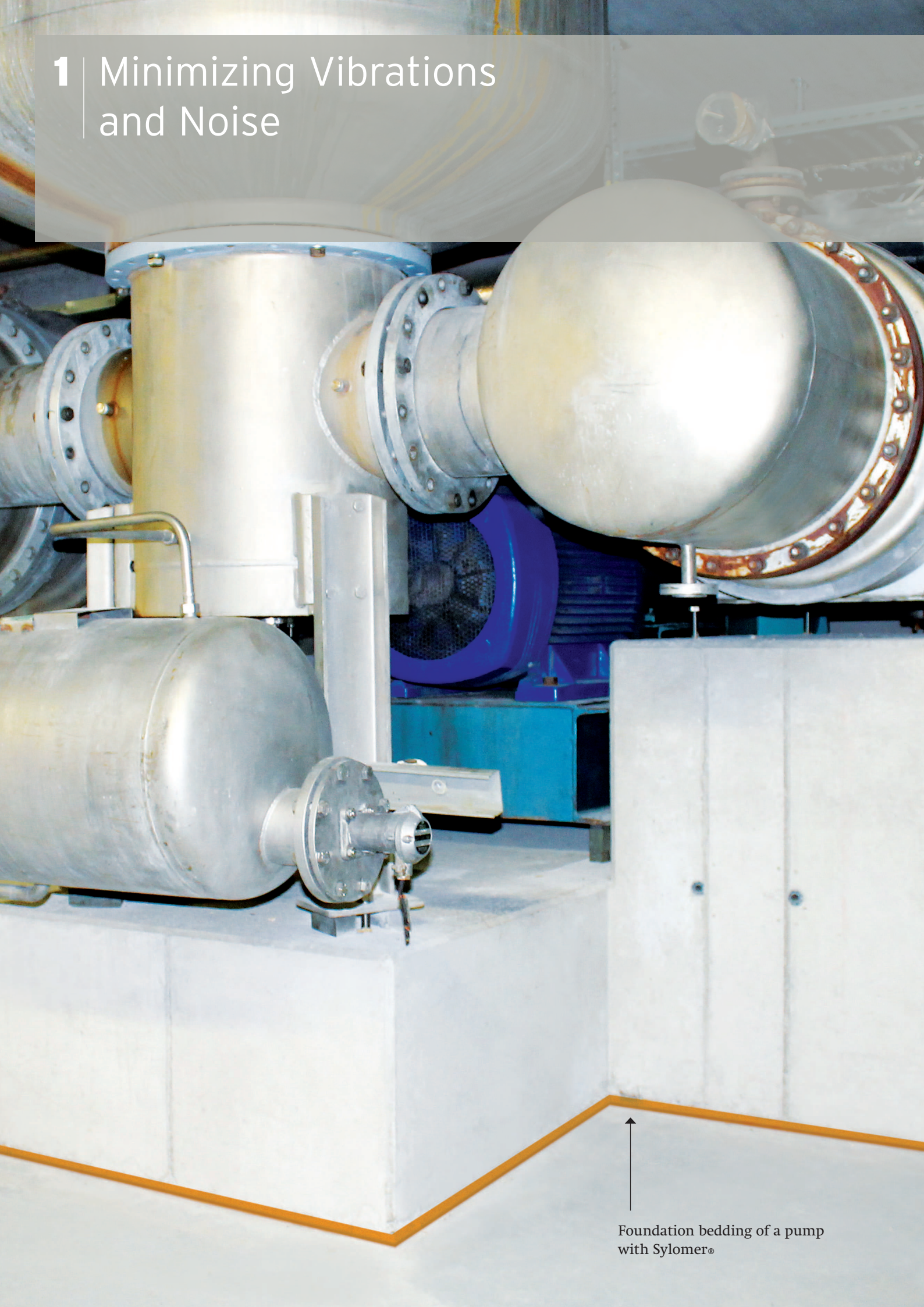
» Vibration protection increases the value of production processes and adjoining residential buildings and working spaces

» The long-term effectiveness of the materials is guaranteed

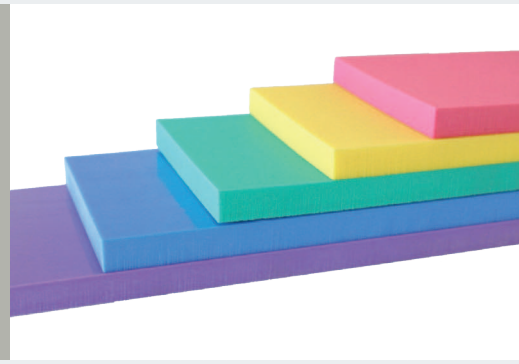
**getzner**  
engineering a quiet future



# 1 | Minimizing Vibrations and Noise



Foundation bedding of a pump  
with Sylomer®



For optimum results: high-tech materials  
Sylomer® and Sylodyn®

### Machines generate vibrations, causing noise and damage.

**V**ibrations and their consequences are not only detrimental to the immediate surrounding area, they also negatively affect manufacturing and quality processes in the vicinity and disrupt the neighbourhood and the environment.

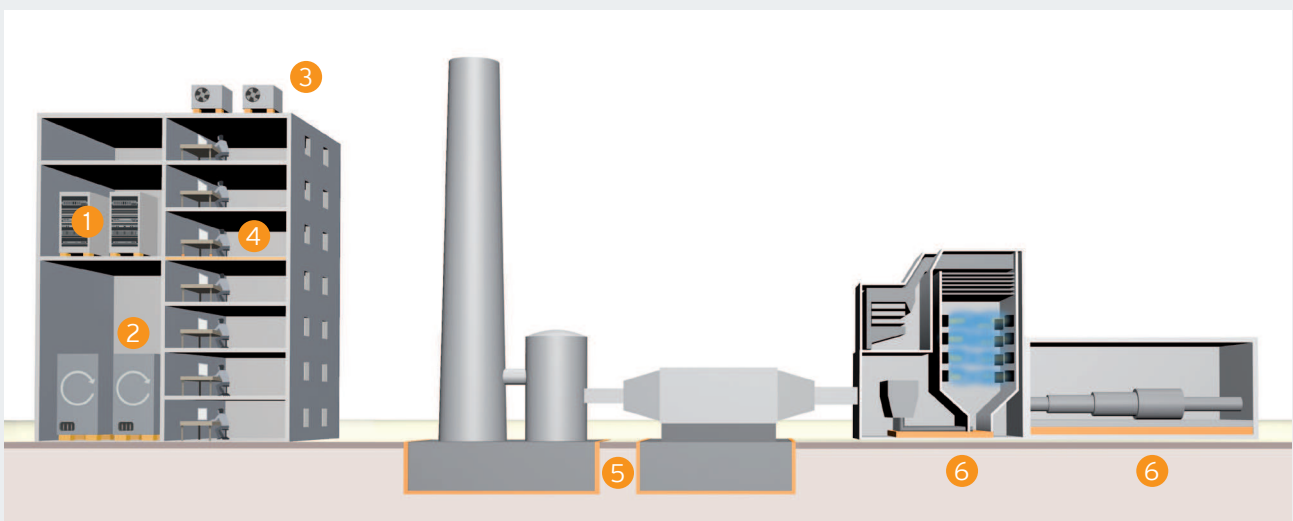
### Why use elastic mountings for machines?

- Elastically mounted devices are more cost-effective and efficient in the long term.
- Optimum vibration solutions usually account for less than 1% of the initial cost. But solutions that are added later are often expensive and less effective.
- Vibration protection increases the value of office space, production processes and adjoining residential buildings.

### The advantages of the Getzner solution

- Elastic bedding on Sylomer® and Sylodyn®, in or under a machine, effectively reduces vibrations and structure-borne noise.
- The bearings are easy to install, maintenance-free and are consistently effective throughout the service life of the machine.
  - As the bedding is individually calculated and adapted, it is possible to achieve a low natural frequency and greater effectiveness.

## Measures to protect devices, machines and the surroundings from vibrations



- 1 Server mounting
- 2 Machine bearing

- 3 Bearing of air-handling-units\*
- 4 Floating floor, bearing of sensitive equipment

- 5 Foundation bedding
- 6 Machine foundation bearings

\* Refer to brochure "Vibration Solutions for Technical Facility Equipment"



## 2 | Potential Solutions and Benefits

### Challenge

When technical equipment is operated, solid objects and machine components start vibrating. This produces structure-borne noise and secondary airborne noise. Vibrations, noise and sometimes even health hazards are the unwanted result.

#### Vibration solution requirements

On the one hand, effective vibration isolation must be able to absorb existing static and dynamic loads. On the other hand, the dynamic reaction of the mounting should be soft and less rigid than comparable materials (such as rubber or cork). Statically and dynamically occurring forces should be dampened both vertically and horizontally.

### Solution description

#### Source isolation (active)

An elastic intermediate layer can dampen the high dynamic forces of a machine. This reduces the passage of disruptive vibrations and decouples the vibration source from the surroundings, e.g. presses, compressors.

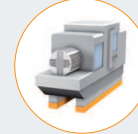
#### Recipient isolation (passive)

Elastic bedding protects machines and sensitive components against the vibrations of instruments that have not been decoupled. The machine is isolated from the surroundings, e.g. measuring equipment, servers.

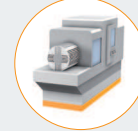
#### Solutions



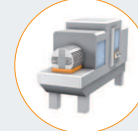
Point bearing  
(Machine base)



Strip bearing



Full-surface bearing



Machine components



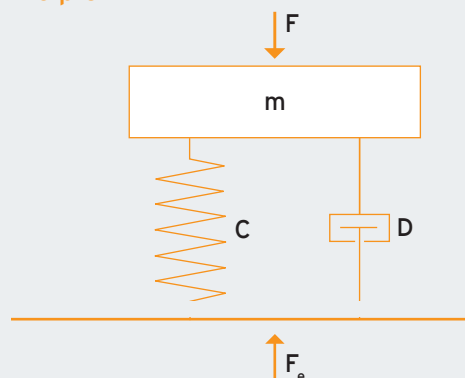
Foundation bedding

#### The single mass oscillator principle

$$f_0 = \frac{1}{2\pi} \cdot \sqrt{\frac{c}{m}} = \frac{1}{T}$$

T = period length (s)  
 $f_0$  = natural frequency (Hz)  
c = spring constant (N/m)  
m = vibrating mass (kg)

C = spring  
F = force  
D = damper

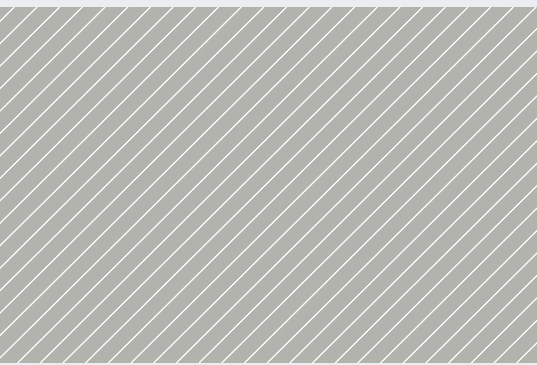


#### Working principle

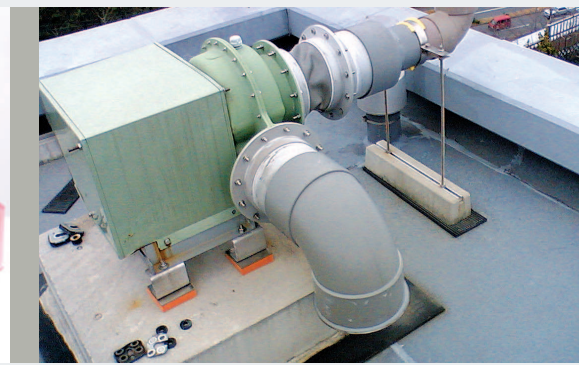
Sylomer® and Sylodyn® combine spring and damper properties in materials.

The mode of operation is based on the principle of a single mass oscillator.





Various application areas



Point bearings for a air handling unit

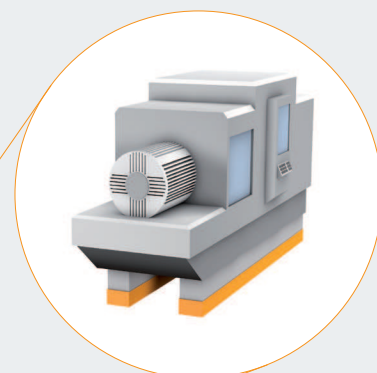
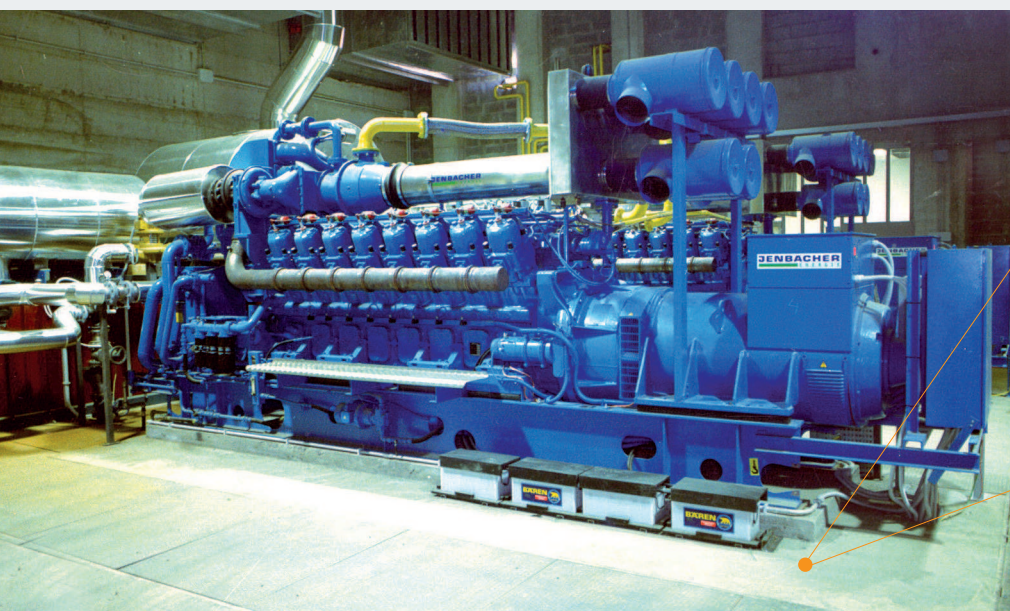
## The benefits of the Getzner solution

- More cost-effective
- Properties can be calculated to tailor effectiveness
- The long-term effectiveness of the materials is guaranteed over the entire service life of the machine
- Zero-maintenance
- Highly effective at a low construction height and deflection (protecting electrical and mechanical connections)
- Natural frequencies from 6 Hz are achievable\*
- Load ranges from 0.5 t/m<sup>2</sup> to 600 t/m<sup>2</sup>

- Tolerance compensation for unevenness
- Can be used as springs, dampers or as a spring/damper combination
- Individually adaptable geometry (adapted to the local installation situation)
- Elastically decoupled pre-stressed bearings and screw connections can absorb tensile forces
- The bearings absorb high dynamic forces as well as horizontal and vertical forces

- The material properties are consistent, as none of the constituents can permeate

\* Lower natural frequencies can be achieved with ISOTOP® spring elements.



Combined heat and power plant  
GE Jenbacher

### 3 | Materials and Services



#### Sylomer® - high elasticity and long service life

Universally applicable elastic PU material, **spring/damper combination**, proven in the field for more than 40 years

##### Material characteristics:

- Mixed cellular
- Static application area from 0.011 N/mm<sup>2</sup> to 1.2 N/mm<sup>2</sup>
- Load peaks up to 6.0 N/mm<sup>2</sup>
- Very low amplitude dependence
- Low creep tendency
- Proven long-time behaviour
- High fatigue strength
- No frequency dependence
- Finely graded range (10 standard types) for optimum system design



#### Sylodyn® - high dynamic durability

**Technical spring** with pronounced dynamic and highly elastic properties, proven in the field for more than 20 years

##### Material characteristics:

- Closed cell
- Static constant load of standard types from 0.075 N/mm<sup>2</sup> to 1.5 N/mm<sup>2</sup>, special types to 6 N/mm<sup>2</sup>
- Load peaks up to 18 N/mm<sup>2</sup>
- Very low amplitude dependence
- Low creep tendency
- Proven long-time behaviour
- High fatigue strength
- No frequency dependence
- Finely graded range (7 standard types) for optimum system design



#### Sylomer® HD - high damping

**Dampers** with special energy-absorbing properties, proven in the field for more than 15 years

##### Material characteristics:

- Mixed cellular
- Static constant load of standard types from 0.015 N/mm<sup>2</sup> to 0.35 N/mm<sup>2</sup>
- Viscoelastic PU construction
- High internal damping
- Mechanical loss factor between 0.35 and 0.55
- Graded range (5 standard types) for optimum system design

#### Material functions: vibration isolation, vibration damping, shock absorption



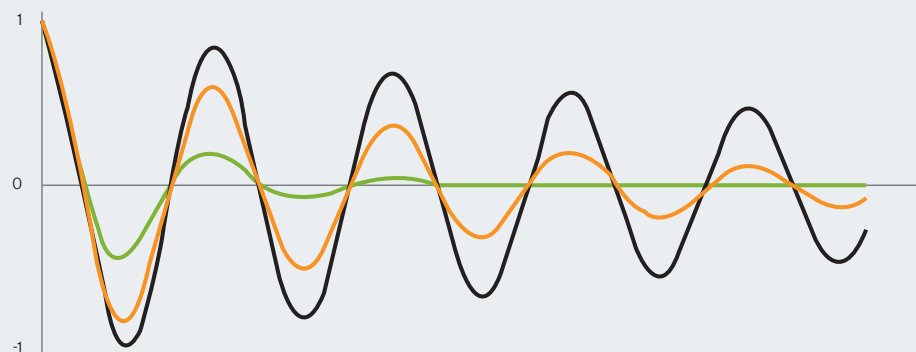
Sylomer®



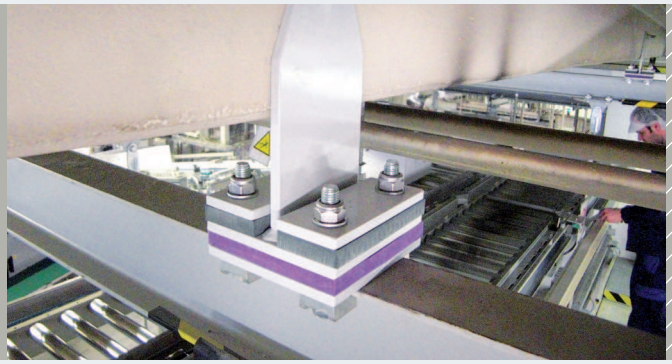
Sylodyn®



Sylomer® HD







Elastic decoupling of a production plant for food

## Services from Getzner: a one-stop shop

### Support in the planning phase

- Calculating the bearing
- Measuring the excitation spectra
- Vibration analysis of buildings
- Taking seismic requirements into account
- Drawing up installation plans
- Advising on connection details

### Online calculation tool

- Calculating the optimum mounting

### High-tech materials from our in-house research and development team

- Guaranteed long-term effectiveness
- Consistently effective over the entire service life of the machine
- Maintenance-free bearings

### Installation and assembly

- Installation support provided by trained specialists
- No interruptions to the construction process

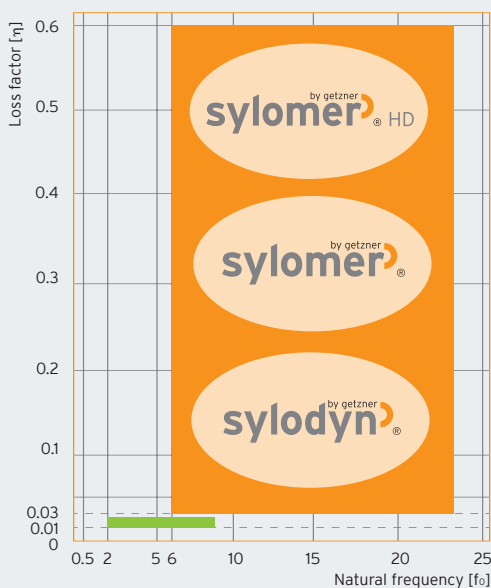
### Cooperation with recognised and independent experts

### Decades of experience around the world in providing bearings for machines

### Option of developing special bearings and material combinations

## Potential areas of application compared

The graphic shows the different properties of the product families with regard to suspension and damping.



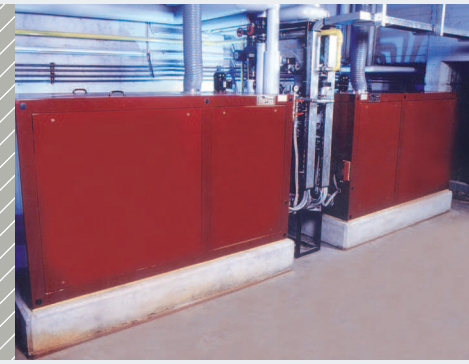
	Loss factor [ $\eta$ ]	Natural frequency [ $f_0$ ]
Sylomer® and Sylodyn®	0.03 to 0.6	6 to 23
Isotop® steel springs	0.01	2 to 8
Steel*	0.0004	0.5 to 5
Compact elastomers*	0.03 to 0.3	6 to 25
Foamed elastomers*	0.03 to 0.6	2 to 25
Cork*	0.1 to 0.2	30 to 60
Air springs*	0.005 to 0.020	0.5 to 5

\* Source: VDI 2062 - Sheet 2, 2007 edition as per Tab. 2

# 4 Applications Overview

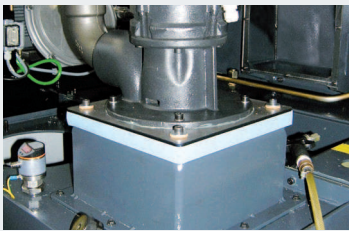


Elastically mounted heat pump

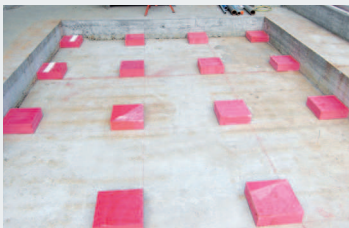


Elastically mounted combined heat and power plant

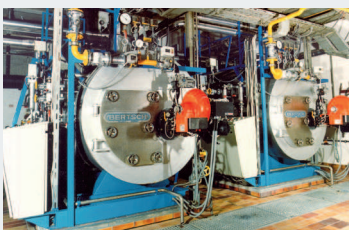
## Elastically mounted pump



## Combined heat and power plant Foundation bedding



## Elastically mounted air conditioning



## Treadmill bearing



## Pump bearing

### Task:

Vibration-suppressing bearing for different speeds and rotations, elastic connectors

### Advantages:

Natural frequencies from 8 Hz, full-surface bearing, suitable for applying to in-situ concrete

### Benefits:

Reduces structure-borne noise and secondary airborne noise

## Bearing for a combined heat and power plant

### Task:

Decoupling the frame for damping higher amplitudes

### Advantages:

Natural frequencies from 8 Hz, extremely resistant to chemicals

### Benefits:

Reduces structure-borne noise and secondary airborne noise, maintenance-free bearings, long service life

## Treadmill bearing

### Task:

Reduces the level of impact on the joints and transfer of structure-borne noise into the building

### Advantages:

The required damping is achieved thanks to the high loss factor. Rapid elastic recovery makes it suitable for use on treadmills.

### Benefits:

Jogging is better for the joints and less vibrations and pulses are transferred to the floor and the building

## Helicopter landing pad bearing

### Task:

Hospitals are protected against disruptive vibrations during landing and take-off

### Advantages:

Safeguards against uplift forces, assembly is quick and easy

### Benefits:

Elastic bedding with Getzner TFB XT (table foundation on point bearing) allows hospital life to continue without disruption





A longer service life for a paper-making machine



Maximum decoupling for safety



A pleasant working environment close to turbines

## Bearing for a papermaking machine

### Task:

The amplitude on the surface of the foundation should not exceed  $3\mu\text{m}$  (value O-P). This guarantees smooth operation and protects the surroundings from vibration.

### Advantages:

Vibration isolation is noticeably more effective than rubber, especially at higher excitation frequencies, simple installation.

### Benefits:

Smooth operation and consistent printing quality for the papermaking machine

## Microscope bearing

### Task:

Complete decoupling of the optical parts of a microscope, protection against the structural vibrations of the building

### Advantages:

High damping during movement of the swivel arm, materials can be cut to size in any geometric shape (for all machine joints), high damping factor.

### Benefits:

Complete vibration decoupling of the optical system. A stable microscope image, unaffected by vibrations

## Turbine bearing

### Task:

The surroundings must be protected against the vibrations of the turbines.

### Advantages:

The foundation bedding efficiently reduces secondary airborne noise, protecting the surrounding buildings and machines against the vibrations of the turbines.

### Benefits:

This increases the service life of the machines and the buildings. The noise and vibration levels are reduced, which improves working conditions.



On the right, bearing of an air conditioner: elastic decoupling with Sylomer®.

On the left, a helicopter landing pad in Interlaken: making sure that "sensitive" buildings stay peaceful



## 5 | References



Foundation bearing for the hydro power plant Steigs in Mels (CH)





Elastic decoupling of an industrial washing machine



Strip bearing of a cogeneration plant

## References (extract)

- Foundation bedding for vacuum pumps, paper mill in Mörrum (SE)
- Foundation bedding for a papermaking machine, Kahoku Shimpō Publishing Co. (JP)
- Foundation bedding for a steel cutting installation, BRC Spencer, Coatbridge (UK)
- Transformer mounting, Electricité de France, Paris (FR)
- Gear decoupling, Hanseatische AG wind turbines (DE)
- Mounting for a water pumping station, M.C.E. Riyadh (SA)
- Mounting for an 18 metric ton, 2 MW combined heat and power plant (DE)
- Table foundation bearing for a helicopter landing pad, Interlaken hospital (CH)
- Vibration decoupling for combined heat and power plants, GE Jenbacher (AT)
- Bedding for HVAC systems, Oslo opera house (NO)
- Elastic bedding for textile machines, Lindauer Dornier (DE)
- Oil pump bearing for pipeline, Dutch oil company (NL)
- Foundation bedding for generators, EGAT Electricity Generating (TH)
- Base plate bedding for a telescope, Cape Girardeau, Missouri (USA)
- Lift mountings, Berlin Brandenburg Airport (DE)
- Foundation bedding for ball mill, Hebel GmbH, Germering (DE)

### More on this subject

#### Rolling mill in Reutte, 1985

The rolling mill in Reutte (A) is just one example of the outstanding durability of Getzner materials. The foundation has a full-surface mounting that efficiently decouples the vibrations of the rollers at their source. Measurements taken in 1986 and 2013 prove that this solution is maintenance-free. There were no relevant changes in effect.

#### Fact sheet “Long-time behaviour of elastically mounted heavy foundations”

#### Further information:

- Increasing value through elastic shielding of buildings
- Construction Mat - Efficient Impact Noise Insulation
- Vibration solutions for technical facility equipment
- Safe vibration isolation in fire-prone areas

You can find the relevant documents at [www.getzner.com/downloads](http://www.getzner.com/downloads)

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